Local and Traditional Knowledge to Improve Community-Based Conservation in Protected Areas in Paraty

by

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ABSTRACT

Some protected areas in Brazil, such as Extractive and Sustainable Development Reserves, allow for the participation of traditional people in their formal management. Yet, much can be done to effectively include people in decision-making in these areas. This thesis seeks to understand how traditional people can participate more effectively and have their knowledge incorporated in the management of the Juatinga Ecological Reserve, in Paraty area, Rio de Janeiro State. Through the lenses of landscape ethnoecology, the thesis also aims to understand how Caiçara people use plants to carry out cultural practices, such as baskets, canoes and paddles making, that are important to Caiçara identity. More specifically, the thesis objectives were:

1. To investigate Caiçara ethnoecology of the landscape of the Juatinga Ecological Reserve
2. To investigate the social and cultural practices of basket making and related knowledge
3. To understand canoe making as a process of cultural heritage
4. To identify Caiçara understandings and motivations for conservation and stewardship

Some 31 participants, from six communities in the Reserve, participated: 28 men and three women aged 32 to 78 years. Semi-structured interviews with basket, canoe and paddle makers; workshops on basket making process; field trips to harvesting sites; a photovoice exercise, and participant observation helped to gather data to understand: the main nontimber forest products harvested, knowledge transmission between local people, details of the process of cultural products manufacture, concepts of conservation and other aspects of knowledge and practice of Caiçara of the area. A promising way ahead may involve co-production of knowledge. This would entail the meaningful participation of traditional people, and incorporation of their knowledge in the planning and management of the Reserve.

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To the Caiçara of the Juatinga Ecological Reserve

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Chapter 1: Introduction

1.1. Context

Landscape and Ethnoecology

There are multiple ways to study and perceive landscapes. Friess and Jazeel (2017) provide and example of this showing how a coastal geomorphologist looks at physical attributes to understand the dynamics of landscape changes across time and how a cultural geographer attempts to understand landscape through politics and architecture. But there are yet, perspectives of landscapes from the agents of landscape, or the people who use and shape it (Friess and Jazeel 2017). Carl Sauer's work was an important landmark, as the author has interconnected physical and cultural aspects for the study of landscapes defined as "… a land shape, in which the process of shaping is by no means thought of as simply physical. It may be defined, therefore, as an area made up of distinct associations of forms, both physical and cultural" (Sauer 1963:321).

Landscapes have also been the focus of ethnoecological studies, which evolved as a field by looking at multiple dimensions of knowledge and practice of Indigenous and traditional peoples regarding their relationships with nature and land (Toledo 1992; Hunn 2007). Scholars have looked at how people's knowledge is expressed through classification systems, people-land interactions, and landscape management, and how landscapes have been shaped across space and time. Some authors, for example, have produced inventories of names of places, in an approach like the Ethnobiology Phase I of Hunn (2007), to compare Indigenous people's knowledge on forests classification and habitat-fauna associations to satellite images (Abraão et al. 2001). Others have investigated the ecological relationships that people have with landscapes, similarly to the Ethnoecology proposed by Toledo (1992), to understand how people's knowledge "reveals

from land" (Davidson-Hunt and Berkes 2010). Topographical and hydrological features, disturbed areas such as burnt areas (Johnson 2010), biodiversity variations (Abraão et al. 2010), and land history and migrations (Trusler and Johnson 2008; Davidson-Hunt and Berkes 2010) help Indigenous and traditional peoples to predict plant-animal-place associations. In her earlier study "*A place that's good, Gitksan landscape perception and ethnoecology*", Johnson (2000) writes:

> "People may know, for example, that low bush blueberries are often associated with low-elevation lodgepole pine stands in relatively flat places without erecting the overt class jack pine flat. As another example, a person may also know, in addition to naming a specific traditional gathering area for spiny woodfern rootstock, that one should look for it in a *lax'aamit* (treeless snowbed area), if attempting to find it in an area not well known to the consultant, or that it is frequently associated with *giist* (*Alnus crispa*) (Johnson 2000:321)."

Hunn and Meiller (2010) suggest the term *ecotope* to define "the smallest ecologically-distinct landscape features in a landscape mapping and classification system" (2010:15). They explain that people may cross-reference a great deal of information about organisms, ecological relationships, and places, in a type of mental map, which facilitates finding resources and important places. Their work in first chapter of *Landscape Ethnoecology* provides theory on people's knowledge of associations used to predict where specific resources (e.g. plants and animals) for subsistence and culture are in landscapes both spatially and temporally:

> "Hypothetically, if people knew which of 500 named plants and 500 animals occurred at each of 500 named places, there would seem to be little need to recognize and classify ecotopes, since species could be located simply by canvassing one's toponymic inventory.

> However, we believe that naming ecotopes saves mental energy and enhances the efficiency of subsistence activities by facilitating the integration of these two massive data bases, the ethnobiological and the toponymic. To appreciate this point, consider the following thought experiment. If we recognize 500 plants and 500 animals, that equals 1,000 kinds of organisms. If, in addition, we recognize 500 named places, we will have 500,000 (1000 × 500) bits of information about the environment to keep track of. On the other hand, if we were to define a few dozen ecotopes such that the organisms and places were evenly distributed among them (each plant and animal and each place uniquely associated with one and only one ecotope), the task of locating a particular organism at a particular place would be substantially simplified" (Hunn and Meiller 2010:18).

The writings of Hunn and Meiller suggest that people with a knowledge of associations in a landscape would locate a resource associated to a given place more easily in this landscape. Investigating how Indigenous and traditional peoples find resources spatially or temporally has been a tendency for peoples in the Amazon (Abraão et al. 2010; Wartmann 2018; Riu-Bosoms et al. 2015), Bolivian Andes (Boillat et al. 2013), Romania (Babai and Molnár 2013), Hungary (Molnár 2012), Brazil (Silva et al. 2016; Poderoso et al. 2017), Costa Rica (Sylvester and García Segura 2016) and others.

This literature has showed us that resources can often be predicted in a landscape. What if, the presence of such resources can be predicted but the resources found are not fit for a cultural practice? Knowing that an important plant may be available in a place does not provide people the security that the plant will be suitable for their use and subsistence. In other words, thinking of broader classification units, like ecotopes, to find resources does not necessarily take into account the possible variation on resources within these ecotopes, which in turn, may not

satisfy peoples' needs. This is the first component of this thesis, discussed in more details in Chapter 2.

There is an association of landscape knowledge with the territory of peoples as traditional knowledge is revealed from land and bounded up by peoples's territory (Johnson 2000; Davidson-Hunt and Berkes 2010). Such knowledge is important for subsistence and livelihoods, and for the establishment of a connection to the land and cultural identity (Trusler and Johnson 2008; Davidson-Hunt and Berkes 2010). Landscapes are often used to refer to the territory of particular groups of people using it for many generations. The terms landscape and territories are often used interchangeably in the literature. For Johnson (2000) "…the landscape is home. Territories and people are inextricably associated. The history of the people is written on the land, which is their larder as well as an active partner in their long history." (Johnson 2000:305). These terms are also often used interchangeably in this thesis[1], but I feel it is important to provide a notion of territory concept. Territory is a portion of land which people may claim, and where people may have partial or full access or control rights of resources for use and subsistence of community members during generations (Diegues 2004). Territory is also where social relationships among community members may happen and cultural practices are carried out (Diegues 2004). One of the major conflicts for Indigenous and traditional peoples arise when protected areas overlap their territories.

Protected areas in Brazil

Protected areas have been one of the most important tools to achieve biodiversity conservation (Gaston et al. 2008). In Brazil, protected areas can include strict protection and

[1] The terms, customary landscape and customary territories, are also used in this thesis.

sustainable protected areas, indigenous territories, legal reserves, and permanent preservation areas. The strict understanding of protected areas as strict and sustainable protected areas (see Dudley 2008) account for approximately 16.9% of the terrestrial area and 1.5% of marine areas (MMA 2014). Although much is needed to achieve the required 10% of protection of coastal and marine areas, the country has almost reached the goal of 17% of protection of terrestrial and inland areas stipulated for 2020 in the Convention on Biological Diversity (Aichi Target 11, CBD 2014). Although this target has been almost achieved (at least for the terrestrial protected areas), the effectiveness of biodiversity protection in these areas is debatable (Bensusan and Prates 2014). Part of this relates to the numerous social conflicts involving Indigenous and traditional peoples when protected areas overlap with their customary landscapes (Prates and Souza 2014).

Despite that, there are also positive examples of relationships of local people with protected areas. The current law for protected areas in Brazil, the *Sistema Nacional de Unidades de Conservação* (SNUC in Portuguese) was enacted in 2000, with twelve protected area categories, five of which have strict protection and seven are for sustainable use (Table 1). Two of them, Sustainable Development Reserves and Extractive Reserves, allow for sustainable use of resources with local opportunities for socio-economic development and participation (Brasil 2000; Seixas et al. 2009; Lopes et al. 2011). In the Amazon, for instance, local communities within the Mamirauá Sustainable Development Reserve have increased their incomes with the sustainable fishing of an endemic fish species while contributing to its conservation (Castello et al. 2009). Researchers and local people found out that local knowledge on counting the fish population was accurate (due the fish species obligate behavior to come up to the surface to breath), providing reliable estimations for fishing quotas for the following years (Castello et al.

2009). This is probably one of the best examples of development and conservation in protected areas. It has, however, required long-term negotiations between local people, researchers, and government to finally establish the terms of a species management agreement.

Although both Sustainable Development Reserves and Extractive Reserves provide local people the right to participate in decisions of biodiversity management, increased local participation levels in management decisions in these reserves (as well as in other protected areas) are still needed (Lopes et al. 2011). One possible way to increase local participation is through the development of institutions that integrate multiple knowledge systems (Berkes and Seixas 2006; Davidson-Hunt and O'Flaherty 2007; Armitage et al. 2011).

Approaches for People's Participation in Management of Protected Areas

The attentiveness of including local people interests in conservation was more evidenced with community-based conservation projects—and the use of traditional ecological knowledge—as an alternative to western conservation which disregarded peoples' participation in protected areas management (Chicchón 2000; Colchester 2000). Some scholars suggested this approach should not be considered as a panacea to conservation (Adams and Hulme 2001; Berkes 2007), as community-based conservation depends on the advocacy of participation, involvement and empowerment of local communities (Western and Wright 1994). Not all Indigenous and traditional communities show the necessary components for effective conservation, which include involvement of communities, funding, strong leadership, capacity building, partnership with organizations and government and alternative for livelihood options (Seixas and Davy 2008). There are yet other components to take into account, for example if the communities have land tenure. Some projects have just reproduced western approaches to conservation under the

Table 1: Categories of Brazilian protected areas, along with the status of protection, management system, and land tenure, listed in the SNUC law (*Sistema Nacional de Unidades de Conservação*) for protected areas in Brazil. The column to the right shows the equivalent IUCN category for comparison.

Categories of protected area	**Status**	**Objective, management system and land tenure**	**Equivalent to IUCN Category***
Ecological Station**	Strict protection	To preserve nature and promote scientific research. Public visitation for educational purposes allowed. Public land (expropriated if on private land).	Ia
Biological Reserve**	Strict protection	To preserve nature allowing human interference mainly for land restoration. Public visitation for educational purposes and scientific research allowed. Public land (expropriated if on private land).	Ia
National Park (State Park or Natural Municipal Park enacted by the state or the municipality respectively)	Strict protection	To preserve nature. Public visitation, tourism and scientific research allowed. Public land (expropriated if on private land).	II
Natural Monument	Strict protection	To preserve nature. Public visitation following the management plan. Public or private land.	III
Wildlife Refuge	Strict protection	To preserve nature. Public visitation following the management plan. Scientific research allowed. Public or private land.	III
Area of Relevant Ecological Interest	Sustainable use	To protect ecosystems with rare fauna and flora species and promote sustainable resource use. Low level of human occupancy. Public or/and private land.	IV
Private Reserve of Natural Heritage	Sustainable use	To conserve biodiversity. Private land. Public visitation for tourism, leisure and education, and scientific research are allowed subject to regulation.	IV

Environmental Protection Area	Sustainable use	To protect biodiversity and control land use for sustainable resource use. Some level of human occupancy. Public or/and private land. Public visitation and scientific research allowed in public land and private land with the permission of environment agency and landowners respectively.	V
National Forest (State Forest or Municipal Forest if enacted by the state or the municipality respectively)	Sustainable use	To promote the sustainable use of native forest resources and to promote scientific research, which aims to make the sustainable use of these forests viable. Public visitation and scientific research allowed. Public land (expropriated if on private land). Presence of traditional communities allowed.	VI
Sustainable Development Reserve***	Sustainable use	To protect nature while assuring the means for traditional livelihoods. Public visitation and scientific research allowed if compatible with traditional people's interests. Resources should be used sustainably, and agriculture is permitted following zoning and management plans. Public land (**may** be expropriated if on private land).	VI
Faunal Refuge	Sustainable use	To promote scientific research of animal populations of various habitats and behavior to promote sustainable management. Public visitation following the management plan. Public land (expropriated if on private land). The practice of amateur or professional hunting forbidden.	VI
Extractive Reserve***	Sustainable use	To promote the sustainable use of resources of a region used by traditional people whose livelihoods are based on forest and sea resources, agriculture, and small livestock. It aims to protect the culture and livelihoods of these traditional communities who have the rights to use the resources. Extraction of mineral resources and practice of amateur or professional hunting forbidden. Extraction of timber and other forest resources for commercial purposes should follow guidelines in the management plan. Public land (expropriated if on private land).	VI

*Following SNUC Law (Brasil 2000), Dudley (2008) and Pacheco et al. (2018). **Only Ecological Stations and Biological Reserves do not require public consultation upon their creation. ***Only Sustainable Development Reserves and Extractive Reserves have deliberative processes of participation for resource management, in contrast to other protected areas in SNUC, which have consultative processes.

label of community-based conservation, often disrespecting local interests, practices, culture and worldviews.

Learning from past experiences, scholars have proposed a number of approaches to involve Indigenous and traditional people in conservation and management of resources—considering empowerment, self-determination, worldviews, social justice and others elements—as these people are the key agents of management living on the land for generations. Three of these are fundamental to the development of this thesis: biocultural approaches to conservation (Gavin et al. 2015), biocultural design (Davidson-Hunt et al. 2012) and co-production of knowledge (Armitage et al. 2011; Tengö et al. 2014; Tengö et al. 2017). To provide some background to reader, I present below the main definitions of these approaches. They will be further discussed as the chapters are presented. Components of biocultural design and biocultural approaches to conservation are used as framework for chapters 3 and 5 respectively. Chapter 6 builds on chapters 1 to 5 and explores co-production of knowledge possibilities in people's landscape.

Biocultural approaches to conservation propose a framework to integrate multiple worldviews—or ways of thinking about the world (Kearney 1984: 41)—in conservation. Defined as "conservation actions made in the service of sustaining the biophysical and sociocultural components of dynamic, interacting and interdependent social-ecological systems" (Gavin et al. 2015: 141), the goal is to help tackle biological and cultural diversity loss. Biocultural approaches for conservation take into consideration the rights of local people, different worldviews with multiple objectives for place-based conservation, and prioritize partnerships for effective conservation (Gavin et al. 2015). Sterling et al. (2017) adds to this definition, stating that these approaches "start with the specific human practices, local knowledge and cultural

beliefs that influence and are influenced by the land- and seascapes of which human communities are a part" (Sterling et al. 2017: 1800).

Biocultural design is a conceptual framework that proposes that people with different knowledge systems, skills, experiences and practices team up to support Indigenous and traditional people to benefit from their biocultural heritage using locally available materials, local values and creativity (Davidson-Hunt et al. 2012). The design team works with "communities to create and deploy solutions to contemporary challenges that reflect their desires, values and aspirations" (2012:18).

Co-production of knowledge is "the collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-oriented understanding of that problem" (Armitage et al. 2011:996). Participatory approaches, where local people and researchers are collaborators in producing knowledge for resource management, have been encouraged by other researchers as well (Davidson-Hunt and O'Flaherty 2007; Maclean and Cullen 2009). Co-production of knowledge seeks to use each knowledge system in its integrity, considering worldviews, local values, culture, identity, management systems, and attending political, scientific and/or ethical motivations (Ballard et al. 2008; Tengö et al. 2017; Berkes 2018).

To effectively incorporate local people's knowledge into management discussions and provide equitable power sharing and outcomes, it is crucial to understand how individuals or groups within a community perceive and use their environment, what their motivations for conservation stewardship are, and what the implications are of limitations or changes in resource access (Johnson and Hunn 2010; Davidson-Hunt et al. 2012). Up today, in some places, formal management systems are based on Western conservation assumptions of a "controllable nature,

predictable yields and exclusion of environmental perturbations" (Berkes and Folke 1998:21). Such assumptions do not align with the local people's understanding and use of resources in their customary landscape.

This thesis is also under the context of relevant global mechanisms (of which Brazil is signatory) that guides national actions towards conservation and rights of Indigenous and traditional peoples. The Convention 169 of the International Labor Organization is a main international agreement that acknowledges that Indigenous and Tribal Peoples have rights to self-identification as Indigenous and Tribal Peoples, to self-determination to control their choices and lives, and to free, prior and informed consent to give or withhold consent to any projects that may interfere (or not) in their culture and ways of life in their territories. The Convention for the Safeguarding of Intangible Cultural Heritage aims to protect, respect and revitalize aspects of intangible cultural heritage such as knowledge and practices concerning nature and the universe and traditional craftsmanship (UNESCO 2003). This is linked to Chapters 3 and 4, the two chapters with discussions on importance and processes of making and the significance these cultural products have for traditional people. Three Aichi Targets (11, 14 and 18) of the Strategic Plan for Biodiversity (2010-2020) focus on increasing areas and improving management of protected areas, safeguarding ecosystems that contribute to health and wellbeing of Indigenous Peoples, and respecting traditional knowledge and practices that are relevant for conservation, ensuring effective participation of these people. These are measurable targets proposed by the Convention on Biological Diversity and agreed to be met by signatories by 2020 (CBD 2014). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services establishes guidelines for the creation of mechanisms for bridging knowledge systems and improving the participation of Indigenous peoples in management (IPBES 2013).

1.2. Overall thesis theme, objectives and research context

The municipality of Paraty is located in the Brazilian Atlantic Forest region, a biome that is comparable to the Amazon in terms of biodiversity. Due to its high number of endemic species and ongoing habitat loss caused by deforestation and forest fragmentation, the Atlantic Forest region is listed as a world biodiversity hotspot with priority for conservation (Myers et al. 2000; Metzger 2009; Ribeiro et al. 2009). Several protected areas have been established since the 1970s in the region, including the Paraty area. The Juatinga Ecological Reserve was the last protected area to be enacted in the region, a rugged peninsula populated with Caiçara communities. This peninsula has been, for many generations, a space for people to engage in multiple cultural activities such as shifting agriculture, diverse fishing techniques, subsistence hunting, harvesting of non-timber forest products (NTFPs), basket making, and wood carving. De Francesco (2010) suggested that the practice of such activities imply a deep connection between these people and their customary landscape, and consequently knowledge retention of the territory. Since the Reserve's enactment in 1992, the conflicts between government and local people have been tense due to restrictions in access to resources in this Reserve, banning of subsistence hunting being an example. Although much of this scenario has changed and some improvement in the relationship between government and local people achieved, yet much needs to be done to address Caiçara needs.

Recent discussions in Paraty refer to the recategorization of the Juatinga Ecological Reserve as SNUC does not comply "Ecological Reserve"—partly in a Sustainable Development Reserve (sustainable area) and partly in a State Park (strictly protection). The Reserve was enacted eight years before the current Brazilian law for protected areas was created, regulating protected areas in the country within two categories, strictly protection and sustainable areas

(Brasil 2000). Although the current Reserve has a strictly protection status people are allowed to perform some activities (e.g. fishing), but for others, penalties may apply (e.g. subsistence hunting). There are yet insecurities regarding tourism-related activities, a high source of income in some communities in the Reserve. For some people, involvement with tourism implies that Caiçara are no longer considered traditional people (Idrobo et al. 2016), and losing the status of traditional people may imply uncertainty of their permanence and governance on their customary landscape. In the recategorization scenario, if a more restrictive category (State Park) applies in important harvesting places in the Caiçara landscape, then use of resources will be illegal and local people will not be able to access these resources, at least not legally. Conversely, a sustainable protected area category could give space to local people's voices, dialogue and collaboration for co-management and conservation.

In this thesis I am interested in understanding three fundamental issues about the relationships between people and nature. First, how traditional and local knowledge can help in protected areas planning. This is a current issue, which meets the concerns of the Caiçara groups of Paraty, who over the last few decades have been dealing with pressures that threaten their cultural practices and customary territory (Siqueira 1984; Vianna 2008). Second, what are the Caiçara' motivations towards stewardship of conservation on their customary landscape? On one hand, preservationists have argued that local people and nature are two distinct entities, and that conservation is incompatible with people's presence, especially in protected areas (Terborgh 1999). On the other hand, although not always effective, a spectrum of community-based conservation programs has tried reconciling local people, conservation and development in the same place (Western and Wright 1994). Lastly, I want to understand how local management practices can be incorporated into formal management. Despite the increased awareness of

researchers towards the inclusion of local people's voices into management, there is much space to involve the Caiçara in the management of protected areas in Paraty (and elsewhere).

Four specific objectives were elaborated for this research:

1. To investigate Caiçara ethnoecology of the landscape of the Juatinga Ecological Reserve
2. To investigate the social and cultural practices of basket making and related knowledge
3. To understand canoe making as a process of cultural heritage
4. To identify Caiçara understandings and motivations for conservation and stewardship to improve management of Juatinga Ecological Reserve

Baskets, canoes, and paddles were used in this research as means by which to understand the knowledge Caiçara people retain of their landscape. Regulations of strict protected areas could, for example, limit the use of plants for basket, canoe and paddle making in crucial harvesting areas. Much of people's concern about the recategorization refers to losing access to their landscape and resources. Resources needed for basket, canoe and paddle making are inherently important to the Caiçara culture, and often used to describe a Caiçara identity. As an example, Caiçara canoes, addressed in Chapter 4, are currently in the process of becoming "intangible cultural heritage" in Brazil (Németh 2011). Maintaining a Caiçara identity does not mean that their culture is "frozen" and not evolving over time. People in the Reserve have been adapting to tourism and applying their knowledge to contemporary context (Berkes 2018). For instance, baskets, once used to hold fish catches, are being redesigned to serve other uses. This is addressed in Chapter 3. As the research evolved, I chose to include paddle making as an example

of Caiçara cultural products (along with basket and canoe making) in Chapter 2. A participant explained that canoe making is notable for Caiçara culture, but the research would be more complete if paddle making was included as well as one needs a paddle to navigate a canoe.

This research is part of and builds on a series of studies from a team research project, "Community-based resource management and food security in coastal Brazil (2009-2014)," supported by the International Research Chairs Initiative (IRCI) under the coordination of Dr. Alpina Begossi and Dr. Fikret Berkes. These studies included the relationship of livelihood diversification to food security (Hanazaki et al. 2013), resilience and wellbeing of fisher communities (Leite 2018), adaptive co-management of fishers (Trimble 2013), gender relations and power influences to livelihoods (Carpenter 2011), local knowledge of game species, and past hunting practices (Islas 2015). Two studies, in particular, were inspirational to this research. One was the approach taken by Bockstael (2017) to improve capacity development for environmental management in Trindade. Located outside the Juatinga Ecological Reserve, Trindade is a neighboring community that has faced similar problems with land grabbers and protected areas. The other study in question was the ethnography undertaken by Idrobo (2014), which revealed aspects of knowledge and cultural continuity with Caiçara in Ponta Negra, a community within the Reserve.

At a later stage, I was also involved in the broader project "Ethnobotany of tree species used in the construction of artisanal canoes on the southeast and southern Brazilian coast (2014-current)," coordinated by Dr. Natalia Hanazaki and financially supported by the National Council for Scientific and Technological Development (CNPq). The main objectives of this project were to investigate the traditional knowledge of canoe making by documenting the canoe making and/or maintenance processes, identifying the tree species known and used by canoe

makers and fishers, and understanding the historical and cultural significance of canoes to local people. The project contributed knowledge on people's use of tree species for canoe making and canoe maintenance in southern Brazil (Roque 2017), people's ecological knowledge on *Schizolobium parahyba*, a species with high relevance for canoes in southern Brazil (Orofino 2017; Orofino et al. 2018), and on the temporal and latitudinal variations on the use of tree species for canoe making (Paula 2018; Paula et al. 2019). The study of Paula and co-authors (2019) was especially important for this thesis, as the author's sample design included the investigation of the use of various trees for canoe making in the communities of the Juatinga Ecological Reserve.

1.3. The PhD project and motivations

According to Houde (2007), local knowledge is expressed by an amalgam of six components, with worldview or cosmology underpinning all the others (Figure 1). According to this author, the studies of integration of local knowledge into conservation actions have focused mainly on three of these components: factual observations (empirical observations, classifications, descriptions of ecosystems components, etc.), management systems (practices adapted to context, methods for conservation, etc.), and past and current uses (land-use patterns, occupancy, harvest levels, history of cultural groups, etc.). Researchers have often overlooked the three remaining components: ethics and values (correct attitudes to adopt), culture and identity of people (links to life on the land, etc.), and people's worldview (or cosmology, which are the assumptions how things work, beliefs, and spiritual relationships).

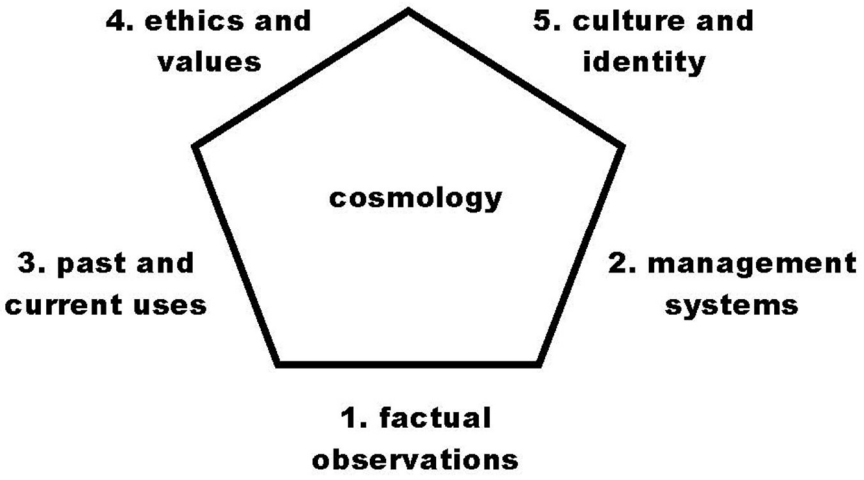

Figure 1: Model displaying the faces of local knowledge (Adapted from Houde 2007).

The relationships between people, nature and conservation have always inspired my curiosity. During my undergraduate and Master's studies, I had opportunities to learn about traditional and local ecological knowledge with people from resource-dependent communities in the Amazon and coastal Brazil. Although my previous experience had led me, at that moment, along the paths of fields like Conservation and Ethnobiology, I was looking forward to an opportunity to deepen my knowledge on emic perspectives and learn more about these components of local knowledge (ethics and values, culture and identity, and worldview). The interdisciplinary nature of my PhD research was a good opportunity to learn about people-nature connections, management systems, and the use of resources in a forested landscape within the context of local people's worldview.

The historical-political background of the Caiçara people in Paraty helps in understanding the current people-landscape relationships. Conflicts with land grabbers, tourism, real estate speculation, and protected areas have impacted the livelihoods of Caiçara people

(Siqueira 1984; Vianna 2008). Within this context, I learned to broaden my worldview. I understood that people have a set of priorities, depending on what rights people are entitled to already. This includes peoples' rights to customary territories, Caiçara identity recognition, self-determination, and conservation issues.

1.4. Caiçara people and the study area

There are about 1500 inhabitants, the majority Caiçara, living in eight communities (with more than 50 people) and 12 small settlements (with less than 50 people) in the Reserve. They are Portuguese-speaking people with mixed heritage, descendants of Europeans, Africans, and the Tupinambá Indigenous people. The number of inhabitants in the communities and settlements studied were (for 2011): Baixio (129), Cairuçu das Pedras (4), Cruzeiro (103), Praia Grande da Cajaíba (10), Ponta Negra (158) and Praia do Sono (314) (IGARA, 2011). Fishing, tourism related activities, craftmanship, and agriculture are the main economic activities. Some of the activities are seasonal, for example, high intensity squid fishing in the summer season, contributing for income of women (Carpenter 2011). Agriculture is represented by manioc flour production, which is currently carried out by elder generations in more remote communities like Cairuçu das Pedras and Praia Grande da Cajaíba (it occurs in other communities as well).

Craftmanship is a strong component of income for artisans in Baixio and other communities located in the Mamanguá inlet, in the northern region of the peninsula. This is due the existence of *Tabebuia cassinoides* forests in the region, a species with particular characteristics for wood carving. Tourism activities including boat transportation are very prominent in Praia do Sono and Ponta Negra communities (Hanazaki et al. 2013). In Praia do Sono, however, the tourism activities are linked to the high tourism season, with people working

in restaurants, camping, and pousadas (guest houses). In Praia do Sono, most of the people are locals who are reluctant to sell their houses to outsiders due to historical conflicts with Gibrail Tannus (explained below) (IGARA 2011). Ponta Negra, on the other hand, has restaurants and pousadas for tourists, but on a smaller scale when compared to Praia do Sono. In Ponta Negra there are holiday houses from people outside of the community. Of the studied communities, only Praia do Sono and Ponta Negra have schools (elementary level). To attend middle school, students travel to Paraty.

Until 1992, the peninsula area was a part of the Cairuçu Environmental Protection Area (enacted in 1983, Brasil 1983), a sustainable protected area under federal management which permits habitations and resource use (see Environmental Protection Area in Table 1). The Juatinga Ecological Reserve with approximately 9,960 ha was enacted by the state of Rio de Janeiro (Rio de Janeiro 1992), with a strictly protected status after a handful of studies, some of them not even considering the presence of local inhabitants. These studies considered the peninsula a key for the Atlantic Forest conservation (Cavalieri 2003). However, the Reserve was created with two objectives, to conserve Atlantic Forest biodiversity and to protect Caiçara culture, but under restricted use of resources (Vianna 2008).

Among some Caiçara in the Reserve, there is also a somewhat different narrative on the origin of the Reserve. Cavalieri (2003) writes the driver of its creation was, according to some, the conflicts around land tenure with land grabbers. According to Cavalieri (2003), some Caiçara and supporters entered a legal action to transform the Reserve into a land with a more restricted status to stop land grabbers and assure the availability of that landscape for future generations.

The main problem came later with the top-down management approach of government environmental agencies with managers holding a strictly preservationist worldview, and

following the Yellowstone model of protected areas. Restrictive clauses in the Reserve's law led to some cultural practices, such as shifting cultivation and subsistence hunting, being banned in the peninsula, and hindered house construction by the Caiçara (Rio de Janeiro 1992; De Francesco 2010).

According to Zuquim (2002), the history of Caiçara is for these people blended with their own fights to maintain their cultural practices and to remain in their customary territory. Different historical issues have had an impact on people-landscape relationships in the region. Over the past decades, conflicts over Caiçara territories have been a thorn in the side for the Caiçara inhabitants. In the 1950s, a famous land grabber, Gibrail Tannus, acquired a farm in the Juatinga Peninsula and attempted to seize some of the neighboring communities: Praia do Sono, Antigos and Ponta Negra (Siqueira 1984; Vianna 2008). He also attempted to seize the Praia Grande da Cajaíba area (De Francesco 2010). With legal documents forged in the notary office in Paraty, he tried to force eviction and encourage Caiçara out-migration to take hold of their traditional land. Much of his strategy was based on mental and physical intimidation; the land grabber hired gunmen to intimidate locals and brought cattle into the communities, which would feed on people's cultivated plants and on plants used for house roofs (Siqueira 1984; De Francesco 2010). In Praia Grande da Cajaíba, he managed to evict most of the families, only two families fought against his attempts and remained in the community (De Francesco 2010). In Praia Grande da Cajaíba, cattle attacked plants useful for dying baskets (e.g. yellow hue was obtained from turmeric), which along with manioc flour, were important source of income at the time (Cavalieri 2003). After the cattle, these plants were no longer available neither further cultivated in the community, resulting in a shift from colorful baskets to only natural color baskets available (Cavalieri 2003). Cavalieri (2003) found out, during interviews in Praia Grande

da Cajaíba, that cattle in this community were later moved to Praia do Sono as a result of legal notice from the government. There are different versions in the literature explaining how the land grabber gave up his attempts (at least physical attempts as up today there is a legal action of his family members claiming ownership of these places) to seize lands from Caiçara in Praia do Sono. One version is found in Camargo (2013), which tells that Gibrail arrived in Praia do Sono, in the *Festa de Reis*, an important religious day, making a call that every Caiçara house would be dislocated to a specific place at the community. Displeased with his actions, community members beat up Gibrail and the gunmen, and they have not returned to the community. There is an alternative version to this, saying that Gibrail gave up his visits to the community when women from Praia do Sono attacked him with nettle plants (Cavalieri 2003).

During the 1970s, another problem came up with the construction of the BR-101 Highway (Rio-Santos section), which facilitated access from major urban centres like São Paulo and Rio de Janeiro to the Paraty region (Teixeira 2006; Vianna 2008). Paraty opened space to tourism developments and to real estate speculation, encroaching on Caiçara customary landscape in the peninsula. The Laranjeiras gated community, one of the richest in the country, is an example. Part of it is built on the customary access used by people in the peninsula to travel to downtown Paraty. These conflicts over land access have lasted into the present day. During this research, I have myself experienced and witnessed difficulties in traveling to and from communities via the access in the Laranjeiras gated community. In 2017, tourists could use this access only during certain hours of the day, and bar owners had difficulties to bring in supplies from Paraty to the communities during the tourism seasons. There is a constant change in rules regarding peoples access (both tourists and Caiçara) and transportation of goods to supply local restaurants.

All these conflicts have been reshaping people-landscape relationships not only in the Reserve but in other areas in Paraty. To tackle the problems caused by real state speculation and protected areas, in 2007 local people organized themselves in a political movement, the Traditional Communities Forum (*Fórum de Comunidades Tradicionais*, in Portuguese). Supported by the National Policy for the Sustainable Development of Traditional Peoples and Communities (Brasil 2007)[2], this political movement aims to assure the livelihoods and territory rights of Indigenous groups, Caiçara, and Quilombolas (descendants of slaves) of Ubatuba, Angra dos Reis, and Paraty (municipalities in Sao Paulo and Rio de Janeiro states). Members of the Traditional Communities Forum have been engaged in many activities to promote cultural practices in their territory, including projects to encourage community-based tourism, to include local knowledge and culture in formal education, and to develop sustainable solutions to sanitation. The Forum has partnered up with the Foundation Fiocruz, a scientific institution, creating the *Observatory of Sustainable and Health Territories* (see https://www.otss.org.br/observatorio) to develop a series of projects with community members and researchers to find solutions for local demands. The Forum was also responsible for launching a campaign used to bring public awareness about Caiçara rights. This campaign was

[2] The National Policy for the Sustainable Development of Traditional Peoples and Communities created under Decree 6040/2007 aimed to promote sustainable development, recognition and guarantee of territorial, social, environmental, economic and cultural rights of the Traditional Peoples and Communities, considering their identity, forms of organization and institutions. Also created under this decree was the National Commission for the Sustainable Development of Traditional Peoples and Communities (later called Council), to coordinate actions in regard with this policy, with the participation of members of several Traditional Communities in matters of their interest (Brasil 2007). The current government, has however, under Decree 9759/2019 extinguished over 30 Councils of social participation, including the National Council for the Sustainable Development of Traditional Peoples and Communities. This extinction has high impacts to Caiçara and other communities, as this extinguish spaces of dialogue and exchange between members of several communities in the country, and between members of communities and government.

used to help elicit concepts of conservation in this research (see Figure 3). Chapter 5 of this thesis discusses the results.

1.5. Why the Juatinga Ecological Reserve?

The current political context in the Juatinga Ecological Reserve provided a good interdisciplinary case study for my research. It helped in the understanding of how local people can be integrated in different steps of protected areas planning and management. The recategorization of the Juatinga Ecological Reserve has brought concerns to local people (Cavalieri 2003; IGARA 2011). Caiçara from the Reserve are worried about how this process may affect land use and management of important species. In this research, such concerns triggered questions to investigate how local people use and depend on forest resources in their landscape, even in a strictly protected area with limitation of resource use.

In a public consultation held in October 2013, the government proposed a State Park and a Sustainable Development Reserve for the area of the Juatinga Ecological Reserve (Figure 2). The park with 83% of the Reserve's area would possibly impose further limitations on local people's access to resources. Access to parks are restricted to scientific research and tourism purposes (Table 1). The Sustainable Development Reserve—with space for resource use—with the remaining 17% of the area would be discontinuous in 13 fragments or "islands", where houses, churches, gardens are located. This implies landscapes and territories are seen differently by different stakeholders. Most of the Reserve's landscape, including places for harvesting resources for canoes, baskets and other cultural practices, some of the trails to access communities and other important places would fall in the State Park area with limitations for Caiçara use.

Caiçara groups responded to the government with a counter-suggestion to transform the whole area of the Juatinga Ecological Reserve into a Sustainable Development Reserve, which, in turn, could grant local people more access to resources giving them more voice over their territory than they have today (JS, personal communication). As of 2019, these negotiations are still underway.

This scenario triggered questions in my mind, and later reflected in my research, about whether or not conservation has the same meaning to all the involved people: Caiçara, managers and policy makers. Sustainable Development Reserves provide benefits but also demand a larger commitment from local people, as sustainable reserves are an agreement between government and local communities regarding land use. The government guarantees land access to local people, who in turn undertake to contribute to the conservation of these lands. Understanding the emic perspectives to nature and conservation is crucial (Bosak 2008; Cocks et al. 2016). This knowledge can open dialogue and help mitigate misunderstandings and conflicts regarding perspectives and expectations of different groups, individuals and other stakeholders (Carlsson and Berkes 2005; Blaser 2009). Such dialogue is especially important in the Juatinga Ecological Reserve, due to its long history of conflict which has left Caiçara with a legacy of distrust in outsiders and their interventions (Siqueira 1984).

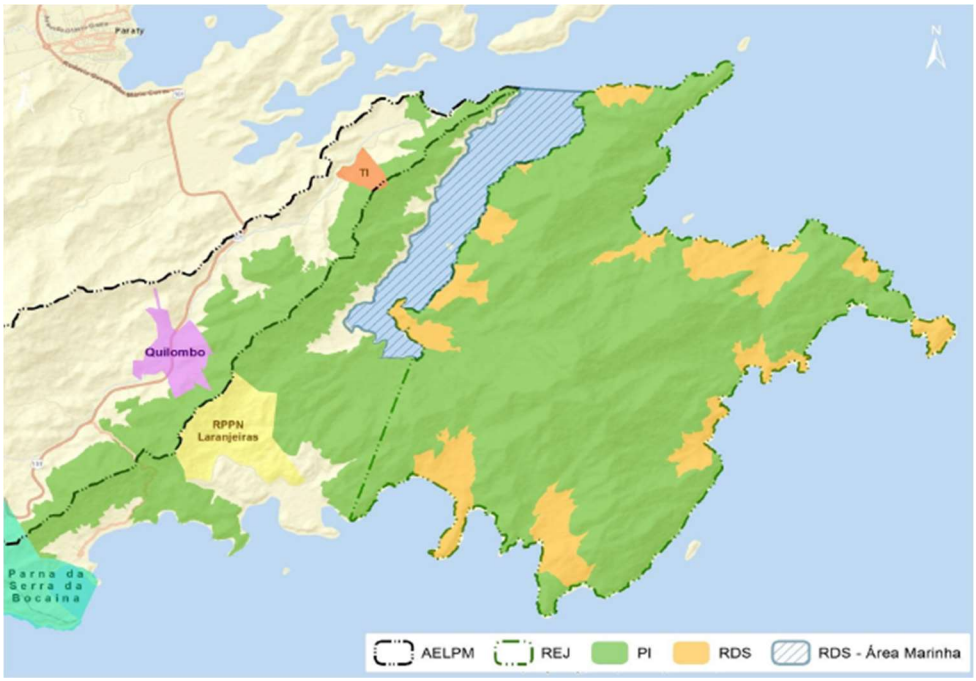

Figure 2: Government's proposal for the new protected areas over the Juatinga Ecological Reserve (and vicinity). Areas in green show the potential State Park (PI), while the 13 yellow patches, within the boundaries of the Juatinga Ecological Reserve (REJ) represent the discontinuous Sustainable Development Reserve (RDS) (Adapted from INEA 2013). The other acronyms in portuguese refer to: AELPM (*Área Estadual de Lazer de Paraty Mirim*, boundaries of a protected area also under recategorization), and RDS – Área Marinha (proposal for a marine Sustanaible Reserve).

1.6. Participatory approach: an attempt to do something different in the community

My belief that research should aim to produce social change for the involved communities drove my choice towards a participatory research approach. A participatory approach poses research questions that meet the interests of local people and consists of a collaborative process between them and the researchers (Creswell 2009). Cornwall and Jewkes suggested that "the key difference between participatory and other research methodologies lies in the location of power in the various stages of the research process" (1995:1667).

Although the initial steps of this research (choice of subject, theory and methods) were designed to fulfill my PhD requirements, I sought a participatory involvement of the local people

in this research. During the research design, I aimed to involve willing participants throughout, in steps such as the design of questions and validation of information. This included a prior visit to Praia do Sono (in 2012) due to an existing contact I had with local leaders. In this visit I explained the purposes of the research and asked for their feedback, especially about the importance of this research to the Caiçara people; and to propose the use of photovoice as a method that could allow for a more active role of participants, letting some of the control out of my hands. The following text provides an overview of how rapport was built, how participants were selected, what methods were applied, the details on research ethics and methods of plant collection.

Building rapport: The conflicts with environmental agencies, tourism and land grabbers caused livelihood impacts in the communities of the Reserve which contributed to their mistrust of outsiders (Siqueira 1984; Mussolini 1980; De Francesco 2010). This problem is accentuated by a research fatigue situation (Way 2013). Some Caiçara are exhausted with the short-term involvement of researchers and others (e.g. NGOs) in the community, and further stressed by the lack of explanation of research purposes and the rarity with which results are shared with participants and community members.

Building rapport was essential to conduct this research. To build rapport within communities in the Reserve, I lived in Praia do Sono for 18 months (2013-2015), took part in events and festivities within communities, and helped in the organization of English and sewing courses for youth and adults. From 2016 to March 2017, I visited the Reserve periodically to complete data collection.

Selection of research participants: Purposive sampling was used to select participants, with a profile following criteria according to the research objectives (Tongco 2007). This method

was applied to find participants with knowledge of resources for, and practice in, basket, canoe and paddle making to fulfill objectives 1, 2 and 3. To satisfy objective 4, purposive sampling helped to find participants with interest in learning and/or practicing photographic skills and discussing notions of conservation. The snowball method was applied to identify other participants with similar profiles in the same and/or in other communities within the reserve (Bernard 2006).

Two other criteria were also considered for the selection of participants: 1. length of residence in the communities around the Reserve (at least 10 years), and 2. willingness to take part in this research. Efforts were made to include participants of both genders as an attempt to cover aspects of gendered knowledge. It is known that specific kinds of traditional and local knowledge are associated with gender (Rocheleau 1991; Berkes 2018), and this is no different in Paraty (Carpenter 2011).

Out of 31 participants, only 6 were women. Objective 1 considered information from all basket, canoe and paddle makers participants through field trips (n=7) and semi-structure interviews (n=25). There is some participant overlap in interviews, as one participant talked about basket and canoe making, two about canoe and paddle making and two about basket, canoe and paddle making. The remaining participants (n=20) talked about one cultural product only (See appendix 1).

For research objective 2, I considered the field trip data (n=3) and semi-structure interviews (n=14) of basket makers only, with three women out of 14 basket makers. Objective 3 used data obtained from interviews with canoe makers only (n=12), all of them men, as canoe making is carried out predominantly by men in the Reserve. Information from photovoice participants (n=6, two women, and four men) was also used to fulfill objective 3. Objective 4

used information mainly from photovoice participants. These photovoice participants were all from Praia do Sono community and did not take part in the interviews about basket, canoe and paddle making.

Photovoice: Photovoice, a participatory method based on the use of photographs in interviews aims to provoke reflections, create space for dialogue and co-produce knowledge during the research process (Harper 2002; Maclean and Cullen 2009). In this research, photographs were produced by participants following a local Caiçara campaign launched by the aforementioned Traditional Communities Forum. This campaign sought to raise public awareness of rights to territories, Caiçara identity, and conservation (Figure 3). Photovoice allowed participants to talk about issues of their choice within the conservation theme.

Focus groups: Through pre-determined open-ended questions with small groups of people, this method stimulated participants to build from other participants' answers (Kitzinger 1995; Krueger and Casey 2015). A focus group session of eight hours over two days was carried out with the photovoice participants to stimulate dialogue and reflections about Caiçara and western conservation within that group.

Semi-structured interviews: These interviews consisted of a protocol with a set of predefined questions about the ecology and habitat of species used for baskets, canoes and paddles with 25 research participants from six communities (Praia do Sono, Ponta Negra, Cairuçu das Pedras, Praia Grande da Cajaíba, Cruzeiro, and Baixio). Through these interviews, participants provided a broader understanding of a Caiçara worldview, talking about the local ecological knowledge of resources, the preferences for certain patches in the landscape, the choices for species and individuals, the social organization to harvest and to make things, and details about the processes of basket, canoe and paddle making.

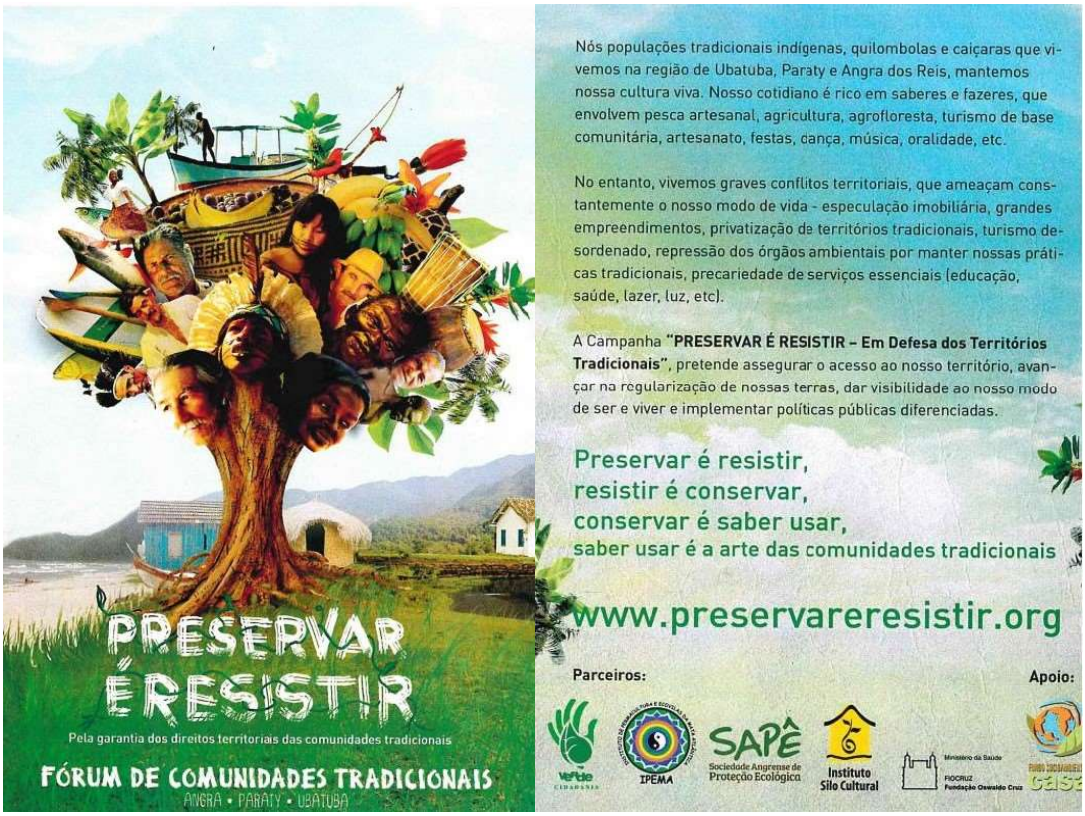

Figure 3: Leaflet containing information about the campaign sought to raise public awareness of Caiçara rights to territories, Caiçara identity, and conservation launched by the Traditional Communities Forum of Ubatuba, Angra, and Paraty municipalities. Source: Traditional Communities Forum website available at https://goo.gl/4tbQih. Accessed on June 13, 2019.

Field trips: Excursions with knowledgeable people were carried out on the land, where informal interviews, photo documentation, georeferenced data and plant collection could take place (Johnson and Davidson-Hunt 2011). In this research, half or one-day field trips were carried out with seven participants from four communities (Praia do Sono, Ponta Negra, Cairuçu das Pedras, Baixio), allowing the understanding of the resources generally favored by Caiçara, or favored by individual participants. Details about the reasons for their preferences, and knowledge about places and landscape patches where these resources can be found were shared by Caiçara participants.

Research ethics and informed consent: This project was approved by the Research Ethics Board of the University of Manitoba (JFREB J2012:155) and INEA, the state governmental agency that regulates the Juatinga Ecological Reserve (Research Permit INEA 051/2015). The ethics code protocols of the International Society for Ethnobiology and SOLAE (*Sociedade Lationoamericana de Etnobiologia*) were followed throughout the research process.

Informed consent was obtained from research participants prior to data collection from interviews, photovoice, field trips and focus groups methods. Oral consent was often a better alternative, due to the discomfort showed by participants with signing written documents and the high illiteracy rates among community members. Data were annotated in notebooks and/or digitally stored when consent was given to voice recording or film making.

Plant collection: Permission for plant collection was given from the state governmental agency INEA. Plants were prepared in the Laboratory of Ethnobotany and Human Ecology, in the Federal University of Santa Catarina, Florianópolis, Brazil, and identified with the help of specialists. Voucher specimens were deposited in the Herbarium EAFM, located at the Federal Institute of Education, Science, and Technology of Amazonas, in Manaus, Brazil.

1.7. Chapter contents and interconnections

This thesis is organized into six chapters, which build upon each other to generate knowledge about a Caiçara ethnoecology of the landscape in the Ecological Reserve of Juatinga. Chapters 2 to 5, the four main chapters of this thesis, address the objectives and results of this research. Objectives 1, 2, 3 and 4 guide chapters 2, 3, 4 and 5, respectively.

Chapter 2 describes a Caiçara-landscape relationship within the perspective of forest resources used for basket, canoe and paddle making. The chapter does this by describing types of Caiçara journeys throughout the landscape of the Juatinga Ecological Reserve, and by discussing

how people find, choose, harvest and manage resources for their special needs. Landscape ethnoecology provides the theory to illuminate how people's embodied knowledge and practical skills help them to access resources in their customary landscape (Davidson-Hunt and Berkes 2010; Johnson and Hunn 2010).

Chapter 3 moves forward to describe knowledge of plant resources for basket making, basket making processes, and local creativity through the lenses of a biocultural design. Basket makers have been adapting to local changes, and baskets are being redesigned to meet touristic demands in the Reserve. The chapter discusses opportunities for a biocultural design approach in the Reserve (Davidson-Hunt et al. 2012; Kuzivanova and Davidson-Hunt 2017).

Chapter 4 builds on the existing multilevel initiatives to protect an important element for the Caiçara people, the dugout canoe, which is in process of becoming tangible and intangible cultural heritage. It presents three points of how both canoe and canoe making are positive to people in the Reserve: to ensure food security and diversify livelihoods, to boost people-forest connections in the landscape and to strengthen relationships between community members.

Chapter 5 unpacks understandings and motivations for conservation under a Caiçara worldview. It uses photovoice, a participatory method, to produce knowledge in a two-way dialogue between participants and researcher. People-nature relationships are revealed with the aid of 44 photos taken by participants, and the results are presented through themes that help to frame a Caiçara perspective on conservation. The chapter presents ideas of potential projects based on a Caiçara conservation concept, which can encourage partnership building and promote co-production of knowledge between stakeholders of the Juatinga Ecological Reserve. The theoretical framework is drawn from the literature on biocultural approaches for conservation,

worldviews and emic conceptions (Kearney 1984; Bosak 2008; Beh et al. 2013; Gavin et al. 2015, Cocks et al. 2016; Berkes 2018).

Finally, Chapter 6, the concluding chapter of this thesis, synthesizes and evaluates the findings from the earlier chapters by evaluating how Caiçara ecological knowledge and management can be incorporated in the formal management systems of protected areas using the concept of knowledge co-production (Armitage et al. 2011; Tengö et al. 2014; Tengö et al. 2017). It assesses the theoretical and practical policy contributions of the thesis, interconnects the findings of individual chapters, and considers how local people should be involved. It examines where the management of the landscape has potential to be shared among different stakeholders, and suggests a better and more equitable (more just) system of management may be established in the future scenario of recategorization into new protected areas in the Juatinga Ecological Reserve.

1.8. Contributions of authors

This thesis is written as a sanwdwich thesis (collection of manuscripts). The result chapters (2-5) are multi-authored; thus, I use the pronoun “we” in some of these chapters. I participated in the project design, data collection and analysis, and wrote the first draft of manuscripts. The co-authors reviewed the draft and offered their contributions, which resulted, in the final journal manuscripts.

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Preface to Chapter 2: Caiçara people in Juatinga Ecological Reserve, Brazil: Landscape ethnoecology of cultural products

This chapter illustrates Caiçara perceptions, more specifically, perceptions from basket, canoe, paddle makers and harvesters, of the landscape in the Juatinga Ecological Reserve. It talks about the possible choices people have for multiple plant resources used for basket, canoe and paddle making—products that are important culturally. These choices are based on Caiçara knowledge, practices, and needs. This chapter shows how a Caiçara knowledge of the landscape, along with the rights to access the landscape in its entirety, are essential for Caiçara livelihoods.

Chapter 2: Caiçara people in Juatinga Ecological Reserve, Brazil: Landscape ethnoecology of cultural products[3]

Abstract

Our research on Caiçara ethnoecology in the Juatinga Ecological Reserve, in Paraty, Rio de Janeiro State, Brazil, focuses on basket, canoe, and paddle making to understand Caiçara knowledge and stewardship of the landscape. Caiçara differentiate individual plants within a given species to select suitable specimens for a specific cultural product. Choices are based on a combination of attributes such as length of roots, quality of fibers, and tree size and health. Resources are found in multiple ecotopes within a diversity of forest types; not all ecotopes produce suitable individuals for particular cultural products. Hence, people need access to areas of Juatinga Ecological Reserve beyond their community for their material and cultural needs. Our findings are of international significance in suggesting ways to make conservation and sustainable use compatible, since many resource-dependent communities are losing their resource rights in the face of increasing conservation pressures.

Keywords*: canoe making, basket making, paddle making, Caiçara, Juatinga Ecological Reserve, Atlantic Forest, Paraty, Rio de Janeiro State, Brazil*

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2.1. Introduction

Throughout the world, Indigenous and non-Indigenous hunters, gatherers, farmers, fishers, and artisans rely on forested landscapes (Chao 2012). Wood for canoes and implements, and non-timber forest products (NTFP) such as seeds, fruits, bark, and resins are harvested for subsistence use and trade (Turner et al. 2009). The field of landscape ethnoecology borrows Carl Sauer's concept of landscape as "… a land shape, in which the process of shaping is by no means thought of as simply physical. It may be defined, therefore, as an area made up of distinct associations of forms, both physical and cultural" (1963:321). Studies employing this approach have provided vital insights as to how people use and manage these resources and perceive the landscapes in which they occur (Hunn 2007; Johnson and Hunn 2010).

Many studies focus on how Indigenous and traditional peoples identify environments where particular plants grow, exploring the linkages between the smallest landscape unit (i.e., ecotopes) and vegetation, and how they find, name, classify, and manage these ecotopes (Boillat et al. 2013; Sylvester and García Segura 2016; Poderoso et al. 2017). This knowledge is important for subsistence and livelihoods, as well as culturally. For example, identification of the "berry patch" as a specific area in the landscape signifies cultural identity and connection to the land as well as knowledge of local ecological dynamics (Trusler and Johnson 2008).

Individual and collective experiences, along with repeated movements within a territory, build local and indigenous knowledge (Turner and Berkes 2006). Movements to harvesting, hunting, and fishing sites contribute knowledge about the relationships between species and the habitats in which they may be found (Trusler and Johnson 2008; Davidson-Hunt and Berkes 2010). Individual observations may be pooled, and often elders review them before they circulate as community knowledge (Davidson-Hunt and Berkes 2010). Continuous use of the landscape is

a crucial part of this process. The movement of people on the landscape may be characterized as journeying "… not in the sense of passing through, but in the sense of repeatedly traveling in an area, in such a way that an intimate relationship with the land is developed" (Davidson-Hunt and Berkes 2010:223).

We assess the role of journeying in seeking to understand the relationships people create with the resources they harvest, and how these relationships are shaped by biophysical and morpho-ecological features, land tenure and appropriation regimes, ethics and values, culture and identity, and worldviews (Turner and Berkes 2006; Johnson and Hunn 2010). This study is in the context of forest resources used by Caiçara to make products for cultural and subsistence purposes (hereafter cultural products). We explore harvesting choices shaped by landscape ethnoecology, focusing on three kinds of products: baskets, canoes, and paddles, as cultural products found in many Caiçara communities.

This study was conducted in a protected area used by Caiçara and examines the frequent conflict between the goals of conservation and resource use. Resource use restrictions are being increasingly enforced in a number of protected areas in Brazil's biodiverse Atlantic Forest region, excluding resource-dependent Caiçara communities and causing considerable hardships (Bockstael et al. 2016; Idrobo et al. 2016; Bockstael and Berkes 2017). It is therefore of some urgency to understand the complexity of Caiçara resource use to design strategies that will accommodate Caiçara harvesting needs alongside conservation goals. Conservation planning globally has often alienated local populations, who are most knowledgeable about the local environment, rather than enlisting their cooperation to share their knowledge and stewardship activities (Berkes 2018). A vast literature documents Caiçara knowledge and use of plants (Hanazaki et al. 2000; Brito and Senna-Vale 2012), including details of those needed for basket,

canoe, and paddle making (Maldonado 2004; Hanazaki et al. 2008; Borges and Peixoto 2009). However, little attention has been given to the variation amongst individuals within a plant species, and how this impacts harvesters' and artisans' choices of individual specimens for specific qualities suited to particular purposes. Our research aims to fill this gap through an examination of Caiçara rationale behind harvesting choices and selection for individual differences.

The overall system with which Caiçara people manage their land, resources, and human relations is complicated and beyond the scope of this paper. For example, Caiçara land tenure and resource rights, and monitoring of the landscape are important topics not addressed here. However, using the three kinds of cultural products (baskets, canoes, and paddles) as the lens through which to understand how Caiçara people perceive their landscape, and how they find, choose, and harvest resources, three topics stand out as particularly important: partnerships in harvesting resources, practices for keeping resources sustainable, and journeying through the landscape.

We begin with an overview of the study area and local communities, followed by a description of our data collection methods. Our results present the species of plants and trees used for baskets, canoes, and paddles, followed by a description of local partnerships, harvesting practices, and types of journeys. We conclude with a discussion of the factors influencing people's choices based on the preferences and motivations to use specific plant individuals found within the customary landscape for specific cultural purposes.

2.2. Study Area and Methods

2.2.1. Caiçara and the Juatinga Ecological Reserve

We conducted our research in six Caiçara communities in the Juatinga Ecological Reserve, located in a rugged peninsula in Paraty, Rio de Janeiro State, Brazil. Caiçara is a term that has emerged over time and is now employed within ongoing processes of identity formation by descendants of Europeans, Africans, and Indigenous peoples who inhabit parts of the southern and south eastern coast of Brazil (Begossi 1998). The south eastern coast encompasses one of the richest fragments of Atlantic Forest, one of the world biodiversity hotspots (Myers et al. 2000; Ribeiro et al. 2009). The Juatinga Ecological Reserve was created in 1992 to protect the natural environment, support Caiçara culture (Idrobo et al. 2016), and to some extent to constrain the activities of illegal land grabbers and developers. It is a strictly protected area where people have rights to the use of certain resources (e.g., fishing, bamboo harvesting, etc.), but with restrictions on the use of others that affect their ability to fulfil a number of their subsistence and cultural needs (e.g., subsistence hunting, shifting cultivation, etc.).

The establishment of protected areas, land grabbing, and tourism development—intensified by the construction of a major highway that opened access to Paraty in the 1970s—triggered physical and psychological tensions among the Caiçara by impacting their cultural and subsistence practices as well as creating insecurity of land tenure (Idrobo et al. 2016). Although relationships between the inhabitants of the Reserve and the state environmental agency (INEA) have improved over time, they still fall short of engaging full Caiçara participation in governance due to the strictly protected area status of this Reserve.

In compliance with the current law of protected areas in Brazil, the Reserve is following a process known as recategorization designed to create a mosaic of strictly protected areas and

sustainable protected areas. Depending on the zoning, regulations governing a strictly protected area could potentially severely limit the use of resources in crucial harvesting areas. A sustainable protected area—where resources are available to local communities under conditions of sustainable use— is intended to provide the political space for local participation, which in turn may encourage Caiçara to partake in governance, applying their traditional ecological knowledge to decisions affecting their livelihoods. Understanding the landscape from an emic perspective may underpin a more just and ethical approach to shaping policies that respect cultural harvesting practices of Caiçara residents in the Reserve.

Caiçara have been living in the peninsula for at least five or six generations (Vianna 2008), engaged in fishing, shifting agriculture, and harvesting medicinal plants and NTFPs for food, building materials, fuel, and the creation of cultural products. Caiçara dependence on the land and seascape has contributed to a way of life unique to Caiçara identity revealed in various cultural practices and relationships among community members, and collaborative help groups for some fishing activities (Mussolini 1980; Adams 2000). The Caiçara-landscape relationships depend on the diversity of forest types and cultural practices on the land. Caiçara harvesting activities shape landscapes and biophysical features of landscapes influence cultural practices. The forested landscape is comprised of multiple forests at various succession stages linked to harvesting practices: planted plots (*roça*), early second growth (*capoeira*), late second growth (*capoeirão*), and primary forest (*mata virgem*).

2.2.2. Data collection and analysis

We collected data from October 2014 to March 2017 in six communities in the Reserve: Praia do Sono, Ponta Negra, Cairuçu das Pedras, Praia Grande da Cajaíba, Cruzeiro, and Baixio (Fig. 1). The main methods of data collection were participant observation, semi-structured interviews, field trips, and workshops. Twenty-five Caiçara men (N=22) and women (N=3), ranging from 32 to 78 years of age, participated in this research. Ethical procedures followed the protocol of the International Society for Ethnobiology and ethics approval was granted by the University of Manitoba. The participants were considered by other community members as knowledgeable makers of baskets, canoes, and/or paddles.

Semi-structured interviews included clusters of questions regarding preferences for resources, landscape use, knowledge of forest resources, and knowledge transmission. The interviews produced themes for further discussions. We conducted follow-up interviews using a conversational approach with some participants (Kovach 2009). Field trips took place with seven participants from four communities (Praia do Sono, Ponta Negra, Cairuçu das Pedras, and Baixio), allowing participant observation and taking part in local experiences of harvesting and journeying. Four participants (Praia do Sono, Ponta Negra) engaged in two informal workshops during which the researcher made baskets with participants. As DP lived in Praia do Sono for over 18 months, participant observation provided opportunity to develop familiarity with Caiçara residents, aiding her understanding of details of cultural practices.

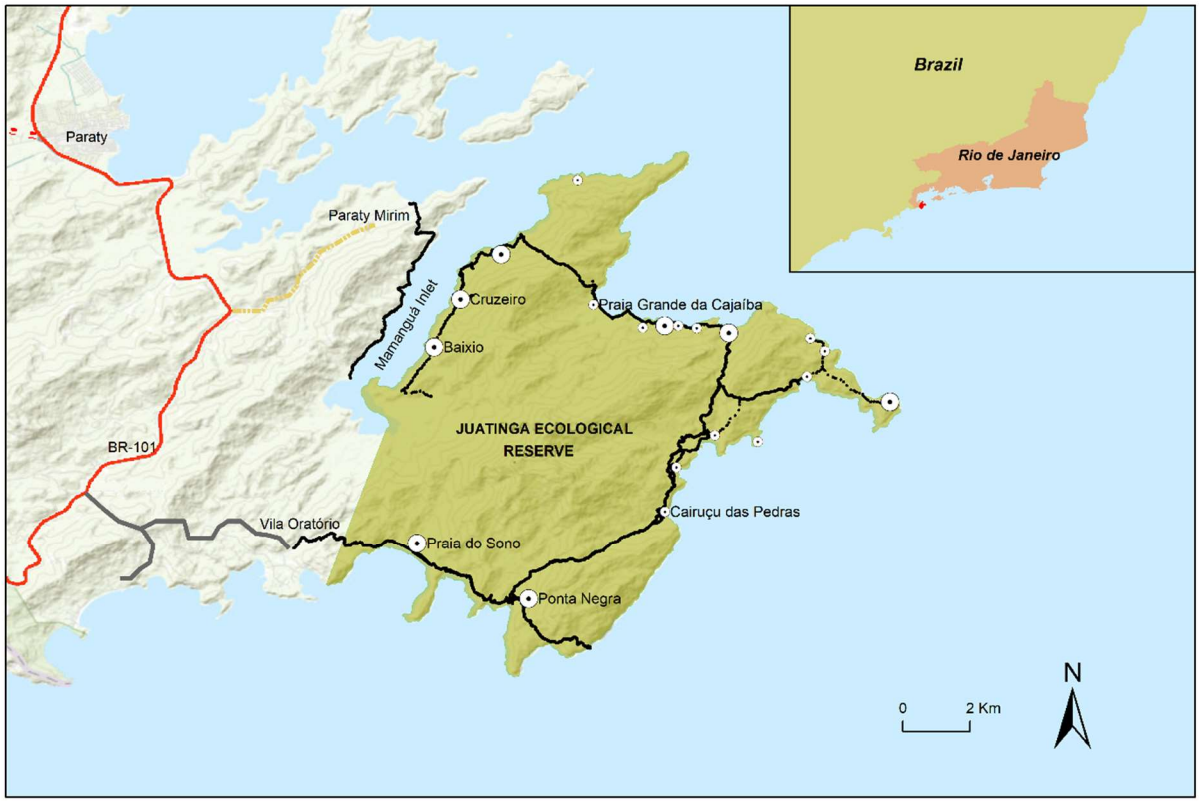

Figure 1: The map shows the Juatinga Ecological Reserve in green with the six study communities: Baixio, Cruzeiro, Praia Grande da Cajaíba, Cairuçu das Pedras, Ponta Negra and Praia do Sono. The big and small white circles show the communities and smaller settlements (with less than 50 people), respectively. The black line shows some of the ways to access communities (trails or by the sea). The red line represents the BR-101 Highway. Map prepared by F. Nossack.

Plants were identified with the help of specialists and the literature (Lorenzi 2002; Flora do Brasil 2020). Specimens were deposited in the Herbarium FLOR at the Federal University of Santa Catarina and the Herbarium EAFM of the Federal Institute of Science and Technology of Amazonas, in Manaus. *Cariniana estrellensis* and *Virola bicuhyba* could not be collected during field work and were identified through the literature (Brito and Senna-Valle 2012; Giraldi and Hanazaki 2014). We were not able to identify all the plants collected at the species level. Borges

and Peixoto (2009) found that *Stryphnodendron polyphyllum* was used for canoe making in the Reserve. Ten species of *Sclerolobium* and nine woody species of *Psychotria* were reported in the region (Silva 2007; Manão 2011).

Collected data were continuously analyzed and interpreted during fieldwork with participants through community member verification or correction of researcher interpretations (Carlson 2010). Data were analyzed with the aid of QSR International's NVivo 11 Software. The information gathered was coded into four themes that were based on the sets of questions of the protocols: favored species, knowledge transmission, the location of resources, and management of the landscape.

2.3. Results

Fourteen participants were interviewed about basket making, twelve about canoe making and six about paddle making. However, single participants could often provide information about more than one of these cultural practices, and two participants were knowledgeable about all three. Three were able to describe at least two practices, and 20 could describe one. At the time of the research, 15 participants were actively engaged in making one or more products. They gather resources from the forest whenever they are needed. Nine people declared themselves no longer fit enough to harvest resources and/or to make baskets, canoes, and paddles, citing the demanding labor required and the need for a number of people to collaborate in at least one stage of the manufacture (see Partnerships for harvesting). The interviewees provided local names of eight, fourteen, and five plant species that used to be or are used for basket, canoe, and paddle making respectively (Table 1).

Table 1: Botanical scientific names and local names of forest resources used for basket, canoe and paddle making. *preferred species according to participants.

Botanical scientific name/Family	Local names
Basket making	
Thoracocarpus bissectus (Vell.) Harling/Cyclanthaceae	*Timbupeba-roliça**
probably *Vanilla* sp., (Orchidaceae)	*Timbupeba-chata**
Philodendron bipinnatifidum Schott/Araceae	*Imbé, imbé-guaçu**
Davilla sp./Dilleniaceae	*Caboclo*
Anemopaegma sp./Bignoniaceae	*Balaio*
Philodendron corcovadense Kunth/Araceae	*Imbé-mirim*
Unidentified species/Bignoniaceae	*Cambira*
Ipomoea sp./Convolvulaceae	*Batata*
Canoe making	
Albizia pedicellaris (DC.) L. Rico/Fabaceae	*Timbuíba rosa*/branca*
Tachigali denudata (Vogel) Oliveira-Filho/Fabaceae	*Ingá-amarelo**
Sclerolobium sp./Fabaceae	*Ingá-flecha*, Ingá-ferro*
Stryphnodendron sp./Fabaceae	*Canafista*
Psychotria sp./Rubiaceae	*Caquera crespa*
Tabebuia cassinoides (Lam.) DC./Bignoniaceae	*Caixeta*
Anadenanthera colubrina Vell. Brenan/Mimosideae	*Cobi*
Ficus cf. *enormis* Mart. ex Miq/Moraceae	*Figueira parda*
Schizolobium parahyba (Vell.), Blake/Fabaceae	*Garapuvu*
Matayba guianensis Aubl./Sapindaceae	*Ingá-de-concha*
Senna multijuga (Rich.) H.S.Irwin & Barneby/Meliaceae	*Angelim*
Cedrela fissilis Vell./Meliaceae	*Cedro*
Alchornea glandulosa Poepp. & Endl./Euphorbiaceae	*Chichá*
Cariniana estrellensis (Raddi) Kuntze/Lecythidaceae	*Jequitibá*
Paddle making	
Pausandra morisiana (Casar.) Radlk/Euphorbiaceae	*Guacá**
Virola bicuhyba (Schott ex. Spreng.)/Myristicaceae	*Bacubixaba**
Senna macranthera (DC. ex Collad.) H.S.Irwin & Barneby/ Fabaceae)	*Fedegoso**
Croton celtidifolius Baill./Euphorbiaceae	*Cubitinga vermelha/branca*
Tabebuia cassinoides (Lam.) DC./Bignoniaceae	*Caixeta*

2.3.1 Choosing resources: species and ecology

Basket making

Eight species were mentioned by participants for basket making in the Reserve (Table 1). We focus on the species most frequently cited to be in current use: *imbé or imbé-guaçu* (*Philodendron bipinnatifidum*), *timbupeba-roliça* (*Thoracocarpus bissectus*) and *timbupeba-chata* (probably *Vanilla* sp.).

The bark of *P. bipinnatifidum* is used to decorate basket handles. Its use is becoming rare, but some artisans still favor the species for aesthetic reasons. Its use is also linked to the artisans' knowledge of the species habitat and their preference for harvesting it. The species is commonly found in backyards due to its ornamental value, although these individuals are not suitable for basket making because they do not develop long aerial roots. Artisans prefer the long roots that are found in individuals hosted in tall trees, usually within the primary forest. The longer the aerial root, the longer the fiber and the better the basket because longer fibers enable the artisan to weave the basket handles with few or no splices (Fig. 2a).

T. bissectus and *Vanilla* sp. are the key species for basket making because their root fibers have a structural function for baskets. Their durability is favored by artisans. *Vanilla* sp. is favored over *T. bissectus* because it demands less effort to peel off the bark, which in turn, results in a better production of fibers and less material loss during preparation. On the other hand, *Vanilla* sp. is less abundant and more difficult to find, so artisans will often use *T. bissectus.*

Figure 2: a) An odd number of straps is needed to enable the weaving process of artisans, b) multiple canoes of different sizes may be carved from a single tree, c), paddles are always crafted in pairs: two, four or more, depending on the tree size. In smaller trees, two paddles are crafted with the back face of the blade facing each other in the center of the wood. In trees that accommodate four paddles, the back of the blade faces the tree bark and d) resources for the three cultural products may come from different ecotopes within the Reserve landscape. Figure prepared by D. Peppler.

A Caiçara ethnoecology of species associations in the landscape helps people locate species in the Reserve. Participants noted that *T. bissectus* and *Vanilla* sp. are found in different habitats, the former in humid, wet, and cool places like streams and waterfalls, and the latter usually in dry, rocky environments. Some informants reported that the two species co-exist within the same environmental conditions, but recognize that one or the other will be more abundant in places with specific environmental characteristics. Participants from Praia do Sono attributed the ease of harvesting *T. bissectus* in their community to the presence of the community waterway system, while participants from Ponta Negra find *Vanilla* sp. more easily because of the dry, steep slopes around the village. However, both species occur in both communities, albeit with these differences in abundance. Likewise, participants from Mamanguá acknowledge the existence of both species in the inlet but abundance of *T. bissectus* is higher due to its co-existence with the forests of *Tabebuia cassinoides* in the region.

Trees for canoe making

The Caiçara use a number of diverse canoes: (1) smaller canoes (2-3m) for travel from docks to anchored canoes; (2) squid jigging canoes (3-4m) found in Praia do Sono; (3) canoes for mullet and other fishing techniques (4-5m) found in Praia do Sono, Cairuçu das Pedras and Mamanguá; (4) canoes for *cerco* (a kind of fixed net) fishing (5-7m) found in Praia do Sono and Ponta Negra; and (5) *canoas de voga,* found in Mamanguá (> 7m) used mostly for transporting goods. When well cared for, a canoe will last many decades and be passed down through multiple generations. Canoes are treated with care as the process of carving one is laborious and time-consuming. Fourteen species were cited as suitable for canoe making (Table 1), and they are chosen based on several attributes of each tree. Finding a tree that meets all the ideal

conditions for canoe making is difficult. Tree health, quality of the wood, trunk size and morphology, forest type, and distance are among the attributes considered when searching for a suitable tree (Table 2).

Table 2: Finding a tree that meets the requirements: major attributes of trees for canoe making.

Attribute	**Explanation**
Tree health	Refers to whether a tree is alive, dying, or dead. Harvesters often favor trees that are sick, dead, or compromised by environmental conditions. A sick or dead tree needs to be cut and used before it starts decaying. A fallen tree saves time and labor because one can skip the cutting process.
Quality of the wood	Weight, durability and hardness influence the quality of wood. Weight is the dominant factor considered by elders preferring lightweight species. Durability (*durável* in Portuguese) relates to the ability to withstand wear. Hardness (*dureza* in Portuguese) is the ability to withstand abrasion, here linked to the ease of carving.
Trunk size and morphology	If only one canoe is needed, the canoe maker will attempt to use a trunk for the size of the canoe needed, although this is not always possible. Canoes used in the region are one of five types, with sizes varying according to end use and the environment in which they will be used.
Forest type	Individuals of a given species have different growth rates depending on the forest type or stage of succession. Some of the species may be growing in primary forests or in secondary forests at different stages of regeneration.
Distance	The amount of time and/or physical space between the harvester and the desirable tree in the forest.

Regarding tree health, one participant described his search for a tree to make a large canoe. He found an *Albizia pedicellaris* (*timbuíba rosa*) tree compromised by a colony of ants.

The colony was covering the base of the trunk, and he had to resort to making a smaller canoe to utilize the tree. Participants mentioned the dynamics of tree health in the area, with possible effects of climate change, noting that the mortality rates of *Schizolobium parahyba* are high in the region, perhaps due to changes in local precipitation. For example, on Ilha Grande, an island off Paraty, all individuals of this species have died (Callado and Guimaraes 2010).

Regarding quality of wood, harvesters considered trade-offs in the weight, durability, and hardness of a tree. Although not a favored species, one participant mentioned that he would choose *S. parahyba* if he had access to a suitable tree. This species is known for lightness, which offsets its limited durability. Pushing and pulling canoes from dock to sea and vice versa is arduous work. Communities in Mamanguá are subject to high variations of tide. The lighter the canoe, the easier it is for fishers to put them away at the end of the working day.

For most Caiçara, durability is key. Some participants prefer *Tachigali denudata* (*ingá amarelo*) due to its durability, even though it is considered heavy as compared to *S. parahyba* and *A. pedicellaris*. Participants mentioned that *T. denudata* is commonly found in Praia do Sono, but is less common in Mamanguá. One participant showed us three individuals of *T. denudata* he considers will be suitable for canoe making that he has been monitoring for years. Another species appreciated for durability is *A. pedicellaris,* highly available in the landscape. There are two local names for *A. pedicellaris*, *timbuíba rosa* and *timbuíba branca*, referring to the color of heartwood, pinkish and white, respectively. The combination of durability and medium weight makes *timbuíba rosa* one of the favorite trees, but not *timbuíba branca.* Canoe makers hope for *timbuíba rosa* when they choose an *A. pedicellaris* tree, but for most participants it is a matter of luck to get *timbuíba rosa*, as it is difficult to distinguish them prior to harvesting.

Regarding hardness, participants considered *Cedrela fissilis* (*cedro*) as one of the best species for carving, but its use is currently illegal. Participants distinguished *cedro* growing on rocks from those growing in early second growth forest. The *cedro* growing on rock are preferred due to the ease of carving. Many participants prefer *T. denudata*, *A. pedicellaris, Sclerolobium* sp. (*ingá flecha*), *Stryphnodendron* sp. (*canafista*), *Psychotria* sp. (*caquera crespa*), and *Ficus* cf. *enormis* (*figueira parda*). The wood of *T. denudata* was considered harder to carve than *A. pedicellaris*, with preferences varying among participants. One participant favored *T. denudata* because its hardness offers more precision when carving; others preferred *A. pedicellaris* because the softer wood allows canoe makers to control their movements more easily.

Trunk size and morphology limit the type of canoe, given the diversity of canoe types. There is a proportional relationship that canoe makers use to check if a trunk meets the size of the canoe they are planning to make. To know the maximum size of the beam (width of canoe at its widest point), they divide the tree diameter by four. The length dimension is the beam size times three or four, depending on the preference of the canoe maker. This relationship needs to be carefully observed, otherwise the canoe may be unstable or unsafe. For example, a trunk of 2m diameter by 6m length would not be a good fit for a *cerco* canoe. The length would be appropriate, but the beam would be too narrow to offer stability to accommodate fishing gear and catch. According to participants, *T. denudata* and *A. pedicellaris* are good choices for squid jigging canoes. They endure rough conditions in the open sea where this fishing activity occurs.

Participants mentioned one species *Sclerolobium* sp. (*ingá-flecha*) which is short but has a large diameter when fully grown. One participant chose *Sclerolobium* sp. over *Cariniana estrellensis* (*jequitibá*) to carve his *canoa de voga* of 7.3 m. Trees of *Sclerolobium* sp. are usually

good for one large canoe, like the ones for *cerco* fishing, mullet, or transportation. Even though it requires more carving and unwanted additional labor, sometimes multiple canoes are carved from the same trunk (Figure 2b), to use the resource available and save material for future needs.

Forest type has a strong influence on the tree chosen. Participants explained that in *capoeira* and *capoeirão* forests trees grow faster than trees of the same species in the primary forest. Trunks in secondary forests usually grow simultaneously in length and diameter. Primary forests, in contrast, are very dense, allowing little sunlight. Here a tree will first grow tall to reach sunlight, and then develop radial growth. Forest type may affect the hardness of the wood. *Capoeira* are dry places because of the open/sunny spaces, influencing the morphology of the trunk, which becomes dry as the tree grows. The drier the trunk, the harder and more difficult it is to carve. In contrast, trees from closed-crown forests are easier to carve, as such forests create and maintain moisture within the environment, and higher levels of humidity and shade makes the wood softer.

Distance is important: a canoe maker needs to think carefully about the distance because he will need to journey on a regular basis from his house to the harvested tree, his first workplace. Canoe makers look for trees in flat, open spaces in the forest because carving on steep hills is more difficult as it requires the building cribs to lay the tree level while carving. First, the trunk is carved into a rough canoe shape, with extra wood left to resist the impacts of transportation. Then, the carver solicits volunteers to form a mutual help group (*mutirão* or *puxada de canoa*) to pull the canoe from the forest to the final workplace. Geographical features of the landscape are also considered. Streams and rivers, for example, serve as a means to transport a canoe-shaped trunk, while steep hills facilitate sliding it down from the forest. One participant declared that the tree he chose for his canoe was based on the tree being close to his

house: this would mean less work and would make it easier to find people to pull the trunk from the forest. Participants mentioned that it is becoming increasingly difficult to find people willing to become part of collaborative help groups.

Trees for paddle making

Wooden paddles, along with canoes, are important to Caiçara culture. Canoe owners use paddles for propulsion, while fiberglass and aluminum boats carry a wooden paddle mostly for safety reasons. Paddles have also decorative function, especially for tourists and local people who want to decorate restaurants and rental houses. Choosing wood for paddles differs from choosing trees for canoes. To narrow down the choice of trunks to one of the five species (Table 1), paddle makers consider the main function of the paddle to be made: propulsion or decoration. The function influences the quality of wood that is needed, which in turn, is related to the forest type and distance. Decorative paddles are usually from trunks of *Tabebuia cassinoides* forests. Propulsion paddles are made of *Senna macranthera* (*fedegoso*) and *Croton celtidifolius* (*cubitinga*) common in secondary forests or *Pausandra morisiana* (*guacá*) and *Virola bicuhyba* (*bacubixaba*) mostly found in primary forests.

Paddles made from any species can be used for decoration but *Tabebuia cassinoides* (*caixeta*) is the preferred species, as softwood facilitates carving, and the lightness eases transportation of products from communities to stores in downtown Paraty. Participants explained that paddles of this species are not appropriate for fishing-related activities because they are not durable, although one participant mentioned that the brackish water where *T. cassinoides* grows increases the durability of the wood. Some fishers use paddles of *T.*

cassinoides for short navigation trips within the Mamanguá inlet. These paddles are, however, inadequate for other environments with rougher sea conditions.

Paddles designed for propulsion and fishing in the open sea are made of *Pausandra morisiana* (*guacá*), *Virola bicuhyba* (*bacubixaba*), *Senna macranthera* (*fedegoso*), and *Croton celtidifolius* (*cubitinga*). The latter two species are difficult to carve, but some participants prefer them because of their resistance to breakage. Other participants prefer *Pausandra morisiana* (*guacá*) and *Virola bicuhyba* (*bacubixaba*) for paddle making, although harvesting them may be more difficult as these species are found in primary forests, which are usually farther away from communities than *capoeira* forests. The trunk splits more easily into two, four, or six equal parts, meaning that little material is lost. Carving is facilitated because of lengthwise fiber orientation and a small number of knots.

In contrast to some of the species for canoe making, which are harvested in ecotopes within more than one forest type, species for paddles tend to be in specific forest types. Participants mentioned that *P. morisiana* and *V. bicuhyba* are in primary forests, and that they need to journey for hours to reach suitable trees. These trees are cut into planks that are heavy, so that paddle makers need to travel multiple times to bring the wood to the communities.

S. macranthera and *C. celtidifolius* are pioneer species commonly found in *capoeira*. They are usually close to *roças* and to the community and more likely to be used by paddle makers. Their difficulty to split and to carve is due to the fibers' crossed directions. Also, not every tree of these species is suitable for paddle making. Suitable trees have straight trunks; trees with many branches will have many knots that create fragile breakage points as well as making carving difficult.

Paddles are always made in pairs because their design allows harvesters to better use the wood material. Some paddle makers prefer smaller trees because they are easier to manage, aiming for two to four paddles per trunk (Fig. 2c). Others prefer larger trees with a diameter large enough for at least six paddles. The length of the trunk is also something to consider. The paddles, especially those designed for propulsion, follow a proportion between blade and shaft. Trees are usually tall enough to fit the length of one paddle at least, obeying the proportions between the height of the blade and the height of the shaft. Elders mentioned stories about trees that were tall enough to make two or three times the length of Caiçara paddles. Such trees would be difficult to harvest and to transport, requiring partnerships for harvesting.

2.3.2. **Partnerships, sustainable practices, journeying**

Partnerships for harvesting

Building partnerships for harvesting is important for managing challenges such as locating or transporting materials from multiple forest habitats to the workplace. Partnering has to be negotiated and depends on the willingness, availability, and ecological knowledge of potential partners. However, Caiçara generally recognize the importance of cooperation in their day to day interactions, and partnerships are formed in one of three ways:

1) Two individuals agree to cooperate on a regular basis. This kind of partnership is often found between people who are closely related, such as father/son and mother/daughter. One partner is often an elder who may have health or mobility issues that restrict their ability to harvest in the forest, for which younger partner is responsible, following the elder's instructions for finding and/or gathering resources. Elders have more experience, knowledge, skills, and are

often more interested in making cultural products than their younger partners. Two individuals, with or without kinship ties, one knowledgeable about the landscape and able to identify suitable resources and remember locations, the other with the practical skills to create the cultural product, may also establish a partnership.

2) One-off groups constituted for special purposes, such as when a canoe maker needs to transport the canoe-shaped trunk from the forest to a work site close to his house to finalize the carving process. This collaborative effort among community members is locally called *mutirão* or *puxada de canoa*. The number of people in the group varies depending on the canoe size and the distance the trunk will be transported.

3) Groups of two or more people coming together spontaneously to exchange knowledge about the landscape. This is common among artisans, canoe makers, other harvesters, and other community members. An individual may change his/her harvesting practices over time and thus acquire to knowledge of different practices and resources in multiple ecotopes that can be shared. Some participants described themselves as very protective of their knowledge, especially regarding species locations, but would not hesitate to share this knowledge with a relative, a friend, or another person with greater need.

Practices for keeping harvests sustainable

Caiçara people follow various cultural practices to avoid overexploitation and to assure the availability of plants in a given spot over time; here we focus on four of these, using the example of plants harvested for basket making. Perhaps the most common practice is to attempt to extract aerial roots without damaging the parent plant (*planta mãe*). If the parent plant is torn

from the host tree, it will most likely die and the harvesting site will be compromised for future harvesting in the area.

Another practice is to collect only the mature roots (*de vez*) from plants, since they have the desired pliability and durability for weaving. Roots have distinct colors throughout the plant's development. Roots of *T. bissectus* and *Vanilla* sp. are green when immature, turning dark purple when ready to harvest. Some harvesters look for knot-free and/or long roots; others collect roots hanging free off tree branches or are less tangled in host trees. Participants did not cite these examples as a way of assuring survival of a species, but nevertheless, the selection of mature, long, knot-free, and untangled roots restricts the number of roots suitable for harvesting.

A third practice is to limit harvesting to the amount needed by an individual for his/her project. Harvested roots are good and resistant for only a few days after collection, after which they lose malleability and become unsuitable for weaving. Caiçara elders described traditional techniques to restore the quality of old harvest roots, but these are regarded by some artisans as a last option. Freshly collected materials are always favored, even though their harvest may require multiple trips to the forest.

A fourth practice is rotating harvesting spots, a common practice in many Indigenous cultures (Berkes 2018). Once plants in one place have been harvested for mature roots, it is imperative to move on to another location to allow the first site to recover. The regular practice of rotational use allows time for species re-growth and reproduction. The new site may be familiar to the artisan, such as one that has recovered from past harvests, one used for other purposes, or one learned about from other community members through knowledge exchange.

Journeying through the landscape for multiple needs

The landscape of the Juatinga Ecological Reserve encompasses geographical features such as cliffs, valleys, rivers, and the shoreline as common landforms that can be seen as boundaries to people, depending on the harvesters and on the nature of their cultural practices (Ingold 2000). For Caiçara, geographical features are essential for movement through the landscape as they provide means of mobility and points of reference that allow people to bond with the landscape in different ways.

One such example is migration within the Reserve. People are used to migrating between communities due to marriage, to avoid land grabbing conflicts, in response to availability (or lack thereof) of land and other resources, and to be close to schools, to the city, and to workplaces. Twelve participants reported that they had lived in at least two communities within the Reserve or adjacent areas. These migrations require that people harvest resources in different communities, which in turn shapes their relationships with different places in the Reserve landscapes.

Daily commuting also entails becoming familiar with the landscape. There is a need to access the city on a regular basis (e.g., for markets, banks and schools). In the Reserve, access to communities is on foot by trails or by sea. Rides in fiberglass or aluminum boats are an option, but often too expensive for many people. Also, rough seas may force people to use forest trails rather than boats. People from Praia do Sono and Ponta Negra have to walk along more than four km of forest trails to access places where they can catch the municipal bus to Paraty. In many cases, these journeys through the landscape are opportunities to find, observe, and build on knowledge of forest resources.

One basket maker shared one of his observations of abundant *Thoracocarpus bissectus* (*timbupeba-roliça*) along the trail that connects Praia do Sono to the bus stop to downtown Paraty. During one of his journeys, he noticed that individuals of this species were dying when hosted on fallen trees. Participants who frequently journeyed along the six km of trails between Ponta Negra and Cairuçu das Pedras reported that after a number of trips they had noticed for the first time the flowers of *Vanilla* sp. (*timbupeba-chata*), another important plant for basket making. In both cases, knowledge of resource depletion or availability was acquired through observations of plants during journeys through the landscape.

In addition to the harvesting of forest resources for basket, canoe, and paddle making, participants described resources used for other cultural practices, such as making *tapeti* (compressible bamboo baskets used to drain processed manioc flour), *pau-a-pique* houses (made from bamboo and clay), hand-held fans made of palm (leaves of coco preto *Astrocaryum aculeatissimum*), and various handicrafts, including small models of boats and canoes carved from *caixeta* (*T. cassinoides*) to sell to tourists. In the Reserve, harvesting occurs within communities and with neighboring communities, and extends to the tops of the mountains and to the trails that connect multiple places in different forest types and multiple ecotopes within these forest types distributed across the Reserve landscape (Fig. 2d).

2.4. Discussion

Our results suggest that Caiçara residents in the Juatinga Ecological Reserve need access to the entirety of the landscape to harvest the materials they require for the production of culturally important items. Landscape ethnoecology provides insights into how cultural

practitioners access individual plants of multiple or single species in multiple ecotopes throughout a diversity of forest types within the landscape.

Previous studies on Caiçara basket, canoe, and paddle making have focused mainly on inventories of species used (Borges and Peixoto 2009; Brito and Senna-Vale 2012)[4]. To our knowledge, our research is the first to describe Caiçara basket, canoe, and paddle making using people's perceptions of the qualities of resources in terms of variations in individual plants that influence their suitability for these cultural products.

Caiçara choices for resources for basket, canoe, and paddle making are influenced by three major factors: variation within individual plants and people's preferences for a given species; worldviews, represented by people's values; and personal experiences of journeying through the landscape.

It is clear that not every plant of a single-species known to be used for baskets, canoes, and paddles is suitable for making cultural products. For example, canoe making requires consideration of a number of factors beyond the height and diameter of a particular individual tree of an appropriate species, including the quality of wood, location, and distance to and from the final worksite. At the ecotope scale, a single-species found in multiple forest habitats may show morpho-ecological differences depending on local environmental conditions. The literature has a few examples of how people choose plants of a given species by using morpho-ecological variations, although see Johnson (2000) for a description of Gitksan harvesting of stonecrop

[4] Other studies have described Caiçara ecological calendars for harvesting activities. Hunting and fishing consider seasonal and lunar calendars while harvesting wood for canoe happens in specific moon phases to guarantee the quality of the wood (see Sanches 2004).

plants from soft soils to facilitate collection or from swamp habitats to obtain suitable succulent roots for medicinal uses.

The Caiçara worldview is shaped by values of reciprocity, respect, and trust. Community bonds, through cooperative partnerships and mutual help groups, are very important. Knowledge exchange among community members of the location and quality of plant resources in the landscape helps artisans and canoe and paddle makers readily find those they need. This social cohesion has been described as: "…willingness to cooperate means they [people] freely choose to form partnerships and have a reasonable chance to realize goals because others are willing to cooperate and share the fruits of their endeavours equitably" (Stanley 2003:5). Local rules regulate harvesting behavior, such as harvesters respecting others by following a first-come-first-served approach but respecting informal land tenure for a tree marked for future use (Berkes 2018; see also Turner and Berkes 2006).

Caiçara have been building connections with the landscape through experiences and practices accumulated over time and space by journeying within and outside the Reserve. All types of journeying — migration, daily commuting, and harvesting — are opportunities for individuals to develop an intimate relationship with the land and build knowledge about places, resources, and biophysical features, within and beyond the boundaries of their communities. As there are no roads to access the study communities, and the sea route is not always a viable option, journeys over forest trails remain important ways for many Caiçara, especially the youth, to understand their landscapes. Journeys in this sense produce cultural landscapes, and turn an undifferentiated space into an area where the location and qualities of resources are known, and cultural practices can be pursued (Davidson-Hunt and Berkes 2010).

The knowledge of variation within individual plant species and the selection of appropriate individual plants for different needs, worldviews and values, and journeying through the landscape are interconnected. The more often people journey through the Reserve, the more familiar they become with the Caiçara landscape. The association of places with resources facilitates accessing resources as needed (Hunn and Meilleur 2010). These places, often kept secret from outsiders, may be termed cultural keystone places, "a given site or location with high cultural salience for one or more groups of people and which plays, or has played in the past, an exceptional role in a people's cultural identity" (Cuerrier et al. 2015:431).

These places are not significant only as a source of raw materials, but also as the wellspring of stewardship values and sense of place for the Caiçara. Harvesting is one way of journeying within a landscape, allowing people to develop an intimate relationship with multiple places (Davidson-Hunt and Berkes 2010; Johnson and Hunn 2010). It is a multidirectional practice that extends to modified natural forests, secondary forests in various successional stages, and primary forests. The Juatinga Ecological Reserve has multiple geographical features, and people search for resources in the entire landscape. For Ingold (2000) features of the landscape, such as rivers, escarpments or built walls, do not necessarily constitute a boundary: "… it is important to note that no feature in the landscape is, of itself, a boundary. It can only become a boundary, or the indicator of a boundary, in relation to the activities of the people (or animals) for whom it is recognized or experienced as such" (156).

As in many other parts of the world, conservation schemes in Brazil's biodiverse Atlantic Forest are increasingly being enforced by squeezing out or displacing resource-dependent communities (Bockstael and Berkes 2017). It is of great practical interest, therefore, to understand Caiçara resource use in all its complexity to understand their harvesting needs as well

as their stewardship practices. As the people most knowledgeable about the local environment, the Caiçara have a role to play in the conservation of the Atlantic Forest region. Accommodating sustainable small-scale resource use in protected areas make the Caiçara, and resource-dependent communities in general (Berkes 2018), allies in and contributors to conservation efforts.

2.5. Conclusions

Caiçara use resources that are distributed in multiple ecotopes in a diversity of forest types within the Reserve landscape, many of which have been shaped by harvesting practices over time, creating cultural landscapes that require more than their current limited access to small community territories. To sustain these cultural practices, it is necessary to provide access to the Reserve landscape in its entirety, and not at a patch scale, as the diversity of resources that people utilize exceeds any given patch. Diverse types of harvesting, ecological knowledge needed for sustainable harvesting, and the exchange of this knowledge among community members all contribute to the creation and maintenance of the relationship between Caiçara and their territory. This in turn determines Caiçara identity, stewardship values, and sense of place—key elements for the management of their territory. Our results can inform the decision making of researchers, managers and other stakeholders regarding forest management, as well as provide support for cultural practices that are crucial to Caiçara identity and connections to land, and for local community cooperation toward conservation success in the Reserve. Our findings are of international significance in light of expanding protected area networks throughout the world. Given that many resource-dependent local communities have had their resource rights curtailed for conservation reasons, our results suggest ways to make conservation and sustainable use compatible.

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Preface to Chapter 3: Making matters: Skill and attentiveness in the weaving of baskets by Caiçara crafters of the Atlantic Forest, Brazil

Chapter 3 is about basket making and its importance in multiple dimensions for artisans in the Reserve. More specifically, it has a section that illustrates the many steps of basket making, while talks about the importance of knowledge transmission and the role of creativity in designing new basket products to attend tourists in the Reserve. The chapter shows how baskets and basket making (with all the knowledge involved in the making process) are important components for providing Caiçara artisans with an extra income while helping keep them in their landscape.

Chapter 3: Making matters: Skill and attentiveness in the weaving of baskets by Caiçara crafters of the Atlantic Forest, Brazil[5]

Abstract

Basket making is an important cultural practice for Indigenous and traditional communities worldwide. Artisans from Caiçara communities within the Juatinga Ecological Reserve, in Paraty, southeastern Brazil still rely on this practice for producing baskets for their own use and for extra income. Fourteen basket makers, from five communities in the Reserve, participated in this research: eleven men and three women aged from 32 to 78 years old. Semi-structured interviews, workshops, and field trips to harvesting sites helped to gather data to identify the main nontimber forest products harvested, understand how elder transmit knowledge to young people, and document the details of the basket making process. A series of photos illustrate the four stage process, from harvesting to the final product, followed by Caiçara artisans who participated in the research. During interviews, was found out that tourism is a major influence on basket making as tourism demands stimulates artisans to craft baskets. Tourism stimulates artisans' creativity to craft new basket forms but does not change their choice of materials and techniques. Concern was also expressed by basket makers, as few young people are becoming competent in the craft as they are busy with other jobs available to them in the tourist sector. The paper concludes with examples of baskets that depict the creativity of

[5] Peterson, D. and Davidson-Hunt, I. Making matters: Skill and attentiveness in the weaving of baskets by Caiçara crafters of the Atlantic Forest, Brazil. Resubmitted to Journal of Ethnobiology with revisions (April 2019).

artisans and ends with a reflection on the possibilities and opportunities of a biocultural design process that could support artisans for the pieces they sell in the tourism market.

Keywords: *ethnoecology, basket making process, basketry, nontimber forest products (NTFPs), biocultural design*

3.1. Introduction

Basket making is an example of a cultural practice through which knowledge is passed down from generation to generation in many societies (Athayde 2010; Roy 2009). Ethnobotanical and ethnoecological studies have increased our understanding about baskets and its significance to Indigenous and traditional peoples in several ways. Commonly handmade, baskets are defined here as "a container created by weaving semi-rigid vegetable fibers" (Roy 2009). Basketry provides women with an opportunity to obtain cash from market exchange (Lincoln and Orr 2011), supports subsistence as they are used to harvest, carry and process food (Muhwezi et al. 2009), and as Vargas and Andel (2005) argue, improves living conditions.

The literature shows a series of conditions that are needed for people to be able to make baskets. People need access to the locations from which the materials can be harvested (Muhwezi et al. 2009), time to dedicate to production, and the knowledge and skills to process and dye materials, weave fibers and make motifs (Reyes-García et al. 2006; Roy 2009). Another important ingredient, less explored, relates to the artisan's creativity, as creativity helps people adapt traditional basketry to make contemporary pieces allowing them to continue making a living from their craft (Berkes 2018; Ingold 2013). Creativity is here considered to be a process

that results in something that is new and appropriate to the task for which it is intended (Kaufman and Glăveanu 2019).

Biocultural design is a conceptual framework and practice to support Indigenous and traditional people in realizing benefits from their biocultural heritage by focusing on locally available materials, local values and creativity (Davidson-Hunt et al. 2012). Through a collaborative approach, a design team works with "communities to create and deploy solutions to contemporary challenges that reflect their desires, values and aspirations" (Davidson-Hunt et al. 2012:18), fomenting their endogenous capacities for development. In Canada, an Anishinaabe (Indigenous People of Canada) community has used this approach to restore habitats, traditional harvest practices and consumption of Manomin ("wild rice"; *Zizania aquatica*) (Kuzivanova and Davidson-Hunt 2017). In Brazil, scholars have explored the creativity of Caiçara traditional people that have recovered traditional fish dishes to attend tourists seeking for local recipes in a community (Davidson-Hunt et al. 2017). In Costa Rica, Bribri cacao harvesters have produced new products in the community, such as jelly and cacao butter, from cacao plants (*Theobroma* spp.) drawing upon their knowledge on plants location, cultural narratives of the species and local techniques to craft raw material into products (Valencia, In preparation).

We pay attention to baskets and seek to understand details of the practice of basket making by Indigenous and traditional peoples. Baskets are commonly visualized as a finished product because "…processes of making appear swallowed up in objects made" (Ingold 2013: 7). But there is more behind the object, as crafting processes may contribute not only economic but social and politically to artisans of communities involved (Athayde 2010). The Juatinga Ecological Reserve is in a richly biodiverse forest, in southeastern Brazil, where Caiçara people have been living for generations (Vianna 2008). Caiçara, in contrast to Indigenous and

Quilombolas (a group of people of African descendant) do not hold legal rights to their territories in Brazil (Brasil 1988). To help justify their permanence in their territories, a Caiçara identity formation as a traditional people has emerged aligned with local movements to claim Caiçara territories which are/were often seized by land grabbers, impacted by real state especulation or restricted by protected areas (Adams 2002, see Traditional Communities Forum[6]). Basket making and other cultural practices contribute to the development of this Caiçara identity.

The published literature on Caiçara has focused on providing lists of the plant species used for baskets (Brito and Senna-Valle 2012; Borges and Peixoto 2009) and less attention to the creativity that is often hidden in baskets' form (Ingold 2013) and to the social and political dimensions behind crafting processes. This research aims to look at how harvesters and basket makers use creativity to craft pieces that appeal to contemporary preferences. We also disclose social dimensions of basket making, which involves among other elements, knowledge transmission and knowledge of customary territories of these peoples.

Ethnoecology has a long tradition of not only documenting the interrelationships of people with biological organisms but also in considering how they contribute to livelihoods (Beaucage and Taller de Tradición Oral del CEPEC 1997; Posey et al. 1984; Toledo 1992). Drawing upon this work, in this study we investigate (1) the favored nontimber forest product materials for basket making, (2) the basket making process, and specifically how knowledge is transmitted within stages of this process, and (3) how traditional ecological knowledge (Berkes

[6] The Traditional Communities Forum (https://goo.gl/4tbQih) is a movement that aims to assure the livelihoods and territory rights of Indigenous groups, Caiçara, and Quilombolas of Ubatuba (São Paulo), and Angra, and Paraty (Rio de Janeiro). Members of the Forum have been engaged to promote cultural practices in their territory, including community-based tourism, and encouraging local knowledge and culture in formal education.

2018:8) —interweaves with artisan's creativity to shape products that correspond with contemporary desires and imaginations (Davidson-Hunt et al. 2012; Ingold 2013).

3.2. Study Area and Methods

3.2.1. Caiçara and the Juatinga Ecological Reserve

Caiçara identify as a people descended from multiple heritages —Europeans, Africans, and Tupinambá Indigenous Peoples— and who inhabit the southern and southeastern coast of Brazil. Some religious feasts, for example, are rooted in African custom (Begossi 1998). Methods to capture fish have influences from Portuguese and Indigenous Peoples (Mussolini 1980). Use of numbing plants to facilitate fish capture and use of vegetable fibers in fishing nets are further examples of indigenous influences (Mussolini 1980). Indigenous practices have also shaped Caiçara culture usage of plant fibers for basketry and techniques to carve dugout canoes (Brito and Senna-Valle 2012; Denadai et al. 2009). Brito and Senna-Valle (2012) reported a great deal of ethnobotanical knowledge of people in the region. According to the authors, Caiçara in the Reserve have higher knowledge of plants than people from other coastal communities in Santa Catarina, Paraná, São Paulo, and Rio de Janeiro states. From the total of 190 plants listed as useful by Caiçara, 48 were for construction purposes, 89 for medicinal, and 40 species for the technological category. Species used for basket making were included in the latter category.

The Juatinga Ecological Reserve is located in a peninsula in Paraty, Rio de Janeiro, in a region of the Atlantic Forest. Due to habitat loss and a high number of endemic species this region was considered a world biodiversity hotspot with priority for conservation (Myers et al.

2000, Ribeiro et al. 2009). It is inhabited by, at best estimate, 1,500 people, the majority of whom are Caiçara. For many generations, this peninsula has been a space for people to engage in shifting agriculture, fishing, subsistence hunting, harvesting of NTFPs, basket making, and wood carving. Established in 1992, the Reserve was the first protected area to encourage both environmental protection and Caiçara culture (Rio de Janeiro 1992). But in practice, much of the Caiçara cultural activities became forbidden: including banning of land and forest use and discouraging Caiçara involvement with the tourism industry (Vianna 2008, Idrobo et al. 2016). These conflicts along with the continuous pressure of land grabbers and tourism developments within the last decades have created economic, political and social impacts to Caiçara livelihoods and cultural practices.

3.2.2. Data Collection and Data Analysis

Data collection took place from October 2014 to March 2017, with 14 basket makers (11 men and three women) from 32 to 78 years old, in five communities of the Reserve (Praia do Sono, Ponta Negra, Cairuçu das Pedras, Praia Grande da Cajaíba, Baixio). A set of methods—semi-structure interviews, workshops, fieldtrips, video recordings (Thrift 2015), conversational approach (Kovach 2009), and participant observation—were applied with each method helping to fulfill the each objective of this research: to investigate (1) the favored nontimber forest product materials for basket making, (2) the basket making process, and specifically how knowledge is transmitted within stages of this process, and (3) how traditional ecological knowledge interweaves with artisan's creativity. Ethical procedures followed the protocol of the International Society for Ethnobiology and ethics approval was granted by the University of Manitoba.

Semi-structured interviews included questions regarding the basket making processes, plant preferences, knowledge of forest resources, and knowledge transmission. Workshops allowed the researcher make products with participants to acquire a better understanding of the crafting process. Four participants from two communities (Praia do Sono and Ponta Negra) participated in two workshops. Field trips allowed for observations of the process of harvesting plants for crafting and of knowledge transmission. Three participants (Praia do Sono and Ponta Negra) participated in field trips.

To display the stages of crafting process, an approach similar to Eric Thrift's approach with pastoralists was followed (2015). The stages are an attempt to systematize the process to provide the reader a better view of basket making as a process and does not represent the way Caiçara participants understand basketry. Through sequences of images from video recordings, Thrift (2015) presented various cultural activities performed by herders in Mongolia. In this research, we present images taken from photographs and video recordings of participants during basket making workshops. Videos were recorded with researcher and participants interacting with each other, "in the manner of an informal interview structured by participants' activities and commentary, rather than strictly observational" (Thrift 2015:73). Such informal interviews prompted further discussions in a conversational approach, a method commonly used as part of Indigenous methodologies (Kovach 2009).

Participant observation provided the opportunity to develop a closer familiarity with Caiçara people, helping in the understanding of details of their cultural practices (e.g. amount of raw material used in baskets, how basket making is made compatible with other activities in a day). To minimize misinterpretations by the researcher, participants were asked for further explanation when Caiçara concepts were not fully understood (Carlson 2010, Doyle 2007).

Questions were coded into four themes chosen *a priori*: favored species, knowledge transmission, making processes, and morpho-ecological relationships. Other themes (historical use and beliefs) emerged from the analysis and also helped organize the results.

3.3. Results

3.3.1. Nontimber Forest Products for Basket Making

In the past people used at least eight species for basket making (Peterson et al. 2019). At this point, according to participants, three species are important for crafting baskets in the Reserve, *timbupeba-roliça* (*Thoracocarpus bissectus*)*, timbupeba-chata* (probably *Vanilla sp.*) and *imbé* or *imbé-guaçu* (*Philodendron bipinnatifidum*). A participant explained why he used these plants instead of others for basket making:

> It's because this plant was the best to do crafts, which was *timbupeba*. And the *imbé* was used to tie [structures of] houses and to cover the sides of *balaio* baskets…That one, *timbupeba* is the most durable. Do you know why *timbupeba-chata* is better? Because *timbupeba-chata* doesn't give much work [for preparing fibers], you chipped it, cut it in half, the strand is ready. And for the *timbupeba-roliça* one needs to remove all the innerside, it demands more work. (Adult man, Praia do Sono)

T. *bissectus* and *Vanilla* sp. are the key species for basket making. Their roots are important for the inner bark which are processed into fiber strands to build the main structure of baskets. Participants mentioned the durability of both species over time. However, *Vanilla* sp.

was commonly favored over T. *bissectus* as peeling off its bark and splitting roots into multiple strands is less arduous, demands less efforts from artisans and wastes less material during fiber preparation. A participant from Baixio, however, shared a different viewpoint, explaining why he preferred to use *timbupeba-roliça*:

> It is easier to clean it [*timbupeva-roliça*]. With a sharp knife you clean it and its done. Then open it in four parts, make thin strands and craft those little baskets… There are other [plants], but this one is closer. This plant is better to work, it is softer [than others]. There are other plants in the forest, that are farther away. Then you must walk a lot to get it. (Adult man, Baixio)

Different morphological parts of aerial roots are important in basket making: *P. bipinnatifidum* is important for its bark to decorate baskets but has small importance as material to support the structure of baskets. The bark of *P. bipinnatifidum* is peeled off like a ribbon; its inner side faces the outside to wrap up different parts of baskets.

> In this part that I am talking about, we take the timbupeba strand, fold it to make the hand of the basket. Of the *samburá* basket…We leave a strand to make the handle…then we wrap it with the *imbé*…we finish the basket with *imbé*, with the bark…you hold it to make the finishing of the rim of basket, make the handle of basket. (Adult man, Baixio)

Not every artisan uses *P. bipinnatifidum* as of today. As the species plays a small role in baskets' structure some artisans use it to have contrast between the dark color of the bark and

fibers of *T. bissectus* and *Vanilla* sp. Other artisans craft baskets but do use the species to decorate them.

3.3.2. Basket Making Stages

For the purpose of this research, we used the process of making a *samburá* to show details of the basket making process, which was divided into four stages (Stages 1 to 4, Figures 1 to 3). A *samburá* is one of the types of baskets commonly found in the Reserve, used for the storage of fish and fishing gear.

Stage 1: Harvesting NTFPs for raw material

It is not our intention here to go into the details of choosing and finding species for basket making in a landscape, as this theme was already addressed elsewhere (Peterson et al. 2019). In this stage, we focus on other dimensions of Caiçara knowledge, which are intrinsic to the local worldview and the selection of basketry materials: season and moon phases, stories and techniques to select materials with the desired characteristics.

Season and moon phases are not a major concern for artisans, who harvest roots throughout the year. They do not consider seasonality for their materials important as they do with canoes and paddles. Only one participant avoided harvesting during the waning moon because he followed the same concepts used to harvest trees for canoes. Some participants mentioned the waning moon influences the water distribution in trees, increasing the humidity levels in a trunk. And humid trunks, when fallen on the forest ground are more susceptible to rot (xylophagy), compromising the wood quality for canoe and paddle making.

Aerial roots show resistance when pulled out from trees. One person may harvest young roots without major difficulties but to harvest old roots more harvesters are often needed. Old roots are thicker and more resistant to pulling even when hanging free from a branch or untangled from tree trunks. Roots are pulled out one by one by harvesters; who often need more than one attempt to succeed. Stories about harvesting species revealed a Caiçara worldview and are shared even by those who do not make baskets. As an example, participants mentioned it is impossible to harvest roots from *P. bipinnatifidum* if its local name–*imbé!*–is called prior to harvesting because saying the local name "awakens" the plant, and an "awakened" plant becomes very difficult, or even impossible to harvest.

> If you call its name–*imbé!*–you can't pull it out anymore. We used to call its name, when we were kids, only to play with it, and our father would get mad at us. (Adult woman, Ponta Negra)

> To pluck it you shall not wake it. You hold it and pull it out. (Adult man, Praia do Sono)

Harvesters cut the part rooted in the soil. This will free up the roots, letting people jiggle, twist and pull them out attentively to prevent damages to the parent plant (*planta mãe*). Once pulled out from the canopy, harvesters clean up roots from knots, and pack them in bundles. This facilitates transportation, which can take many hours, from harvesting sites to people's houses. As an example, four hours were taken to gather material for the workshop with the basket maker from Praia do Sono, including walking from the participant's house to the harvesting site, harvesting time, and walking back to the participant's house.

Fresh material is valued by makers because once harvested, roots start drying out, losing pliability and breaking up easily. Fresh-collected roots are always favored, thus people prefer harvesting a given amount of roots each time rather than harvesting more material and risking the quality of the product. Basket makers attempt to prepare the fiber strands and make baskets within days after harvesting.

Stage 2: Transforming Roots into Weavable Strands

This stage involves cleaning, splitting, and shaping raw materials into weavable strands. Cleaning starts with bark removal. There are a few exceptions— depending on sizes, ends, and species— where roots are used in basket making in their entirety. Large baskets used as garbage bins by restaurants at the beach, for example. The bark is kept because it does not compromise pliability for larger baskets and increases durability for products that are permanently exposed to the weather. Also, there is another species, less commonly used, that does not require bark removal (i.e. *Davilla* sp., cipó caboclo in Portuguese). In most cases, however, the bark is removed and discarded (except for *P. bipinnatifidum*). The removal of barks increases pliability of strands, which is essential for weaving baskets.

Another important characteristic is the durability of the material as baskets are often exposed to weather and seawater. *T. bissectus* and *Vanilla* sp. are durable for participants. Some artisans favor *Vanilla* sp. because the bark removal is less arduous and more efficient for this species. As the outer bark of *Vanilla* sp. is not very adherent to its inner bark, one can separate them by hand applying a slight tension in opposite directions. For *T. bissectus*, a knife is needed as the outer bark strongly adheres to the inner bark. Furthermore, according to participants, this species shows an abrasive-rough surface when the bark is removed, considered unpleasant to handle by artisans, who call it *vidro* (i.e. glass in English).

Fibers are split longitudinally into several thinner strands. The pliability of *T. bissectus* and *Vanilla* sp. varies and influences the shape of strands. *T. bissectus* is rounded in shape and is less pliable than *Vanilla* sp. Basket makers can split it into two to four thicker pieces because its inner bark breaks up easily as the fiber splits. Splitting roots of *Vanilla* sp. is easier. Basket makers divide roots in two, four or more long strands, depending on the size of the product to be made. Bigger baskets require thicker strands, as they need more strength and resistance to hold objects. Strand thickness also affects pliability. The longer the diameter, the less freedom a maker has to weave; strands are less malleable and more susceptible to the imperfections, which may result in gaps between woven rows in the finished basket.

Figure 1: Making steps of stages one (a, b, c, d) and two (e, f, g, h). Photos: A. Sagnori and D. Peterson.

Stage 3: Weaving the basket base

Once strands are ready to use, basket makers separate them by length. Shorter strands, locally know as *esteios,* are preferred as passive strands for the initial assemblage of the basket base. These passive strands are arranged in radial formation, functioning as a structure to support the active strands that are to be added. Basket makers use an even number of *esteios*: eight to fourteen or even more depending on personal preferences and basket size.

There are two ways to combine *esteios* to start weaving a basket: a cross and a square design. Some participants, especially elders, knew how to start baskets using both designs. They usually choose one or the other pattern according to their own aesthetic preferences and practices. Others, especially the youth, are more familiar with one or the other pattern, usually the square. One participant, who was familiar with the square design, declared his motivation to learn the cross design to use it in his baskets in the future.

Artisans interlace a few circles of one strand into the square or cross to make it sturdy. Then they stick an extra strand in the center of the basket, half size of the *esteios* used previously, to have an odd number of *esteios*. This extra strand is locally named *capitão* or *mestre* (captain or master in English), and it is what enables the weaving process. Artisans always state the importance of the *capitão* highlighting that basket making will never work without this extra strand in the initial assemblage.

Longer strands, named by some participants as *fio de tecer* (i.e. weaver in English), are preferred as active strands. These long strands will serve as the active strands, which interweave helicoidally with passive strands, forming the weaving pattern. Long strands enable artisans to interweave baskets with none or few splices, and it is much appreciated by artisans as it

improves the aesthetics and the quality of the product. Participants prefer *Vanilla* sp., as it has longer roots and fewer knots than *T. bissectus*. Artisans press each new woven circle against the previously made one to make the structure tight. When the active weaver strand ends, a new one is stuck into the woven pattern, overlapping a few centimeters with the end of the previous strand, enabling the artisan to continue and reach the desired size of the basket base.

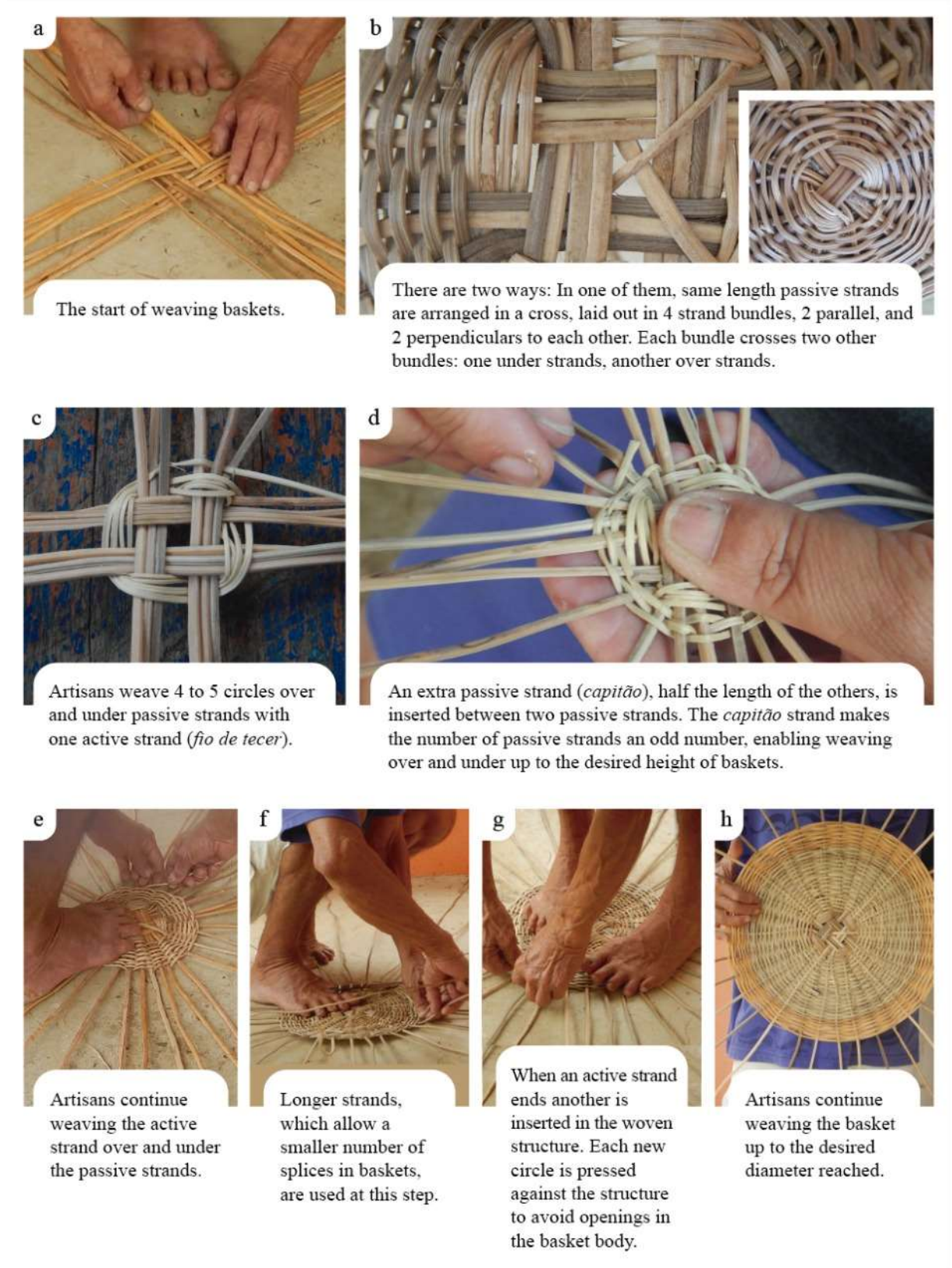

Figure 2: Making steps of stage three. Photos: A. Sagnori and D. Peterson.

Stage 4: Bending, Growing and Finishing the Product

With the desired base size, the next step is upsetting the basket, when artisans bend it up gently transforming the flat base into a tridimensional object. If artisans take too many days to bend the base the strands will dry out and crack easily when curved. Although artisans prefer fresh material, they know techniques to recover humidity and pliability from dried strands. One is to leave the material under dew or rain overnight. Some artisans consider it not ideal because this humidity may favor the manifestation of fungus in strands decreasing the quality of their craft. Another technique applied is soaking the roots with bark in nearby streams. Both these techniques seem to be mostly used for roots collected over a few days but can also help in materials recently harvested. Basket makers may also mix species and, fresh or old materials. The color of older, drier material is light beige while the fresh material is usually a bit darker. A participant commented that he sometimes mixes materials because he likes the aesthetics of baskets with contrasting colors.

One of two designs is used to build the rim and the handle in Caiçara *samburá* baskets. The most commonly known has the ends of strands cut off approximately 10 centimeters above the rim, with the ends hidden in the interwoven structure. In the second design, locally known as *beiço virado,* the artisan twists both active and passive strands to build the rim. Artisans consider the *beiço virado* design more beautiful, but also more difficult.

The handles of *samburá* baskets are wrapped up with strands made of the bark of *P. bipinnatifidum.* It has a burgundy color, which contrasts with the beige body of the baskets. During workshops and other opportunities in the field, it was observed that basket makers also use *T. bissectus* and *Vanilla* sp. for ribbons to wrap up the handles. When questioned about this change of material, an elder explained that harvesting *P. bipinnatifidum* is harder than harvesting

the other two species. The species is usually far away in the forest, in high tall trees, which requires a strong harvester to collect them. As roots of *P. bipinnatifidum* are not crucial for the product's structure, some artisans have been not relying on them for basket making.

Figure 3: Making steps of stage four. Photos: A. Sagnori and D. Peterson.

3.3.3. Knowledge Transmission

During our conversations about knowledge transmission all participants but two noted that they learned basket making with family members, most of them through vertical transmission (e.g. from grandfather, father, mother, uncle) and just one through horizontal transmission (i.e. from husband). The other two people, one of whom came to the region alone with his brother circa 67 years ago, explained that they learned the techniques by observing basket makers in their communities as they made baskets.

Five artisans said that they have not passed on basket making knowledge to their descendants while four artisans taught basket making to their children or relatives like cousins, siblings, or other community members. Two elders have taken part in workshops organized by third parties to promote Caiçara culture, with teenagers and children attending these workshops. Only four artisans acknowledged that the people who learned with them continued producing baskets regularly.

A closer look at the results suggests that interactions between groups of different ages were dissimilar between the four stages. Youth are more involved with other livelihood activities, such as fishing, transportation, and tourism. In spite of this, some are still taking part in basket making processes. When asked why they weave baskets, their motivations to produce baskets were related to the need of helping out their family members, to the possibility of having an extra source of income, or to have a hobby.

Stages one and two were those in which the highest interaction between family members happened. Three elders over 55 years declared that they have been counting on their descendants and close relatives (e.g. son-in-law) to obtain fiber material from the forest. Mobility limitations

and other health issues make harvest hard for these elders, who are not able to harvest material for making baskets. In addition, the youth have access to faster means of transportation (e.g. motorized fiberglass or aluminum boats), which facilitates reaching other communities and harvesting far away. Elders pass on knowledge regarding species identification, harvest sites, and local management practices among others. This knowledge is sometimes widespread across communities and becomes a skill as youth harvest material for relatives, with each harvest trip contributing incremental ethnobotanical knowledge to the youth. When back home with bundles of roots, artisans engage in stage two. Fiber preparation that involves the participation of people from different age groups during workshops, with the youth cleaning and processing fibers with their parents.

During the workshops, some of the youth began to exhibit difficulties at the beginning of stage three, struggling with the initial design of basket making and with the insertion of the extra *capitão* strand. This was the moment of the workshop when community members, approached the group of artisans and started sharing their own stories about past and current harvesting practices, products that were made, functions of these products, and inherited baskets. Children from the community came by and asked elders for material leftovers, to try to replicate basket making at home.

Part of stage three and part of stage four are considered an easy step in basket making, and the youth acknowledged to have skills to go through this part of the process. Some Caiçara say that they do not know how to start but know how to continue a basket. In this stage, elders called attention to the repetitive interweaving process without jumping any of the passive *esteio* strands. Building the basket rim is, however, more complicated and similarly to what was found for the beginning of stage three, some of the youth struggled to master this skill.

3.3.4. Knowledge, Creativity, and Innovation

There is a great variety of Caiçara baskets (e.g. *tapeti, samburá, and balaios*). In this research we focus on *samburá*, *balaio* and some of their variations, which are highly significant for Caiçara people, and have a similar making process and share a common weaving technique. They differ in form, *balaio* is larger and cylindrical while *samburá* is rounded with a handle (Figure 4). There is also a difference, pointed out by a community member, which is connected to a Caiçara worldview. S*amburá* displays relationships between people and sea while *balaios* are mainly a representation of people and land.

> The relationship of Caiçara people with *samburá* baskets dates from far back. We carried it on our head, on our back. *Samburá* basket is more related to fisheries, [made to store] nylon fishing nets, to store catch, [to] fish in the rocky coast. The *balaio* basket is connected to the soil, agriculture, [and is made] to store manioc root…(Adult man, Praia do Sono)

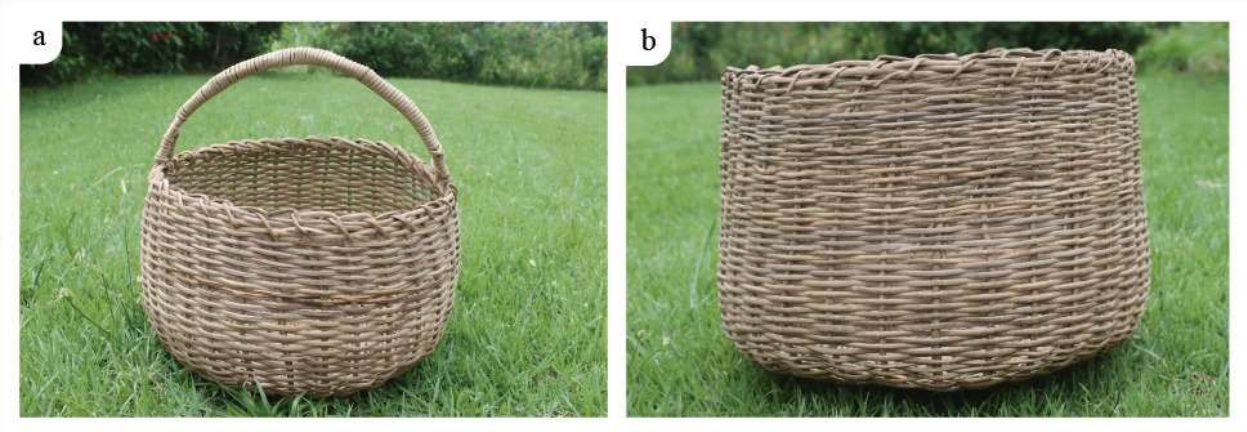

Figure 4: Samburá, in the left, a handled basket commonly used for fishing activities. In the right, is a *balaio* commonly used for carrying roots from shifting agriculture. Photos: J. Leocádio.

Balaios have been produced and used by people mostly as a container to accommodate and transport edible manioc root (*Manihot esculenta*) from places of shifting agriculture (*roças*) to flour-making houses (*casa de farinha*), where manioc is processed into flour. *Samburá*, on the other hand, is useful to store fishing gear and small-size catch, such as squid (*Loligo plei and L. sanpaulensis*), from artisanal fisheries. Variations of these two types of baskets are found in the communities. Depending on the ends, the artisan can make variations with the same weaving patterns. As an example, they make smaller versions of *samburá* for storing sewing supplies or a shorter version of *balaio* for storing fruits.

Basket makers across the Reserve have been adapting to other demands over time. Participants from Baixio community were, years ago, dependent on markets in downtown Paraty and would supply Paraty shops with their production. Artisans produced baskets of diverse sizes, depending on the market demands. With the decrease of these demands, the production of baskets decreased, and artisans shifted to products made from *caixeta* trees (*Tabebuia cassinoides*) highly available nearby this community. Replicas of canoes, paddles, and trawlers gained space in the Paraty market and in the community. As of today, some artisans depend on the *caixeta* products, and this region is commonly known for these crafts. Few people in Baixio stated that they still weave baskets, the ones that do still make baskets are making them for their own use or for family members. There were, however, in past years, some initiatives organized by third parties to promote Caiçara culture, where the elders, could teach the youth knowledge on basket making.

In Ponta Negra community, artisans have begun to make baskets to respond to the preferences of both local people and tourists. Artisans weave baskets over the year, but prior to the beginning of the tourism season some of them plan ahead to make baskets for tourists to buy.

Artisans in Ponta Negra have learned that small versions of baskets are preferred by some tourists because of the ease of transportation. On the one hand, smaller baskets are more laborious as artisans split the fibers into several thin strands—the smaller the product, the thinner the strands. On the other hand, the cost-benefit of smaller baskets is better because these baskets use less raw material and are sold for almost one-third of the price of the bigger baskets. The prices ranged from R$20 (US$5.30) for small baskets to R$60 (US$16) for large *samburá* baskets (currency exchange as of March 2019). Another activity sometimes performed by artisans during the high season is the demonstration of basket making to tourists. A participant commented that she used to have such demonstrations at her house. In these events, tourists would have the opportunity to experience stages of Caiçara basket making and buy some of her pieces.

Praia Grande da Cajaíba is a community accessible by trail and a boat ride from downtown Paraty with only two Caiçara families permanently residing. There is an artisan, who is well known in the region, for her productivity and creativity, as she does more than just make baskets of various sizes. She likes to use very thin fiber strands and to transform shapes by playing with sizes, formats, and functions of these baskets. Figures 5a and 5b show examples of her products, which range from R$20 (US$5.30) to R$80 (US$21). She explained that to be able to make baskets, she needs help from her son, who is responsible for harvesting; he is learning from her on how to harvest plants. The artisan also mentioned that her daughter was making and learning from her about the details of how to make the baskets.

Figure 5: Baskets show the creativity of a basket makers in the Reserve. At Praia Grande da Cajaíba community, a) a decorative basket with cover made of the same material, b) a lamp adapted to fit a fluorescent bulb, and in Praia do Sono, c) commissioned purse, an attempt to make a new model of a purse, based on the knowledge on weaving techniques. Photos: A. Sagnori, D. Peterson and J. Leocádio.

In Praia do Sono, artisans retain knowledge about how to make other products with the same weaving patterns from *samburá* and *balaio*. In a local restaurant, one can find a bottle case made of interwoven thin strands, evidencing the creativity of a local artisan. During the period of this research, however, artisans were mainly focused on making *samburá* and *balaio* baskets. Their production was often traded with community members or nearby communities with bigger baskets at an average price of R$50 (US$13). Praia do Sono is the most touristic place of all communities in the Reserve, receiving thousands of tourists in the summer high season

(December to February). Despite that, makers from Praia do Sono have not yet started to focus on the production of baskets that respond to tourist preferences in contrast to artisans of Ponta Negra and Praia Grande da Cajaíba communities though this is not due to the lack of their creativity.

During a workshop an elder from Praia do Sono was asked to weave a product based on his own interest. He could make any basket that he wished. The elder chose to weave a purse inspired by one that he had previously seen made of taboa (*Typha angustifolia*). Taboa is a malleable plant, which is available elsewhere in the Paraty region but difficult to find in Praia do Sono. In the end, the elder was asked about the weaving process and what difficulties he encountered. The elder explained that he initially planned to use the inner side of *P. bipinnatifidum*, which in his opinion could replicate the malleability of *Typha angustifolia*. As he was unsure if he would be able to harvest—including find and collect—*P. bipinnatifidum* in the forest, he decided to change to *T. bissectus or Vanilla* sp. The participant added that in contrast to the other baskets made during the workshop (*samburá* and *balaio*, both products which he was more familiar with), weaving the purse was not without challenge. During the making process, he had to unweave and reweave the same parts of the purse several times until getting the desired result (Figure 5c).

3.4. Discussion

Our results show that a skill, such as basket making, once so important in the past, may be still important for contemporary life if well adapted for a contemporary demand. The environment has shifted from a demand on woven baskets made of raw material from plants in

the Reserve to be replaced by industrialized products (e.g. plastic containers). However, the emergence of tourism has also created new demands for basket making. Thus, contributing to a window of opportunity in the Reserve to promote biocultural design projects. These projects, in turn, may help improve the income of Caiçara artisans within the local market for baskets, while promoting the valorization of the local culture, territory, and self-identification of people through the process of basket making.

While tourism may affect basket making by drawing people away from these cultural practices, it may also foster creativity and innovation with artisans seeking to make new products, drawing on traditional and local knowledge. Caiçara participants acknowledged that as time passes by, people, especially the youth, are less involved with some of the local cultural practices (e.g., basket making, manioc flour production, and canoe making) and more involved with tourism-related activities (e.g. boat transportation, restaurants). Tourism impacts varies across communities in the Reserve (Hanazaki et al. 2013), triggering different responses from basket makers in different communities. Basket making is usually not the main activity of artisans, but it is included in the portfolio of activities for their subsistence and it provides an extra income to local people in the Reserve (Hanazaki et al. 2013). As biological materials are available year-round in the Reserve, basket making could improve income not only during summer high season, but also during low season, if a market opportunity is well established. Other groups who hold basket making as cultural practice in Paraty have adapted to tourism demands and established a local market for their products. Guarani Indigenous peoples and Quilombolas (African descendants) fabricate baskets in a similar way to Caiçara in the Reserve, but they craft other varieties as well. Guarani fabricate baskets, decorated or not, with *taquara* (*Chusquea ramosissima*), *taquara de lixa* (*Merostachys ternata*) and *imbé* (*P. bipinnatifidum*),

the last is used to provide the dark, black contrast to baskets (Menoret 2012). There is a difference in basket design, according to its end, which relates to Guarani cosmology. Guarani understand that baskets for community members should be inconspicuous (usually in natural and black colours), because bright items may affect basic senses making communication with deities difficult (Assis 2006). Bright colourful items, usually dyed, are crafted but only for tourists, as Guarani understands this facilitates market exchange (Menoret 2012). Quilombolas from Campinho da Independência use corn and banana leaves and *taboa* (*Typha domingensis*), in addition to *imbé* (*P. bipinnatifidum*) and *timbupeba* (T. *bissectus* and/or *Vanilla* sp.), to produce a variety of baskets (Menoret 2012). These baskets are sold to tourists in a local craft store built by community members. In contrast to Caiçara in the Reserve, Quilombolas are located nearby the Highway BR-101, which facilitates the access of tourists to the products of basket makers from this community.

The prices of baskets in the studied Caiçara communities were similar for smaller products (R$20, US$5.30) but varied for bigger products (R$50 to 80, US$13 to 21). As shown in this research, artisans from the studied communities engage differently with basket making. This may be due tourism and availability of resources. In the case of Ponta Negra, artisans adapted products to tourists demands, but not necessarily in Praia do Sono, where artisans crafted baskets to attend the community. In Baixio there is high occurrence of forests of *Tabebuia cassinoides* (*caixeta* trees), which serve as raw material for other articrafts with a local market established). *Caixeta* trees, however, are co-existent with *T. bissectus*, which is one of the important species for basket making. With a potential demand for baskets from artisans in Baixio, artisans could save efforts, harvesting for both species at once, while diversifying livelihoods by producing *caixeta* articrafts and baskets.

In addition to economic gain, there are other components to support Caiçara artisans to continue making baskets. As Ingold (2013) points out baskets are not only a finished object, there are aspects behind the woven structure of baskets to be revealed. In the case of Caiçara in the Reserve, making baskets is an expression of the relationship that Caiçara people have with their landscape, and this is shown through knowledge. Caiçara artisans continue making baskets so that knowing how to do so is not lost, a concern shared by Caiçara participants in this research. These new opportunities for basket making may help Caiçara people to maintain, as well as to acquire, knowledge and skills.

Knowledge is built through a continuous process involving artisans' own observation and engagement with the materials and objects that they make themselves (Sennet 2008). Ingold (2013) showed through an exercise with his students, how the making process of baskets enabled students to learn by weaving and unweaving their own work as many times as needed. This repetitive process enabled them to adapt and search for solutions to challenge the difficulties they encountered when making baskets (Ingold 2013). In this research, a similar situation was found for the artisan who decided to innovate by making a new purse model. Drawing from his knowledge on basket making, in a learning process of trial and error, the artisan made a new product that he has not made before.

In the case of Caiçara, basket making involves knowledge of weaving patterns, basket forms (i.e. *samburá* and *balaio*) and important plant species, including knowledge of these species in the Reserve landscape (Peterson et al. 2019). This knowledge is the starting point for making baskets that respond to current preferences of residents and tourists in the Reserve. But there is more to it: the creativity expressed by some of the Caiçara participants, which helps artisans to adapt to a new market in the Reserve. The Caiçara way of making baskets is similar

across the Reserve as if every artisan based their work on the same design passed down over the generations. While using similar materials and techniques artisans exhibit their own style that reflects their preferences as well as their knowledge, practical skills, time available to weave, interests and creativity. The diversity of basket shapes from communities in the Reserve suggests that some basket makers have been innovating in response to the contemporary preferences of both community members and tourists. As an example, the research findings show that participants crafted smaller baskets to attend tourists not able to transport bigger products.

In addition, basket making is important as it create spaces of significance to the artisans because making things creates political spaces and settings to share stories, concepts, and material resources while knowledge is shared between people (Roy 2009). The transmission of knowledge promotes and increases social cohesion (Gómez-Baggethun et al. 2012), and social cohesion, in turn, helps maintain the integrity of socio-ecological relationships (Alcorn et al. 2003, Bremer et al. 2018). For example, in this research elders that are no longer going to the forest reported to have shared their knowledge on harvesting species (e.g. management techniques and harvest places in the landscape, see figure 1) with youth willing to collaborate with them as they continue to make baskets. This helps strengthening social cohesion. The youth, in turn, gain opportunities to learn harvest techniques that are known to be working for long time in Reserve (for more details on the local management of resources for basket making in the Reserve see Peterson et al. 2019). Management of species that have been working for long time suggests a healthy social-ecological relationship.

Furthermore, knowledge transmission plays a role in people's self-determination, because people can use their traditional knowledge to promote their own governance (Whyte 2018). In the case of Caiçara in the Reserve, knowledge on basket making (as well as in other cultural

practices) is an expression of the long-term relationship that people have with their landscape, which in turn, reassures a Caiçara identity and encourages the movements for land claim and governance. Caiçara people have been organizing in multiple ways to promote their identity, claim governance and secure access to their territory. For example, Caiçara, Quilombola and Indigenous groups have partnered up with third parties[7] to develop projects for empowering communities and promote local governance. These projects include drawing upon Indigenous and traditional knowledge and interests to build maps to help members argue with multi-actors about governance in customary territories of Indigenous and traditional peoples (Freitas et al. 2016, Cortines et al. 2018).

A biocultural design approach may help to safeguard this identity, highlight the Caiçara stewardship in the Reserve, and if well done, it may help to provide devolution of power to local people. As shown elsewhere, this approach may be useful to restore knowledge and cultural practices benefiting Indigenous groups and promoting knowledge co-production within a diverse group of people focused on specific goals (Kuzivanova and Davidson-Hunt 2017, Davidson-Hunt et al. 2017, Valencia, In preparation). Our findings show that artisans depict creativity to make pieces to attend the tourist market and suggest that researchers, managers, designers and many others that wish to encourage makers, to partner up with artisans and other Caiçara people to support them to be able to write their own future.

[7] The Traditional Communities Forum has partnered up with the Foundation Fio Cruz, a scientific institution, creating the *Observatory of Sustainable and Health Territories* (https://www.otss.org.br/observatorio) which develop a series of projects with community members and researchers co-producing knowledge to find solutions for local demands.

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Preface to Chapter 4: Understanding canoe making as a process of preserving cultural heritage

Caiçara canoes are important for Caiçara culture, importance also acknowledged by researchers and policy makers. This chapter shows and explains three aspects of the importance of canoes, rarely explored in the literature, that may reinforce the need for policy and action regarding the preservation of canoes and canoe making. For the people in the area of the Reserve, canoes provide the means for food diversification, as different kinds of canoes are used to fish different species. They also foster people-landscape relationships, as canoe making requires intimacy with forest resources. Finally, people-people connections may also benefit from canoes and canoe making, as they encourage socio-cultural activities such as mutual help among Caiçara people in the Reserve.

Chapter 4: Understanding canoe making as a process of preserving cultural heritage[8]

Abstract

Canoes are deeply ingrained elements of the Caiçara culture, not only for their historical and current practical uses, but also for their socio-cultural outcomes. Caiçara people are the descendants of Europeans, Africans, and Indigenous peoples who inhabit parts of the Atlantic Forest in the southern and southeastern coast of Brazil. Despite this, canoe making has been declining in several Caiçara communities, while many ongoing initiatives have attempted to encourage the maintenance of this practice. This article explores some of the Caiçara-canoe relationships within the Juatinga Ecological Reserve, in southeastern Brazil. We discuss how canoes are an appropriate technology for some fishing techniques, and are thus not easily replaced by fiberglass or aluminum boats. We also explore some socio-cultural dimensions of canoe making in light of the relationships of Caiçara canoe makers and fishers with the forest and with other community members. This article contributes to a growing body of knowledge to protect elements of Caiçara identity, including initiatives to help maintain canoes, and canoe making, and the people involved with them.

Keywords: *Ethnoecology; Food security; Traditional knowledge; Caiçara; Brazil.*

[8] Peterson, D., Hanazaki, N. and Li, F. Understanding canoe making as a process of preserving cultural heritage. Ethnobiology Letters 10(1):59-68. DOI**:** 10.14237/ebl.10.1.2019.1363

4.1. Introduction

Dugout canoes have special significance as a cultural product for local, traditional, and Indigenous peoples worldwide (Gilmore et al. 2002; Orofino et al. 2018). They are a means of transportation of people and goods in more remote areas, where access by land is often difficult. They also play an important role in the subsistence of small-scale fishers who depend on them to ensure their food security. Despite this, researchers have been reporting declines in the practice of canoe making, with concerns that the traditional knowledge associated with this cultural practice may get lost or eroded. The decline of canoe making is related to the complexity of this skill (Lee et al. 2001), the lack of access to natural resources (Paula et al. 2019), the increase of aluminum boats (Orofino et al. 2018), the influence of Western education (Brosi et al. 2007), and the discouragement the youth face when learning this practice (Németh 2011). All these issues relate to the current scenario in Paraty, on the southeastern coast of Brazil, where local communities of Caiçara people inhabit the Atlantic Forest, a world biodiversity hotspot (Myers et al. 2000). Over the past 40 years, with the intensification of tourism and urbanization, and the establishment of protected areas, Caiçara communities have been expressing their concerns to maintain their rights to their traditional territory and cultural practices, including canoe making.

Multi-scale initiatives involving policy makers, researchers, and Caiçara have emerged to help protect this practice. At the policy level, Caiçara canoes were recognized as tangible and intangible cultural heritage of the Rio de Janeiro State (IPHAN 2013; Rio de Janeiro 2016), and an ongoing process seeks to recognize them as part of the intangible cultural heritage in Brazil (Németh 2011). Researchers have generated knowledge on aspects of canoes and canoe making and called social media users to identify canoe makers in a collaborative digital map[9] (Denadai et

[9] This collaborative map is online: https://tinyurl.com/yywgznq5. Accessed on May 28, 2018.

al. 2009; Maldonado 2004; Németh 2011). Community-based initiatives, such as canoe racing, also help raise awareness of the significance of canoes for Caiçara identity.

This article aims to contribute to current initiatives to maintain the Caiçara cultural practice of canoe making. Researchers have documented the cultural practices associated with canoe making, favored tree species, and canoe-related stories (Denadai et al. 2009; Maldonado 2004; Paula et al. 2019). But there are also other aspects of the Caiçara-canoe relationship that can be highlighted. This article takes an ethnoecological approach to (1) discuss the Caiçara reliance on canoes for specific fishing techniques and food security, (2) examine how canoe making may help maintain people-forest connections, and (3) consider how both canoes and canoe making may help maintain relationships between Caiçara people. The research presented in this article is part of a larger project that aimed to understand how traditional people can participate more effectively in the management of protected areas.

The Juatinga Ecological Reserve, established in 1992, was chosen as the study site due to its current political significance. To comply with the current Brazilian environmental law for protected areas[10], the Reserve has been undergoing a process of recategorization into a new protected area status that allows for the sustainable use of resources and participation of traditional people. We employed a set of research methods that included ethnographic fieldwork, semi-structured interviews with canoe makers, participant observation, and a multi-stage photovoice

[10] The SNUC law stands for *Sistema Nacional de Unidades de Conservação* and was enacted in July 2000. This law regulates the Brazilian protected areas and divides them into 12 categories (five strictly protected areas and seven sustainable use areas), depending on the objectives of protection, land tenure, use and management of resources, research and tourism activities. As the "Ecological Reserve" category was not included in the SNUC law, the Juatinga Ecological Reserve needs to be recategorized.

process conducted with members of a Caiçara community in the Juatinga Ecological Reserve. In each corresponding section, the research methods will be described in greater detail along with the results of the study.

4.2. The Caiçara people and the Juatinga Ecological Reserve

The Juatinga Ecological Reserve is located in Paraty, Rio de Janeiro state, in the Atlantic Forest. It is home to approximately 1,500 people, the majority Caiçara. The Caiçara are mixed-heritage descendants of Europeans, Africans, and the Tupinambá Indigenous people, and have for many generations engaged in subsistence activities such as shifting agriculture, subsistence hunting, plant harvesting, basket making, wood carving, and fishing. Their inherited fishing cultural practices include the use of plant fibers to make fishing nets and baskets, the use of numbing plants to capture fish, and carving techniques to make dugout canoes (Mussolini 1980). In a study on the diversity of plant knowledge in Praia do Sono, Brito and Senna-Valle (2012) found that Caiçara participants (men and women) had extensive ethnobotanical knowledge of the plants of this Reserve. People's relationships with the landscape have been influenced over time by the establishment of protected areas, the presence of land grabbers, and the increase of tourism activities in the region. These factors contributed to cultural changes in the communities within the Reserve[11]. Land tenure became a major concern to many Caiçara in the Reserve as land grabbers engaged in legal disputes with them over their traditional land, forcing many people to

[11] Other factors have also influenced Caiçara relationships with the landscape (and seascape), where Caiçara people adapted to social, cultural and environmental changes over time. For example, we find fishery innovations brought to communities by Japanese migrants that have influenced the manufacture and use of canoes by people within the Reserve (Adams 2000, Idrobo and Davidson-Hunt 2012).

migrate to other regions in Paraty. The establishment of the Reserve followed a top-down management approach, adding conflicts over traditional land as cultural activities, such as shifting agriculture and hunting, became forbidden. Tourism contributed to changes in the local economy as people became more involved with tourism-related activities (e.g., working and managing local restaurants, camping, and transporting tourists). Other changes (e.g., incorporation of industrialized food in the local diet) were also significant, but for some Caiçara in the Reserve, they play a smaller threat to the Caiçara culture—beliefs, values, social structure, economy, and arts—when compared to former examples (Sinay et al. 2019). Changes in technology are also evidenced by an increasing number of fiberglass or aluminum boats in the communities. Sinay et al. (2019) reported that all adult men of one community in the Reserve (Martim de Sá), had by 2015, changed their canoes by motorized fiberglass or aluminum boats to facilitate access to markets and tourists in Paraty.

4.3. Caiçara canoes: an appropriate technology

Photovoice is a participatory method which involves providing people with cameras and asking them to identify and represent images that illustrate their own reality (Castleden et al. 2008). Photovoice was conducted with six Caiçara participants with diverse roles—artisan, community leader, small-scale farmer, church representant, park ranger, environmental educator, and local tourism guide—in Praia do Sono, a community located in the Juatinga Ecological Reserve (for a detailed description of photovoice data collection see Peterson et al. in press). Praia do Sono was chosen because it has the easiest access to downtown Paraty, which facilitated photo printing, and it is probably the most impacted community by tourism expansion in the Reserve. Participants were selected based on the following factors: (1) time living in the community or around the

Reserve (at least 10 years), (2) willingness to take part in this research, (3) interest in photography, and (4) interest in talking about conservation. The participants were asked to take photos in response to the research question: *What do you understand as conservation*? Photos were then used to guide individual interviews with participants. The word "canoe" was the second most cited ($n = 254$) in the photovoice process, surpassed only by the word "community." From the 44 photos chosen by participants to prompt photovoice interviews, seven photos portrayed canoes (Figure 1). Participants used these photos to talk about the cultural significance of canoes, the practice of passing canoe making knowledge to youth, and the aesthetics of canoes in their landscape.

Figure 1: Photos of canoes taken by photovoice participants of the Praia do Sono community in the Juatinga Ecological Reserve (2015–2017).

When asked why canoes are so significant for the Caiçara people in the Reserve, one participant remembered that, in the past, they were the only means to bring goods to some places

in the Reserve. This participant noted that the transportation of goods would still rely on canoes if they did not have access to fiberglass boats. The Juatinga Ecological Reserve is a remote peninsula, and access to most of the eight communities and twelve smaller settlements located there is difficult (Figure 2). There are no roads connecting these communities, so people walk to them on trails or access them by sea.

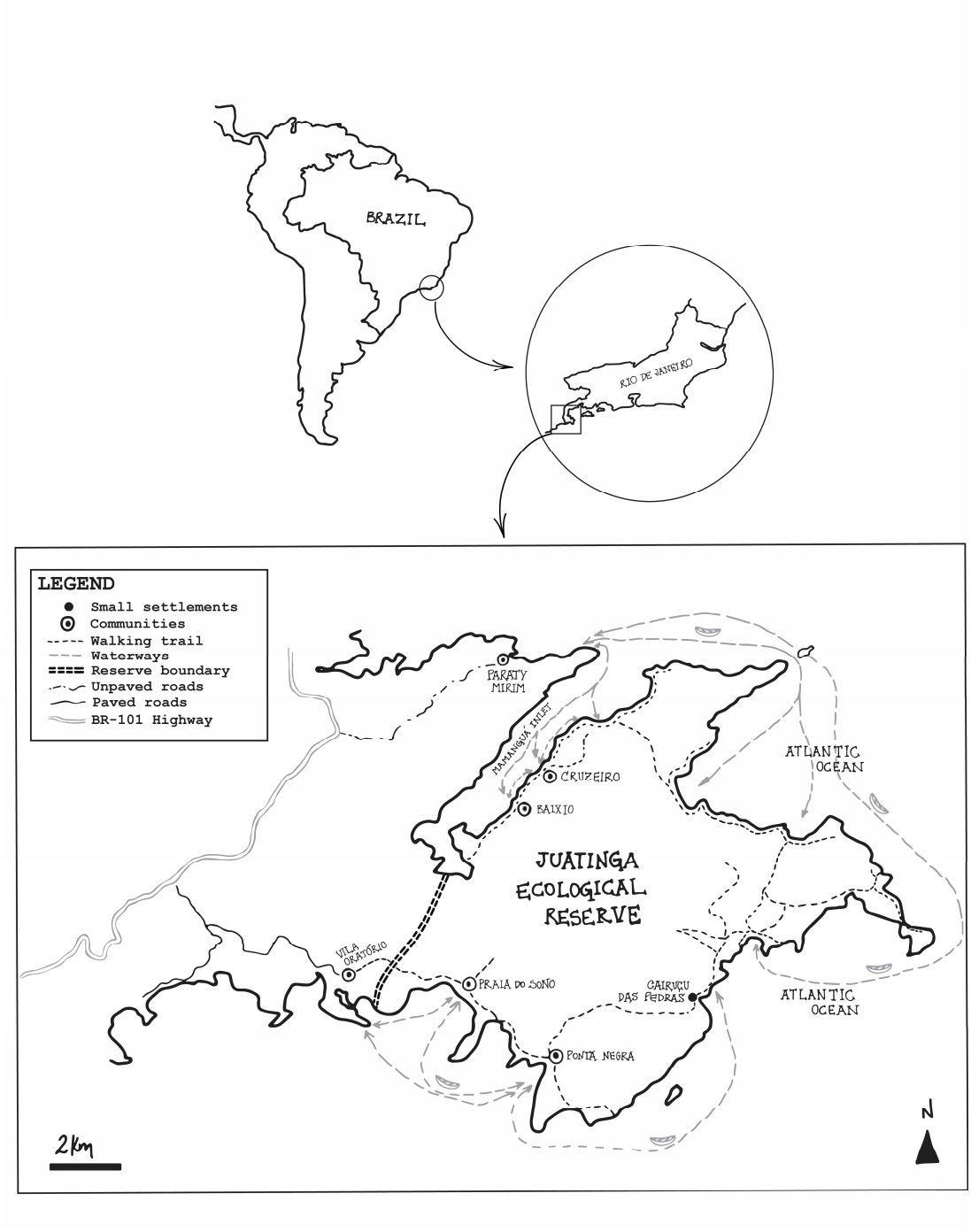

Figure 2*:* Main walking trail (bold dashed line) and waterways (grey dashed line) to access communities and small settlements (with less than 50 people) within the Juatinga Ecological Reserve. Paraty Mirim and Vila Oratório are important communities as they are close to the Reserve and have access road to downtown Paraty. Map prepared by G. G. Orofino.

The seascape is a variable environment that impacts people-canoe relationships. Sheltered or open waters influence the characteristics of canoes (and paddles), while the availability and behavior of the fish species influence fishing practices. The northern communities of the Reserve are mostly in sheltered waters, in an inlet called Mamanguá. Although subjected to high variation in sea tides, this inlet has mostly good navigation conditions. Fiberglass and aluminum boats, as well as canoes, are important for both fishing and transportation within this inlet. In Mamanguá one can find small canoes (~2–3 m) used for traveling from the docks to anchored canoes within the inlet; canoes for other fishing techniques (~4–5 m), and *canoas de voga,* the biggest canoes (more than 7 m), used mostly for the transportation of goods. The southern communities, in contrast, are in the open sea, often facing rough sea conditions. In these communities, fiberglass and aluminum boats are currently used for transportation and sometimes for fishing, whereas canoes are commonly used for squid, mullet and *cerco*[12] fishing. Squid jigging canoes are the smallest (~3–4 m), canoes for mullet fishing are slighted bigger (~4–5 m), and canoes for *cerco* fishing are the biggest ones (~5–7 m).

As the tradition of canoe making is declining, many people see canoes slowly giving way to more modern watercraft, such as motorized fiberglass and aluminum boats[13]. Although this may be a possible scenario for some places, in the Reserve the Caiçara canoes were mentioned as the best technology for some of the local fishing techniques, mullet fishing being one example. The mullet fishing happens every year from May to August with social, economic, and cultural importance for fishers in the southern and southeastern coast of Brazil (Abreu-Mota et al. 2018).

[12] *Cerco* is a stationary fishing technique, a kind of pound net, brought into the Juatinga Ecological Reserve by Japanese immigrants in the 1970s–1990s (Mussolini 1980).

[13] França (1954) showed that *canoas de voga* were almost abandoned with the arrival of motorized boats, brought by the Japanese immigrants.

Canoes with paddle propulsion are more suitable to surround the mullet schools because they are more silent than motorized fiberglass boats. A photovoice participant (Translated here and elsewhere by DP) explained this:

> ...with mullet, with any fish species... it is difficult to go fishing with the engine working. Because it [the school of fish] submerges and goes away. In this way, the canoe is better for this fishing technique. Because it is not noisy, they [fishers] go out fishing with paddles. The [sound of the] engine frightens the fish… Fishers [in fiberglass boats] will not surround them [the schools]. They use the fiberglass boat to cover larger distances... And for when they use tangle nets... They place it one day and go visit it one day later. To surround a mullet school... you cannot use the engine, you cannot make noises.

These ideas relate to the notion of appropriate technology, which implies that technology should serve the needs of people (Schumacher 1973)—in this case, the need for a silent watercraft. Furthermore, Caiçara canoes are small, simple, capital-saving, user-centered, and have a sustainable approach, which comply with Schumacher's criteria for appropriate technology (1973).

Similarly, the Waimiri Atroari Indigenous people from the Amazon found aluminum boats unsuitable for fishing with bow and arrow in the flooded forest (Milliken et al. 1992). Part of this unsuitability was related to the size of these boats and the difficulty of maneuvering them in that environment. Small canoes were found to be more appropriate to the Waimiri Atroari because they enabled fishers to approach the prey without ripples or noises, which may scare the fish away. As fish was the major source of protein for them, having the appropriate technology was imperative to assure their daily diet (Milliken et al. 1992).

Orofino et al. (2018) found no consensus for the preference in watercraft among the Azorean descendants of southern Brazilian coast. They found that some people favored canoes due to their properties, such as buoyancy, perceived safety advantage, and quietness, which facilitates fishing. In contrast, other people preferred the fiberglass or aluminum boats due to their easier maintenance and because there was no need for environmental authorizations to access the trees and no dependence on the few canoe makers to obtain a vessel.

4.4. Canoe making: people-forest connections

People-forest connections are influenced by the degree of exposure people have to forest resources, which in turn, can contribute to greater ethnoecological knowledge. As an example, women, who are usually more involved with traditional medicine, retain greater knowledge of medicinal plants than men (Aswani et al. 2018). On the other hand, men highly engaged with forest activities usually retain greater knowledge of forest resources than women do (Aswani et al. 2018).

The ethnoecological knowledge of tree species—such as the ability to identify suitable species for canoe making—and peoples' observations of forest dynamics may reveal how canoe making influences people-forest connections. Table 1 shows the number of species used for canoe making by various communities in Brazil, displaying a range of six to 42 species of trees. In this study, participants cited a higher number of species for canoe making than what was previously found in the literature for the Reserve (Brito and Senna-Valle 2012). Canoe makers cited 14 tree species suitable for every type of canoe needed in the Juatinga Ecological Reserve. Purposive sampling may have contributed to this as the method helped select Caiçara with knowledge of resources for, and practice in, canoe making specifically. In addition, the snowball method helped identify other participants with a similar profile within Praia do Sono, three other communities

(Ponta Negra, Cruzeiro, and Baixio), and one small settlement (Cairuçu das Pedras), covering different locations in the Reserve. Twelve canoe makers took part in semi-structured interviews with questions regarding preferences for resources, landscape use, knowledge of forest resources, and knowledge transmission. Ethnographic fieldwork was conducted with five canoe makers, who helped to identify species, allowing for participant observation and partaking in local experiences in the forest. Plants used for canoe making were identified with the help of specialists and the literature (e.g., Flora do Brasil 2020).

Table 1**:** Key references on canoe making with number of species used by each group.

Setting and human group	**Number of species used for canoe making**	**Key References**
Búzios, Brazil - Caiçara	7	Begossi et al. 1993
Amazonia, Brazil - Waimiri Atroari	10	Milliken et al. 1992
Ubatuba, Brazil - Caiçara	25	Maldonado 2004
Paraty, Brazil - Caiçara	7	Borges and Peixoto 2009
Ubatuba, Brazil - Caiçara	20	Denadai et al. 2009
Paraty, Brazil - Caiçara	6	Britto and Senna-Valle 2012
Multiple cities, Brazil - Azorean descendants	18	Roque 2017
Multiple cities, Brazil - Caiçara and Azorean descendants	42	Paula et al. 2019
Paraty, Brazil - Caiçara	14	This study

The knowledge held by canoe makers is valued by other Caiçara people. One photovoice participant used a photo (Figure 1) to talk about this knowledge as necessary for conservation:

> …They [canoe makers] end up creating several, several things so they do not take the tree in the [wrong] moon, because otherwise it [the canoe] will rot. It seems like

> a way [to say] to you not to make it [wrong], to respect. But everything has a certainty. Everything has a certainty in what they are talking about. Regardless of the way it is being talked about. It has to be [made] sort of exactly how they say, otherwise it does not work. A canoe, for example, will not last years if you take out the tree during the time that is not good for removing the tree. It [the knowledge] is not taught as a rule, it is taught with stories, it is passed on through stories. This is certainly why we have everything there, due to this teaching process, right? This is part of the way it is today, the way it is preserved…Because it is what we have said, they know exactly where the trees are. They know what is there and where they are keeping them, which is as if they were keeping them [the trees]. To conserve is for them a way of keeping them.

People observe potential trees for canoe making as they journey through the forest. They monitor their growth, their health, the abundance of certain species, and any possible natural or human disturbances. One community member, for instance, called attention to a xylophage white larvae that has been eating the wood of one of the significant species for canoe making in the region, the *Sclerolobium denudatum* (*ingá-amarelo* in Portuguese). As trees of this species are being attacked by these larvae, he is concerned with what may happen with the affected trees. He made other canoe makers aware of the presence of these larvae, asking them to monitor the *S. denudatum* in the forest whenever possible. This resembles a disturbance that occurred in past years, which was mentioned by some participants, where the trees of *Schizolobium parahyba* (*garapuvu* in Portuguese), started dying in the region. People noted the disturbance but did not know the reason for the mortality. In their research, Callado and Guimarães (2010) estimated that

climatic anomalies were most likely the responsible factors for the mortality of *S. parahyba* on an island near the Reserve.

The ecological knowledge that is built from people-forest connections can contribute to forest conservation. The local forest management practices, such as selecting a tree that best fits the canoe maker's needs, and the local observations of potential forest disturbances and alterations within the landscape, such as the presence of xylophagic pests in trunks are some examples of how this knowledge can provide insights for local conservation.

4.5. Caiçara canoes and canoe making: people-people connections

Canoe making may also contribute to social connections within the Caiçara community. This was noted by the specialists of the *Instituto do Patrimônio Histórico e Artístico Nacional* (National Institute of Historic and Artistic Heritage) as the reason why Caiçara canoes should be considered as intangible cultural heritage in addition to tangible cultural heritage (IPHAN 2013). One of the best-known social events related to canoe making is the *puxada de canoa* (also called *mutirão*), a collective effort (usually carried out by the canoe maker's friends and relatives) to pull the pre-shaped tree trunk down from the forest (Peterson et al. 2019). There are, however, other cultural dimensions of canoes and canoe making that are important to acknowledge.

First, canoe making encourages people to plan and organize cultural events such as canoe racing (Denadai et al. 2009). These events have been important to reunite Caiçara people from communities along the Brazilian coast and partaking in these meetings contributes to the development of social cohesion and a Caiçara identity. In August 2018, Praia do Sono had its first canoe racing with men, women, youth, and children from different communities participating in different categories. Second, local stories are told by community members about canoes and canoe

making. Some of them relate to adventures in the canoe making process, others about experiences during fishing or transport, and yet others follow the history of canoes inherited through generations. The practice of telling stories helps to disseminate environmental knowledge and local guiding principles across generations and between members of communities (Berkes 2018), and it is advocated as a tool for biodiversity conservation practice (Fernández-Llamazares and Cabeza 2018). Third, canoes have aesthetic and recreational value for community members in the Reserve's landscape, which are within ecosystem cultural services, and contribute to people's well-being (MEA 2005). Finally, the exchange of knowledge among community members is important to the exchange of information between harvesters about potential trees for canoe making in the landscape. Evidence of such exchange was mentioned by Peterson et al. (2019) in regard to Caiçara people in the Reserve. As people often conduct different harvesting activities, which requires the use of multiple forest habitats within the Reserve, their knowledge of the resources in the forested landscape may vary, and these variations may help canoe makers and others to access resources from different locations.

4.6. Conclusion

This article highlights some of the reasons why canoes and canoe making should be encouraged among traditional and Indigenous peoples in this Reserve and elsewhere. There are fishing techniques that cannot be performed with motorized fiberglass or aluminum boats because they are noisy and less manoeuverable. Hence, these boats are not entirely a substitute for dugout canoes. Fishing is the most important livelihood activity for food security in Paraty (Hanazaki et al. 2013). In the Reserve, the use of canoes to fish for mullet and other species provides the Caiçara with a diet staple and livelihood diversification. If canoes are not available in the Reserve, fishers

will have to search for them elsewhere, or even change some fishing practices. Caiçara canoes are an important component for cultural practices and are fundamental to a Caiçara identity. Thus, they need to be protected as a tangible cultural heritage associated with an immaterial knowledge. A diversity of initiatives can help to protect them. For example, intergenerational activities involving the elders and youth could be implemented to restore and paint the existing canoes. Such measures can extend the lifetime of canoes but are sometimes not taken because of the price of these services.

Canoe making also needs to be protected as intangible cultural heritage. The complex process of canoe making requires knowledge of the best trees for carving, the availability of resources in the landscape, and the local regulations governing access to these resources. This detailed knowledge, along with some of the people-forest connections, may get eroded, as has been happening elsewhere (Orofino et al. 2018). As canoe makers are the ones who have the practical skills, theoretical knowledge, and canoe making techniques, they should participate in the different processes of canoe protection that seek to encourage the sustainability of this cultural practice—for instance, educational actions with youth, and meaningful participation in policy decisions regarding the legal use of trees in the Reserve.

The combination of different knowledge systems (e.g., traditional and academic) can contribute to efforts to maintain the cultural aspects of canoe making and encourage conservation. One way to do this is through knowledge co-production, a collaborative process that aims to use the range of knowledge available to help solve problems (Armitage et al. 2011; Tengö et al. 2014). As this research shows, Caiçara forest knowledge can provide clues that can help researchers to investigate forest dynamics in the Atlantic Forest, a region that demands substantial conservation efforts. This combination of knowledge systems may prompt better ecological and social outcomes

in the management of resources, especially in the case of protected areas. Our findings illuminate how canoe making contributes to practices that shape peoples' landscape, identity and food security. Given that many Caiçara communities have had their resources curtailed for conservation reasons, our findings are particularly important to support Caiçara peoples' rights to access forest resources that are significant to maintain the local practice of canoe making.

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Preface to Chapter 5: Do we all speak the same language when talking conservation? Caiçara understandings of conservation in their landscape

Conservation is often a controversial subject, especially when protected areas overlap with indigenous customary territories. This chapter unpacks Caiçara concepts of conservation in a series of themes, to provide an understanding that there may be other forms of conservation thinking in the Caiçara landscape. The chapter expands on six themes and provides a guide to help researchers and policy makers to elaborate projects regarding conservation in the Reserve.

Chapter 5: Do we all speak the same language when talking conservation? Caiçara understandings of conservation in their landscape[14]

Abstract

Based on their worldview, indigenous and local communities may have their own concepts of conservation, which may be different from Western ideas of conservation. Here we report the results of a photovoice study with a Caiçara community in the Juatinga Ecological Reserve, a protected area in the Brazilian Atlantic Forest region. Participants were asked to take photos of their landscape/seascape to illustrate what they understand as conservation. Photos produced by the participants served as "boundary objects" that helped to evoke feelings, ideas, and thoughts of people-nature relationships during individual interviews, and finally during a group discussion. The results helped to explore ways to frame a Caiçara concept of conservation and highlight the importance of developing place-based conservation projects and approaches meaningful for Caiçara people. Such initiatives can help in understanding Caiçara motivations for conservation, aid partnership-building, and promote knowledge co-production between community, government managers and other stakeholders.

Keywords: *photovoice, boundary objects, worldview, biocultural approaches, protected areas, knowledge co-production*

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5.1. Introduction

Western conservation mainly seeks to maintain biodiversity at the genetic, species and ecosystem levels. However, it is not the only concept of conservation. Historically, conservation goes back to sacred species and sacred natural sites (Posey 1999), and can mean different things to different people in the contemporary world (Bosak 2008; Gonzales and Gonzalez 2010; Chan et al. 2016; Willow 2019). Bosak (2008) suggests conservation ideas may revolve around livelihood activities, where local people understand "…the landscape is the provider of subsistence and wealth and as such must be cared for" (Bosak 2008: 219). For some Indigenous Peoples, conserving biodiversity within a landscape relates to connecting humans, nature and gods in livelihood practices (Gonzales and Gonzalez 2010). Chan et al. (2016) argue that land stewardship and people's identities are inextricably linked as caring for places helps to maintain cultural identity and well-being. Conservation may be, for some Indigenous Peoples, a way to "retain or regain control of customary lands and thereby promote their peoples' physical, cultural, and political survival" (Willow 2019: 26). As a driver, conservation may help "…to ensure the continuance of the land-based sustenance on which their survival as culturally distinct and politically autonomous peoples depends" (Willow 2019:26).

Notions of conservation are based on one's worldview, and it cannot be assumed people will share the same concept, even within a given geographical area or cultural group. Worldview or a "way of thinking about the world" (Kearney 1984: 41) is fashioned by several components and shaped by personal and collective experiences such as observations of ecosystems, practices of management, past and current land uses, ethics and values, and people's culture and identity (Posey 1999; Berkes 2018).

Biocultural approaches to conservation propose a framework that encourages the integration of multiple ways of understanding human-nature relationships, or multiple worldviews. Defined as "conservation actions made in the service of sustaining the biophysical and sociocultural components of dynamic, interacting and interdependent social-ecological systems" (Gavin et al. 2015: 141), these approaches have emerged as a tool to help tackle biological and cultural diversity loss. A biocultural approach respects the rights of local people, acknowledges the possibility of multiple objectives and different worldviews for place-based conservation, and recognizes that partnering up is important for achieving success (Gavin et al. 2015). It also encourages conservationists to "start with the specific human practices, local knowledge and cultural beliefs that influence and are influenced by the land- and seascapes of which human communities are a part" (Sterling et al. 2017: 1800). Bearing in mind that conservation planning is often disconnected from the values of local communities and indigenous groups (Bockstael and Berkes 2017), actions that "start locally" may be of high significance within the context of protected areas.

Although considerable research has been carried out about emic ("insider") conceptions of nature to guide conservation policies (Bosak 2008; Beh et al. 2013; Cocks et al. 2016), very little is known about Caiçara perceptions of conservation as a concept and as a practice. This research uses the lenses of biocultural approaches for conservation to address this gap in the literature. Studies in the region have shown that Caiçara agricultural practices contribute to the diversity of species such as manioc (*Manihot esculenta*) and yams (*Dioscorea* spp.) (Peroni and Hanazaki 2002; Emperaire and Peroni 2007). Also, there is evidence that Caiçara ethnobotanical knowledge can be important for the conservation of the Atlantic Forest (Hanazaki et al. 2000). A better understanding of emic perspectives—understood here as non-static view, open to

changes—of conservation can be the starting point to build dialogue and strengthen relationships between local people and different actors, taking into account the existing connections that local people have with nature (Chan et al. 2016).

This research is especially important in the context of the Juatinga Ecological Reserve[15], a richly biodiverse region in southeastern Brazil, where negotiations to introduce a new arrangement of protected areas are taking place. The Caiçara are local people who have been living in this area for at least five or six generations (Vianna 2008). Under the current regulations, they are allowed some use of local natural resources, but many restrictions apply, affecting their livelihoods and culture. This research can contribute relevant information to help managers, policy makers, researchers, and NGOs to better understand local concepts and rationale for conservation, to talk the same language as local people, to expand their own worldview, and to converge efforts to build strategies to address biodiversity and culture loss.

This research starts with the assumption that the Caiçara may hold a particular understanding of conservation, shaped by their worldview, experiences and place-based historical events. To understand a Caiçara ethnoecological perspective, we (1) unpack the concept of conservation, and (2) describe the local motivations for conservation. This is done by exploring the results of a photovoice exercise in a Caiçara community in the Reserve. We begin with an overview of the study area and local communities, followed by a detailed description of photovoice data collection. The results and discussion sections explore themes raised around the

[15] The Reserve enactment in 1992 followed a Western conservationist concept (the "Yellowstone model"), which considers that protected areas should be free of people and does not take into account peoples' needs (Brito 2003). The Reserve is located at the Atlantic Forest which was considered one of the world biodiversity hotspots (Myers et al. 2000).

local conservation concept. Finally, we provide suggestions on how to develop conservation programmes based on a Caiçara biocultural approach for conservation.

5.2. Study Area and Methods

5.2.1. The Caiçara people and the Juatinga Ecological Reserve

This research was carried out with Caiçara people in the Juatinga Ecological Reserve, in Paraty, Rio de Janeiro, Brazil. The Caiçara are mixed-heritage descendants of Europeans, Africans, and Indigenous peoples that inhabit regions of the southern and southeastern coast (Begossi 1998). They have lived in the region for many generations, engaging in a range of cultural activities in both land and seascapes, such as shifting agriculture, fishing, subsistence hunting, harvesting of non-timber forest products (NTFPs), basket making, and wood carving. Eight communities and twelve smaller settlements with approximately 1500 people, the majority Caiçara, live in the study area (Vianna 2008; IGARA 2011). Since the 1950s, this region has been targeted by land-grabbers trying to seize lands in Caiçara territories illegally (e.g., with forged notary documents). Such events have contributed to Caiçara out-migration, and for those Caiçara who stayed,building a sense of distrust of outsiders (Siqueira 1984).

Paraty is well known for its scenic landscape with beaches, forests, and waterfalls. Tourism in Paraty intensified after a major highway opened in the 1970s, facilitating access of people from São Paulo and Rio de Janeiro. The Reserve's location is out of the highway, and even though its geography has contributed for some isolation, tourism contributed to changes in the local economy as Caiçara people engaged in tourism-related activities (e.g. working and managing local restaurants, camping, and transporting tourists).

The Reserve is located in the Atlantic Forest region and is about 10,000 ha. It is one of

the last remnants of the Atlantic Forest, a biome with biodiversity comparable to the Amazon. The high rates of habitat fragmentation combined with a high number of endemic species of this biome have caught the attention of conservationists, who consider this a priority area for conservation (Metzger 2009; Ribeiro et al. 2009). The Juatinga Ecological Reserve was created in 1992 with the objectives of fostering both environmental protection and Caiçara culture (Rio de Janeiro 1992; De Francesco 2010)[16]. The category "Ecological Reserve" is not covered by the SNUC[17], the most recent law that regulates protected areas in Brazil. Hence, the Ecological Reserve of Juatinga is going through a process of recategorization, which could lead to a new category of protected area being instated in the area. This process has been going since the SNUC law; many studies have documented the case, discussing possible scenarios for the potential categories of protected areas that could be established (Cavalieri 2003; Silveira and Brandão 2004; Monge et al. 2013). As of 2019, local people and the government have not reached an agreement, and negotiations are still in progress.

5.2.2. Data collection and analysis

Photovoice is a participatory research method that enables an active role for participants, and stimulates discussion and critical thinking about the issues of their place through a creative process (Wang and Burris 1997). Photos generated through a photovoice process function as boundary objects, which evoke new forms of information, feelings, and memories, generating

[16] It was, however, enacted without much concern for the involvement or participation of local people (Brito 2003).
[17] SNUC in Portuguese stands for *Sistema Nacional de Unidades de Conservação da Natureza*, or the National System for Protected Areas, law number 9985, July 2000. http://www.planalto.gov.br/ccivil_03/leis/L9985.htm. Accessed on: March 14, 2019.

richer, varied and in-depth results (Harper 2002; Bennet and Dearden 2013). Boundary objects help researchers to understand emic concepts because "… their structure is common enough to more than one world to make them recognizable as a means of translation. The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds" (Star and Griesemer 1989: 393).

Boundary objects, obtained here through the photovoice process, are a means of communication to translate ideas and information, to transform and co-produce knowledge (Carlile 2002; Feldman et al. 2006). Photovoice was used with six local participants between 18 and 41 years to investigate Caiçara perceptions on conservation, in the Praia do Sono community in the Juatinga Ecological Reserve. An attempt was made to include men (N=4) and women (N=2), to cover aspects of gendered knowledge. Although, our sample size was smaller than suggested by Wang (1999) and (Palibroda et al. 2009), the six participants offered diverse experiences and perspectives on conservation, as they had diversified roles in the community (artisan, community leader, small-scale farmer, church representant, park ranger, environmental educator, local tourism guide). As the first author Debora Peterson (DP) lived in Praia do Sono for over 18 months (2013-2015), she had the opportunity to build rapport and develop familiarity with Caiçara people, which was essential for this research. A long-term engagement helped the researcher to acquire the ability to better evaluate photovoice material (Nakamura 2008). Ethical procedures followed the protocol of the International Society for Ethnobiology and ethics approval was granted by the University of Manitoba. Informed consent was obtained from research participants prior to data collection.

Data collection took place from June 2015 to January 2017 through four steps (Figure 1). The first step was the recruitment of participants through purposeful sampling and snowball

technique. Participants were selected according to the following criteria: (1) time living in the community or around the Reserve (at least 10 years), (2) willingness to take part in this research, (3) interest in photography and in learning how to use the camera, and (4) interest in talking about conservation.

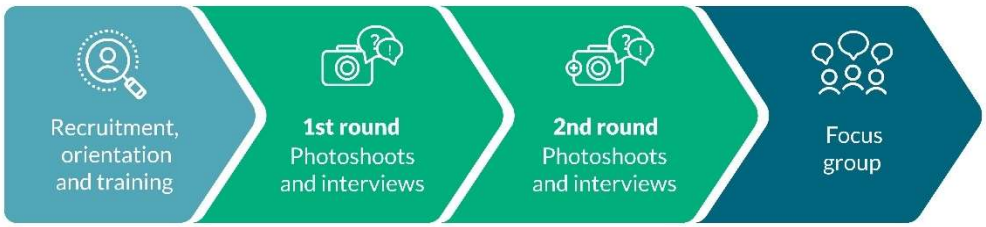

Figure 1: The steps of the photovoice process carried out with Caiçara participants. Figure prepared by D. Peppler.

Participants were asked about the relevance of using a local awareness campaign as inspiration to prompt discussions about conservation perceptions. During the period of the fieldwork, the Traditional Communities Forum[18] launched a local campaign to raise awareness about Caiçara rights to cultural practices and to customary landscapes, helping to align the objectives of the research with the local context. The participants' orientation started with an explanation of methods and objectives of the research, ethical matters (e.g. ask permission to

[18] *Fórum of Comunidades Tradicionais* (www.preservareresistir.org). Caiçara, Indigenous and quilombola peoples (descendants of Africans) from São Paulo and Rio de Janeiro states organised themselves in this initiative, to join efforts to defend their rights and customary territories. This Forum prepared a video, a pamphlet and wrote the poem below as part of the local campaign mentioned in the text, with the objective of raising awareness about rights and territories. The poem read: "To preserve is to resist, to resist is to conserve, to conserve is to know how to use, to know how to use is the art of traditional people." (*Fórum of Comunidades Tradicionais*, translated by DP)

take photos of community members), advice on the camera's functions and suggestions on taking good photographs. The cameras (Nikon AW120) were waterproof, which permitted participants to shoot underwater photos. Time was given to participants according to individual needs and varied from two to seven months.

The second step consisted of the first round of photo shooting, photo selection, and interviews. Participants were asked to take at least ten photos to answer the primary question, "What do you understand as conservation?" At this stage, the photos (N=330) were printed and given to participants. Each participant selected three photos to describe their perceptions during semi-structured interviews. They would often choose extra photos to complement their ideas or help explain a concept. Semi-structured interviews were conducted individually in the local language (Portuguese). The researcher (DP) asked questions to probe further explanation of concepts and ideas. At the end of the first round of interviews, participants were asked for one to four new topics for the next step. Participants came up with a diversity of topics for potential follow-up for the next step. These were: canoes and canoe-making; the landscape; the meaning of a traditional community; the meaning of a "Caiçara community"; how to obtain support for projects; and intergenerational teaching/learning techniques.

In the third step, which was the second round of photo shoot and interviews, participants were asked to take five new photos about each of the topics named by participants in the previous round. At this time, we used the digital version of the photos, saved in a laptop. Each participant chose at least one photo of each topic for the interviews. Again, participants chose extra photos to help illustrate concepts and ideas whenever they felt necessary. In total, 44 photos guided 12 interviews, which varied in length from 38 minutes to 1 hour and 35 minutes.

The fourth and last step consisted of a focus group discussion. The focus group objective was to create a space for dialogue and knowledge exchange between participants, which are principles of the photovoice process (Wang and Burris 1997). The preparation for this step included an initial exploratory analysis of the interviews, carried out by the researcher, with coding for recurring topics (codes)[19] common to all participants (Ryan and Bernard 2003). Six major code families, related to the Caiçara conservation concepts, were identified by the researcher (Table 1). As an example, the code family "social cohesion" was used for every content cited by participants that linked peoples' attitudes (or lack thereof) to mutual help group (code) and engagement of community members (code) in community-related issues. This categorization was an attempt to present the results in a systematic way to guide participants' discussion during the focus group. The focus group was held for 6.5 hours over two days; the results presented to participants consisted of photos chosen for interviews, quotes from interviews, and codes and code families common to participants. Follow-up questions (based on these codes and code families) were posed to the group, one at a time, to encourage group discussion about interview results. Participants would often build their answers from other participants' answers. Individual answers were reported separately, and a consolidated consensual answer for each question was presented for validation by the participants. As an example, the notion that a Caiçara territory is continuous was posed by participant 1, and generated a rich discussion, with all participants supporting this idea. Building up from these thoughts, participant 5 complemented that a traditional territory encompasses activities held on that land (see excerpt from participant 5 in section 5.3.3). The focus group helped to articulate,

[19] We used Gibson and Brown (2009) for defining: 1) code: a label used to describe a general category of data, 2) code family: a collection of codes that belong together, and 3) theme: representation and recontextualization of the data to which they relate in a dataset.

whenever possible, commonalities and differences within participants, and to validate and share results among participants. At a later stage, during the preparation of this manuscript, the researcher reassessed and further elaborated codes and code families into themes (Table 1), as an attempt to systematize the results and provide further context to the reader.

5.3. Results

From 1429 photos produced in the second and third steps of the research, the 44 photos chosen illustrated several subjects such as the landscape, daily duties (making and fixing nets), examples of food obtained and/or prepared for local diet, children playing, and more. This section explores each theme. Table 1 shows the codes, code families and themes that emerged from data obtained through photos, interviews, and focus groups.

Table 1**:** List of codes, code families and themes illustrating the Caiçara conservation concept, using the 44 photos from the photovoice process chosen by the six participants for interviews, and focus group discussions. Codes were obtained from recurring topics in individual interviews. Code families are the collection of related codes, which helped guide focus group discussions. Themes were developed later, for this manuscript, to contextualize the data.

Codes	Code family	Themes
Cultural continuity Erosion of knowledge and cultural practices Inclusion of culture in formal education Caiçara identity as traditional community	Culture	Caiçara culture and identity is related to cultural continuity, knowledge translation and past and present cultural practices
Knowledge continuity (use and management of plants) Knowledge transmission among Caiçara Knowledge transmission between Caiçara and tourists	Traditional and local ecological knowledge	Traditional ecological knowledge is related to knowledge continuity, and knowledge transmission among Caiçara
Territory Sea protection Exclusion of outsiders Build local capacity (guided tours)	"Taking care of the land"	"Taking care of the land" is linked to rights and responsibilities towards the customary territory
Mutirão (Mutual help group) Building decentralized leadership capacity Engaging local people	Social cohesion	Social cohesion is a strong expression of the Caiçara culture, related to cooperation and leadership
Long-term interactions Cyclical relationships	People-nature relationship	People-nature relationships connect the people, forest, and sea
Aesthetic appreciation Sacred natural sites	Aesthetic, spiritual and recreational values	Landscape and seascapes provide aesthetic, spiritual and recreational values

"Culture" and "traditional and local ecological knowledge" are interrelated but were initially presented as two code families to facilitate focus group discussions. There is also some overlap elsewhere; for example, knowledge transmission comes up in several themes. Culture is

the subject of section 5.3.1, along with results on beliefs, customs, behaviours, and Caiçara identity. Knowledge, use, and management of natural resources are covered in section 5.3.2, and the other themes in the four subsequent sections.

5.3.1. Caiçara culture and identity is related to cultural continuity, knowledge translation and past and present cultural practices

Defining culture is challenging because of the many ways in which the term has been conceptualized. Bates and Plog (1990: 7) define culture as "the system of shared beliefs, values, customs, behaviours, and artifacts that the members of society use to cope with their world and with one another, and that are transmitted from generation to generation through learning". For research participants, Caiçara culture was linked to (but not restricted to) knowledge transmission and the skills of: making fishing nets, carving canoes, using seeds as condiments, cultivating edible roots and gardens, preserving food (e.g. salt dry fish), using parts of plants for canoe making, and house construction (Figure 2). The photos portraying everyday life situations and landscape elements were used by participants to show concerns about cultural continuity, erosion of cultural practices, knowledge transmission (including culture in formal education), and Caiçara identity.

Figure 2: Photos portraying elements of Caiçara cultural practices: (a) youth manufacturing a *cerco* net, (b) canoe and fishing nets, (c) seeds of *Bixa orellana*, used as condiment, (d) cultivating edible manioc root (*Manihot esculenta*), (e) cultivating gardens, (f) dry fish, (g) a Caiçara canoe, (h) *pau-a-pique* building under construction, and (i) *pau-a-pique* house.

Figure 2a was used to show concerns about cultural continuity. A participant mentioned the importance that youth perceive Caiçara culture as their own culture and as part of their everyday lives (youth is considered here as people between 15 and 24 years, UN 2018). This local concern for the potential erosion of knowledge and cultural practices triggered ideas for local actions to help contain this situation and to value Caiçara culture. For instance, Caiçara initiated partnerships to find resources to build space for promoting a valorisation of culture to

Caiçara people and tourists. In this space, artisans (wood carvers, basket makers, embroiderers, painters) could show and sell their work.

Knowledge transmission in a formal educational system is another way to value cultural practices. A participant mentioned how elders are concerned with the possible erosion of cultural practices. Such concerns are accompanied by creative ways of accomplishing knowledge transmission, because the Caiçara style of learning is by imitation or learning-by-doing:

> You have the knowledge of the tree to take away, the whole cycle there and such. Just like the fishing net. The size of the fish net. The way to make the fish net. The kind of nylon, of weight, of rope. The place where to put the net, how will you catch the fish with the net. And here the same thing, from the manioc plantations. You have the time to plant, the time to harvest, the time to cut, to prune the branch, for the branch to grow, to thicken the roots. You cannot leave them in the soil too long or harvest early. This is driven by a need. And this need is a culture... This shows that these people are differentiated. It is different, the right and the place where these people live it has to be safeguarded... That is why these people are different, although they adapt a lot, they have a culture, they have a way of doing it. (Participant 1). [Here and elsewhere, translated from the Portuguese by DP]

The decline of cultural practices due to transformation of livelihoods was explored by participants. Some felt nostalgic, telling many stories about how things used to be. Others used these as a trigger to raise awareness of cultural practices, as Caiçara identity is linked to these practices. These are not, however, the only elements of identity. For participants, a Caiçara

identity is linked to a culture that is dynamic, and that has been inclusive of other cultures. The use of terms has evolved over time to better define elements of a Caiçara identity. In the past, Caiçara were mostly identified as traditional fishers by outsiders, but the term Caiçara is better suited in their opinion:

> As we began to become more involved with Caiçara organization [to fight for rights and territories], we used a more comprehensive term, more than traditional fishers that was once used. The [term] Caiçara has a more comprehensive relation to the whole, with culture, whereas the [term] fisher has the closest relation to the sea. (Participant 1).

5.3.2. Traditional ecological knowledge is related to knowledge continuity and knowledge transmission among Caiçara

Traditional ecological knowledge can be defined as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission" (Berkes 2018: 7). Local ecological knowledge, by contrast, refers to knowledge that is not necessarily multigenerational and not necessarily transmitted culturally (Berkes 2018). Traditional and local knowledge are here considered to be open to changes, and not static and inflexible (Berkes 2018).

Participants explored photos to talk especially about the use and management of plants, and knowledge transmission. Discussions about traditional ecological knowledge came up with examples of use of plants. Bamboo is a crucial resource for *pau-a-pique* houses, a local construction technique with bamboo and clay. Although this type of building has been giving way to modern ways of house construction, it is still practised in Sono and other communities.

Bamboos of several species including *Bambusa vulgaris, Dendrocalamus asper,* and *Phyllostachys pubescens*, among others (Brito and Senna-Valle 2012) are used today in the region to build not only houses, but also beach benches and sand retaining walls. Although most of these species are non-native to Brazil, they have been an important resource for the Caiçara for a long time. Participants used photos of bamboo plants (Figure 3a) and *pau-a-pique* houses (Figure 3b) to explore the importance of these resources. According to local rules, harvesters should harvest only mature shoots. Sustainability issues aside, mature shoots are known to be more durable and resistant to weather conditions. A harvest of immature shoots is considered a bad practice:

> We go far away to get this bamboo. And we have to choose mature bamboo to be able to maintain it for longer. Now if we harvest it out of the season, it rots fast. In six or four months. When it [the bamboo] is good [mature], you strike it with the machete four, five times to cut it. When it is not [good], you strike it twice and it is cut. (Participant 2).

Figure 3: Photos used by photovoice participants to discuss traditional ecological knowledge in Praia do Sono: (a) bamboo species (*Bambusa vulgaris*) used by the Caiçara for many purposes, (b) an old *pau-a-pique* house, and (c) women embroidering a commissioned work.

Another participant used a photo to explain knowledge transmission among Caiçara for craft making (Figure 3c). Women in Praia do Sono are well known for their embroidery, which embraces forest, sea and cultural elements as motifs in canvas. Embroidery has become a creative way to tell, pass on, and register parts of the local stories. However, women may lack familiarity with some details, and may seek ecological knowledge from others. For example, when uncertain about the plumage colours of bird species they want to embroider, they usually seek help from knowledgeable elders and relatives:

> They [the women] tell stories through embroidery. This is why I chose this photo… I like the knowledge that people have in their hands, and how they pass this along through beautiful drawings and colours...you see a tree, a bird, everything they live for, everything the community lives for, they [the women] try to pass through embroidery. They [women] ask them [men], what are the [bird] colours, how they are. Then, many women embroidered birds with the knowledge retained by men, because men had the experience of looking for birds… They know them well. They [women] ask them because they know the knowledge they have. (Participant 3).

As many tourists buy embroidery from women in the community, some of this ecological knowledge may be also passed on to non-Caiçara people as well. Artists often explain the meaning of the motifs and the stories as they show their canvas to potential buyers, locals and tourists.

5.3.3. “Taking care of the land” is linked to rights and responsibilities towards the customary territory

The term “taking care of the land” (*cuidar do lugar*) appeared to explore a range of topics during the interviews, namely: territory, seascape protection, excluding outsiders, and capacity building. This resembles the term “caring for country” used to describe stewardship of aboriginal peoples in Australia (Zurba and Berkes 2014). During the focus group, participants explained that “taking care of the land” was used to define the intention of maintaining what the Caiçara have in the land for the generations to come.

Taking care of the land was linked to discussions around rights and responsibilities of Caiçara towards their customary territory. Participants mentioned that the word territory was new for participants, who formerly called the place “the land of traditional communities”. The local understanding of the common landscape extends from the limits of Praia do Sono community to the entire landscape of the Juatinga Ecological Reserve. A practical aspect of this understanding is that communities may share resources within the Reserve landscape. Plant harvesting is one example. Not all useful bamboo species are found in every community; Praia do Sono has a bamboo species which is not found in Ponta Negra. This means that people need to travel outside of their communities for harvesting certain species. In this context, there is an understanding that land and resources that fall in the Ecological Reserve are for all Caiçara in the region, and not restricted to a particular community.

The Caiçara territory is seen, by participants, to be continuous, meaning it encompasses landscape and waterscape, going beyond the geographical boundaries of communities within and outside the Reserve. A participant drew attention to the current pollution of the river and river mouth with the photo shown in Figure 4a. This suggests a local sense of responsibility to

biophysical elements of the landscape, and indicates that participants feel responsibility also for the pollution in their landscape:

> I love this almond tree [*Terminalia catappa*] because it comes from the [river] margin, it is actually in the water… then I took [the picture] because it shows that even though it has pollution, that *barra* [river mouth] is polluted, we can still have such a beautiful tree, can't we? ... Hence we need to stop to think that the *barra* needs to be well taken care, doesn't it? Because the *barra* looks ugly, doesn't it? Then we just go there to take pictures, because to swim it is not good any more. (Participant 4).

Figure 4: Participants photos obtained by a photovoice process show: (a) a *Terminalia catappa* tree on the river bank, (b) trail to one of the cascades in the community, and (c) one of the engraved rocks in the cascades.

A participant highlighted how protection of the sea is often overlooked, remembering that both land and sea should be taken care of, and linking this notion of continuity to the integrity of a Caiçara territory. This participant remembered that the land is often the target of much of attention by managers and policy makers, but few legal measures are taken for the sea environment. He justified his thoughts with examples of the occurrence of spearfishing with scuba, practised by outsiders.Participants reported that tourists seeking seasonal residences and

entrepreneurs of tourism developments are difficult to contain. People mentioned that the Reserve brought in some legal restrictions that helped to limit outsiders, but only to an extent. On the other hand, they highlighted that the Reserve has not been fulfilling its objectives for local culture valorisation in their territory:

> The traditional territory encompasses a little of everything you do in there [and] I believe we are stronger in this matter, maybe because of the Reserve enactment. I do not say we do it [conserve] because of the Reserve. We have been doing it. We somehow did conserve. You can see that we live here, I think we are already the fifth generation, and the Reserve was only created in 1992. …. If you have people aiming at protection, you first have to listen to the community, not just create the laws without hearing [the community], create a law to protect this community, see what the community needs and what it uses. (Participant 5).

One participant advocated for more opportunities for youth in the community. His photo of one of the most touristic trails in Praia do Sono (Figure 4b) evoked ideas of training youth as guide tours to potentially lead tourists on trails. The community has a high demand for touristic activities, and engaging youth in such activities as local tour guides would bring benefits. First, it would help in local economic development by providing extra income to youth for doing something that many of them enjoy doing. Second, it would open an opportunity to disseminate knowledge about local nature and culture. Third, it would serve as a means to monitor negative effects of tourism on trails and other places in the landscape. Littering and rock engraving along the cascades (Figure 4c) are examples of pollution that concern the Caiçara. Lastly, building this type of capacity would be an encouragement to keep the youth in the community.

5.3.4. Social cohesion is a strong expression of the Caiçara culture, related to cooperation and leadership

Stanley (2003: 5) suggests social cohesion as the "willingness of members of a society to cooperate with each other in order to survive and prosper. Willingness to cooperate means they [people] freely choose to form partnerships and have a reasonable chance to realize goals because others are willing to cooperate and share the fruits of their endeavours equitably". Social cohesion was portrayed as a strong expression of the Caiçara life by the participants. Photos explored during the interviews linked social cohesion to organizing mutual help groups, the desire of forming a decentralized leadership, and building leadership capacity.

Mutual help groups, locally called *mutirão*, were referenced by participants as an example of social cohesion. People gathered to perform work that benefits specific group of individuals or the entire community, such as building bridges, schools or houses. Mutual help groups are also needed to perform daily activities more efficiently. According to one of the participants, this *mutirão* practice was commonly found in the community in the past.

> In the old days we had the need to help each other, hence we had a lot more *mutirão*… to build bridges, to build a church, to fix the school, to build houses, to cook the paint for dying the fishing nets… to bring out logs to build canoes in the middle of the forest, didn't we? Since the logs are very heavy, we had to have *mutirão*. (Participant 1).

Some people say things have changed over the years, especially with tourism expansion, which for some challenged social cohesion and triggered individualism. The frequency of the

mutirão practice has diminished for some tasks, such as building houses. However, people still keep the habit of helping each other (Figure 5a), and this is especially true for livelihood activities, such as for getting ready for fishing (Figure 5b):

> …Kinship, from family, kind of unites people, because it has always been a solidarity tie. You call the people to help pulling out the canoe… they also go there to see if you caught fish, or didn't. It [the photo] really is something very strong. Very strong for the Caiçara's life. (Participant 3).

Figure 5: Photovoice participants took these photos to show situations where people need and collaborate with each other within the study region: (a) a mutual help group to transport building material, (b) a group of people is necessary to move canoes in and out the water, and (c) three fishers working in partnership. At least three more people are needed to help them pull this canoe in and out.

Figure 5c shows fishers combining effort during mullet (*Mugil liza*) fishing. This technique requires two or three fishers and a canoe of 4–5 m. These large canoes (Figures 5b and 5c) accommodate fewer people than are needed to pull them into and out of the water. Figure 5c shows a canoe that has the capacity for three fishers, the required fishing gear, and the potential catch. However, a minimum of six men is needed to move it with ease. Such dependency on each other builds and strengthens relationships and fosters social cohesion.

The second challenge to social cohesion is linked to leadership or lack thereof. Highlighted during the focus group, participants agreed that capacitating leaders in the community is difficult. There are few people acting as local leaders, and they are often overwhelmed with many matters. There is a great need for capacity building for a diversity of roles: to organise local actions, build dialogue within the community, deal with external matters, and build bridges to improve communication between internal and external leaders. Participants believe that having decentralized leadership, with a higher number of local leaders, would be beneficial. Leaders would be more engaged and could focus on one matter, more people would be involved in leadership, and the community would have a more organised structure for local governance.

Social cohesion (or lack of it) may also affect the success of local participation. Participants mentioned difficulties in gathering the interest of community members in projects developed by outsiders or initiated by the community. Two factors may have contributed to this—trust and local capacity. With long-term projects, external partners may be able to access more resources and be helpful in addressing local issues, but community members are often reluctant to participate because of the history of land grabbing by outsiders. The distrust of outsiders often affects projects funded by external organisations. There are however, organizations that have been working for some time in the community and have built trust with people in the community. Nevertheless, initiatives emerging locally have higher chances of participation by community members. Participants acknowledged some level of engagement from community members in local initiatives (e.g. organisation of festivals, development of trails to access local schools). The challenge is, according to participants, to build local capacity to access financial and human resources to address matters in the community.

5.3.5. People-nature relationships connect the people, forest, and sea

Many resource-based peoples have holistic views of people-nature relationships. A holistic worldview often characterizes indigenous people, who view their culture, people, and environment functioning in a connected way rather than as disconnected parts (Berkes 2018). Participant photos and interviews explored these people-nature relationships with examples of long-term and often cyclical relationships:

> The people talk a lot about the forest, you know? We don't live only off the forest, we live with the forest as well. But you know there is not one thing without the other. If we don't take care of the forest, subsequently we don't have water. If we don't take care of the water, we don't have a life, you get it? Water is life, isn't it? It is what they say, but I think water will be subject to conflict from now on. We don't think about it, but if we keep the forest preserved, we will have water. If we maintain the water clean, we have life, haven't we? It is all part of a "cogwheel", isn't it? (Participant 5).

The model in Figure 6 was drafted from interviews based on Figures 7a and 7b. *Cerco* fishing is a fixed-net fishing technique brought in by Japanese immigrants in the 1970s-1990s (Mussolini 1980, Idrobo and Davidson-Hunt 2012). Participants explained that every few months, *cerco* nets are submitted to a dying process to make them more durable because the resin in the dye. It also makes them less visible for fish because of the dark colour. The preparation of the dying solution requires plant species found locally. In Praia do Sono, the bark of *aroeira* (*Schinus terebinthifolius*) and/or *quaresmeira* (*Tibouchina granulosa*) are harvested and boiled in the containers—*tacho* or *caldeirão*— until the liquid turns reddish brown (Figure

7b).

Figure 6: The model displays *cerco* nets interconnecting forest, sea, and culture as a system. Figure prepared by D. Peppler.

Figure 7: Photos taken by participants: (a) man repairing *cerco* nets, (b) the container (*tacho or caldeirão*) used for dying *cerco* nets in Praia do Sono, and (c) fisherman in fishing spot casting his net.

This cyclical relationship around *cerco* nets comes from a worldview, where forest, sea, and culture are interrelated as a system: "this one [photo] of the *caldeirão* and this one [photo] of the net are part of the same story: the knowledge that everything is for the sea. You come out of the forest and go to the sea—just like the net and the *caldeirão*." (Participant 3).

Long-term interactions between the Caiçara and marine resources were also cited. A participant chose a photo (Figure 7c) to call attention to cast nets, a multigenerational fishing practice. He is expressing a particular worldview, where he believes that continuing to use a resource helps maintain its availability:

> And there are areas of abundance of robalo [*Centropomus* spp.], of parati [*Mugil platanus*]. Depending on the season, each has its own time, of course. The cast fishing was already a tradition since the time of my great-grandfather and that has been maintained. And why does it hold? Because you still have this resource to use… I think they [fishers and fish] complement each other. (Participant 5).

5.3.6. Landscape and seascapes provide aesthetic, spiritual and recreational values

The aesthetic, spiritual and recreational values of land and seascapes are some of "the nonmaterial benefits people obtain from ecosystems" (MEA 2005: 40), intrinsic to peoples' well-being. During interviews, contemplative words like beautiful, wonderful and pretty appeared consistently to describe natural and cultural scenes portrayed by the photographs. Participants talked about the beauty of the place, showing the ocean, coast, forest, river, houses, and other elements. This suggests an aesthetic appreciation of the Caiçara landscape/seascape in Praia do

Sono. Two participants shot photos very similar to one another to explain this feeling (Figures 8a and 8b):

> What does this picture mean to me? It is a very beautiful photo, right? But what does it mean to me? I think it means everything because it is the Sono, right? This is the place, as I told you, this is the place I do not want to leave. This is the place I find beautiful, wonderful. (Participant 6).

> I come to this side, it is so beautiful with these canoes on the beach. The ranch, each one with its canoe, the fishing net... Sono is a very beautiful place. Then it is so appealing to see that there are still people... who care, don't they? Just like I say, each one takes care of their yard, right? Where there are no [people], the people see that no one is caring, [then they] are throwing things in there. I took this picture because it had the beautiful landscape. (Participant 4).

Sacred natural sites are part of landscapes and seascapes defined as "areas of land or water having special spiritual significance to peoples and communities" (Verschuuren et al. 2010: 1). The river mouth in Praia do Sono shows elements of sacred natural sites, because it is where important religious celebrations, such as baptism, take place. It also functions as a recreational place for children and families. The community does not allow any construction near the site. The local perception is that the river mouth is a communal area that everyone should have the opportunity to enjoy. Local rules are extended to tourists and campers who are not allowed to set up tents. It is not rare that some community members inform tourists about local

restrictions and/or contact the environmental agency for legal enforcement, in the event of tourists disrespecting rules. The ecological functions of this ecosystem were highlighted by one participant (Figure 8c):

> This photo was taken in Sono, in a place called *barra*, which is a sacred place for me. The *barra* is sacred, you know? It is a beautiful place, it is a kind of mangrove. [As well] you have a school of *robalo* [*Centropomus* sp.] or *parati* [*Mugil* sp.] which develops inside here, right? They come to reproduce, to spawn. It is here. The resources are enormous. The *barra* is rich in everything. Where else can you find this? To me, to conserve is to maintain what nature has given you, what the creator has given you as a gift. For me, this is conservation. (Participant 5).

Figure 8: Photovoice photos show a Caiçara landscape/seascape: (a), (b) beautiful landscape, (c) the river mouth, locally known as *barra*, has elements of sacred natural sites.

5.4. Discussion

Photovoice was effective in engaging community members in the research, especially in the context of a complex theme such as conservation. It was both time-consuming and challenging: time-consuming for participants, who needed several months for shooting photos and completing interviews. Photovoice was also challenging because participants needed to be

engaged in the research even when the researcher was not in the community.

At the individual level, photovoice allowed participants to explore their own creativity, and through digital cameras, had more freedom to exercise photography, by taking and retaking multiple shots, often of the same object. This creative process helped them to reflect on which frames would work as the boundary objects they really wanted to illustrate, showing personal agency (Bowles 2017). Figure 8c is an example: the participant took multiple shots to frame the school as he was willing to show the importance of the river mouth as nursery habitat for fish.

The interaction around the boundary object, with interviews, discussions and participants' reflections helps create knowledge (Fischer 2004). Photovoice was particularly useful to create space for local people to talk about their community, and on a broader scale, about Caiçara identity. One participant mentioned his feelings about the opportunity to have his voice heard, adding that he would likely not have shared his thoughts with others if not for this research. During interviews, participants mentioned occasions where they shared with others personal reflections raised by photovoice.

The photovoice exercise was initially planned to involve seven participants or more (Wang 1999; Palibroda et al. 2009). As this research was part of a greater initiative (a doctoral research) it was difficult to conduct the photovoice exercise with more than six participants (within the doctoral time frame). This was due to the nature of the method, which as previously discussed demands a lot of time from participants, and lack of material and personal resources (as more cameras would be necessary, and at least one field assistant to help with the data collection). Yet, six participants, with an in-depth analysis, provided an understanding on Caiçara conservation, as the research consisted of many steps of data collection and the roles of participants in the community were diverse (Masterson et al. 2018). Furthermore, the small

number of participants promoted a comfortable space to exchange information and co-produce knowledge. However, there were limitations in having a smaller number of participants: it may have contributed to results with a smaller number of themes. Having participants somehow engaged in environmental activities (park ranger, environmental educator, local tourism guide) and with leadership roles (community leader) may have contributed to results with strong similarities with Western conservation concepts. This is because these participants are often more involved with researchers, conservationists, NGOs, Reserve staff and government representatives than other community members.

For the participants, culture is the pillar of local relationships, as people learn cultural practices from others. These practices help people to formulate a Caiçara identity. There are local concerns about the potential erosion of cultural knowledge, due to tourism, social transformation, and modernization (Brito and Senna-Valle 2012). Idrobo (2014) presented an analysis of the association of knowledge loss with modernization, as this often hinders local development. Suggestions to promote cultural continuity (e.g., inclusion of cultural elements in formal education) open up space for collaboration among different actors (e.g., elders, children, formal teachers, researchers), and opportunities for co-producing knowledge.

Traditional ecological knowledge was linked to Caiçara conservation in a range of practices, including fishing and plant harvesting (Sanches 2001; Hanazaki 2003; Hanazaki et al. 2009). In the process of this research, conservation came to be identified by participants as something that they do naturally during their daily activities—for instance, knowing the time to harvest mature bamboo shoots or manioc plants. This was a revelation to the Caiçara, as the term conservation was initially brought into the communities by outsiders. Willow (2019) reported something similar with Indigenous people in Canada, who explained environmentalism was a

term used by outsiders to describe indigenous practices that have been happening for long time in their territories. In the reserve, Caiçara people refrained from using the term conservation, as it was associated with past and present top-down conservation (Idrobo et al. 2016).

The idea of "taking care of the land", as part of this new understanding of conservation, appeared linked to rights and responsibilities of Caiçara to their customary territories. Building local capacity for tourism-based activities (e.g. training youth as tour guides) is a way to strengthen relationships with the land and motivate conservation stewardship, while contributing to economic development. Many indigenous groups consider that a higher degree of people-land interaction promotes responsibility for land and fosters stewardship, helps to strengthen cultural relationships, and keeps youth on the land (Davidson-Hunt et al. 2010). Keeping traditions and ways of life, as well as retaining and regaining rights to customary lands are some of the goals of elders for the future of youth in Indigenous territories (Willow 2009).

Capacity-building was understood by the participants also as a way to strengthen social cohesion in the community, which has become weaker[20]. Bockstael (2017) found out that capacity-building improved social cohesion and fostered leadership in Trindade, a Caiçara community close to Praia do Sono. Building-capacity for leadership could be more efficient for community-based governance than simply imposing resource management actions without meaningful local participation (Bockstael et al. 2016). This corroborates participants' belief that a higher number of leaders focusing on different aspects of life, including conservation, would

[20] Weakening of social cohesion among Caiçara communities has been described by scholars. Prado (2013) shows how crises and threats have affected social cohesion in Praia do Aventureiro.

strengthen community cohesion[21].

Caiçara concepts of conservation are relevant to resource sustainability. The worldview of people-nature relationships resonates with other indigenous groups, who believe the diverse relationships—people-animals (Berkes 2018), people-plants (Rosado and Moreno 2015), people-deities (Sylvester and García Segura 2016), people-land (Davidson-Hunt and Berkes 2010)—are needed to maintain resources. It is part of the Caiçara worldview that to make a resource continuously available and keep it productive, one needs to make use of that resource. A similar view was found among the Cree of eastern Canada, who believe that trappers need to keep trapping beavers to maintain the productivity of animals. Similar views exist among many indigenous groups of the world, from the Inuit to the Maori of New Zealand (Berkes 2018).

Caiçara concepts of conservation also have a strong biocultural component. The aesthetic, spiritual and recreational values of some places in Praia do Sono remind Caiçara of the beauty of their community and make them appreciate what they have. The way participants see these places resembles "cultural keystone places", described by Cuerrier et al. (2015: 427) as "places of high cultural salience for a particular group of people at a particular time and critical to their identity and well-being". Lepofsky et al. (2017) suggested that "cultural keystones places" can be the link between people's past and future through the memories of shared landscape. Landscapes are known to have well-being effects leading to physical, mental and social improvements in people's lives. An individual's perceptions of a landscape relate to the meaning, identity, attachment, belonging, memory and history that the landscape evokes

[21] In Paraty, many management decisions are centralized by the government. Araujo (2014) advocates that to have local representatives in decisions regarding fisheries management, one needs to invest in local emporwerment and leadership bulding.

(Abraham et al. 2010). The concern with pollution at the river mouth, for example, is rooted in its ecological function as fish nursery, but there is also a sense of cultural attachment to the site which resonates with sacred natural sites (Posey 1999).

In terms of policy-relevance, Table 1 is by no means an exhaustive list, but it provides some of the main elements of the local conservation concept, which can potentially help in understanding the local motivations for conservation and in partnership-building with community members. These elements, organised in a list of themes, can be used as a tool by researchers and managers to develop conservation projects as part of a biocultural conservation approach (Gavin et al. 2015). Such an approach would give priority to fostering knowledge transmission, social cohesion, and leadership—some of the ideas revealed here for Caiçara conservation.

5.5. Conclusion

The government criteria to define protected areas in Paraty were similar to those other protected areas, where conservation plans had little or no involvement of the local people[22]. In recent years, some local participation is emerging; for example, Caiçara from Trindade, a community close to the Reserve, were involved in the revision of the management plan of a protected area (Bockstael et al. 2016)[23]. There is, however, still much to do. Encouraging mutual learning and knowledge-sharing among stakeholders is a way to improve participation, and communities need opportunities to learn about Western conservation (Bockstael et al. 2016).

[22] See Castro (2017) for power inequalities among stakeholders of protected areas that overlap Caiçara territories.
[23] For more examples of opportunities for Caiçara participation in management and conservation see Prado (2013) and Araujo (2014).

Similarly, managers, researchers and policy makers should acknowledge the existence of a unique Caiçara understanding of conservation as a first and necessary step to mutual learning leading to co-production of knowledge.

The Caiçara showed interest to partake in projects they believed would benefit people-nature relationships: training local people (especially youth) as environmental guides, teaching the value of places in the landscape to children and youth in local schools, and increasing awareness of local biocultural diversity. Community initiatives in creative art and artistic processes can help communicate about land and water management, encourage knowledge transmission, and bridge knowledge systems (Zurba and Berkes 2014). Thus, a potential space for knowledge co-production may be within the women's embroidery group. These biocultural approaches could underpin a broader approach to conservation, taking into account local knowledge, cultural beliefs, and people-nature interactions. By starting locally, not only are the chances of participation increased, but the approach will be more just by involving those who have been living in this landscape for generations.

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Preface to Chapter 6: Discussion and Conclusions

This concluding chapter presents an integrated discussion of findings of the previous chapters, including an elaboration of the major theoretical and practical contributions of the thesis. It provides guidelines, in the form of a table, for potential opportunities and spaces for Caiçara participation and use of Caiçara knowledge in the context of formal management of the Juatinga Ecological Reserve.

Chapter 6: Discussion and Conclusions

6.1. Introduction

The Juatinga Ecological Reserve, enacted in 1992, aimed to protect nature and promote Caiçara culture. As of 2000 with the SNUC[24] law, the Reserve has been undergoing recategorization into a new protected area status that may allow for sustainable use of resources. Over the last 19 years, recategorization has fostered heated debate between government, local people, and researchers (Idrobo et al. 2016). On the one hand, local people feel frightened by the potential negative outcomes precipitated by a new, more restricted protected area. On the other hand, this recategorization could be the opportunity to achieve a devolution of power to local people (Cavalieri 2003). The government's proposal for a new arrangement of protected areas in the Reserve—state park in 83% and sustainable development reserve in 17% of the landscape—will leave approximately 1,500 people, the majority being Caiçara, restricted to use resources within less than one-fifth of the original area of the Reserve. A large portion of their customary territory, including trails to access communities and other important places, will have use restriction (See chapter 1).

In contrast to the Indigenous groups and Quilombolas, a group of people of African descendant, who hold rights to their lands under the Brazilian Constitution (Brasil 1988), the Caiçara do not hold legal rights to their territories although considered traditional people (Brasil 2007, 2016). According to Adams (2000, 2002), the scholarly debates in favor of resource-dependent communities in protected areas strongly influenced the formation of a Caiçara identity as a traditional people to help justify their permanence in protected areas. While the Juatinga

[24] SNUC stands for *Sistema Nacional de Unidades de Conservação da Natureza*.

Ecological Reserve has, to some extent, helped constrain impacts from land grabbers and tourism developments in Caiçara territory, it has also triggered physical and psychological tensions among the Caiçara people by effectively banning some of their cultural and subsistence practices (Adams 2002).

A sustainable area, such as Sustainable Development and Extractive Reserves, could in turn, promote a more just and effective involvement of traditional people in decisions of their interest[25]. There are concerns about real participation levels in such protected areas (Lopes et al. 2011). But other categories of protected areas, more restrictive to resources use, may show even lower levels of local participation in management (Bockstael et al. 2016). Furthermore, a positivist approach taken by some stakeholders (e.g. government and protected area managers) may hinder peoples' participation in decisions regarding their landscape (Brito 2003; Prado 2013; Araujo 2014). For example, negotiations with pre-determined rules leaves little space for the inclusion of traditional and local peoples' knowledge and may compromise the legitimacy of the process to some of those who are involved (Bockstael et al. 2016).

6.2. Overview of findings

The relationship that Caiçara people in the Reserve have with their land—the Reserve landscape here—is key to this research as the core of elements such as traditional ecological knowledge, cultural practices, local values, worldviews, and social relationships. Not only the presence of people but also their relationship with land has been often overlooked by stakeholders which hold a different relationship with that landscape (e.g. protected area

[25] Sustainable Development and Extractive Reserves have deliberative processes of participation to their structures of management of resources, contrasting to other protected areas in SNUC, which have consultative processes (Brasil 2000).

managers and researchers). In protected areas especially, this may cause people to disconnect from landscapes when their cultural practices are forbidden. The previous chapters show that Caiçara in the Reserve have knowledge of their landscape and that knowledge can be incorporated into the management of the Reserve. Caiçara knowledge is relevant, given that the Caiçara people are the experts of their customary territory.

This knowledge includes choices for and management of specific plant resources across a diversity of forest habitats in the entire landscape as showed in chapter 2. It involves opportunities for knowledge transmission, creativity and innovation in their landscape discussed in chapter 3. It considers that making products builds knowledge on plant resources while promoting people-people, people-forest and people-seascape relationships, as discussed in chapter 4. A Caiçara way of conservation which promotes land stewardship through a set of local values is explored in chapter 5. Various aspects of Caiçara knowledge and stewardship are discussed through the various chapters of this thesis (see more details in Table 1 which links findings to research objectives).

The connection with land provides with a sense of place and builds stewardship values for Caiçara people in the Reserve, which may contribute to conservation and participation in management. In the context of international policies, global policy bodies have been paying attention to the importance of Indigenous and traditional knowledge for conservation, considering local participation and respecting customary cultural practices. The research findings of this thesis are in the path of Aichi Targets 11, 14 and 18 of the Convention on Biological Diversity (CBD 2014) and Deliverables of The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2013).

The Aichi Targets are global guidelines that include conserving important areas of biodiversity and ecosystem services through conservation measures and effective management systems in well-connected systems of protected areas integrated in wider landscapes and seascapes (Target 11), safeguarding and restoring ecosystems that contributes to health, wellbeing and needs of people, including Indigenous peoples (Target 14), and respecting traditional knowledge and practices of Indigenous peoples (Target 18). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), in turn, seeks to create opportunities to bridge knowledge systems among researchers, and local and Indigenous People to contribute to their participation in policy making. In Brazil, there is yet much to achieve these international goals, especially in the context of conservation and sustainable use of plants (Hanazaki et al. 2018). The following sections provide theoretical and practical contributions of this thesis, along with a discussion regarding these global targets and policies, and the literature on landscape ethnoecology, protected areas, and some of the approaches and opportunities for peoples' participation in the management of the Reserve.

Table 1: Major findings and contributions (theoretical and practical) by research objectives.

Research objectives	Major findings	Theoretical contributions	Practical contributions
(1) To investigate Caiçara ethnoecology of the landscape of the Juatinga Ecological Reserve	Caiçara have their own ways of managing materials harvested for basket, canoe, paddle making. Stages of development of forest habitats (e.g. early, second growth, primary forests) may influence intra and interspecific variation. This variation influences people's harvesting preferences and choices in the landscape. The source of the materials needed are widely spread across the Reserve's landscape. Plant distribution across the entire landscape does not guarantee quality and/or morphological traits across the harvested plant species and may not satisfy people's needs.	This thesis adds to the literature of landscape ethnoecology in two ways: 1) It addresses a gap in the literature about how people use resources according variations within a single-species, and of multiple species. This knowledge includes several relational components built from multiple interactions among people, plants and landscape; 2) It shows how landscape ethnoecology may help in protected area planning.	It is important that harvesters and makers of the three cultural products have access to the Reserve landscape in its entirety to access resources. Managers and policy makers may use these findings in the ongoing recategorization of the Reserve, and in the future management plans of the recategorized protected areas.
(2) To investigate the social and cultural practices of basket making and related knowledge	Caiçara basket making involves many stages. Caiçara artisans in the Reserve use knowledge of basket making to innovate products to meet contemporary demands.		The endogenous potential of Caiçara artisans for innovation and creativity in making baskets may help meet contemporary demands in the Reserve. A biocultural design approach can help local artisans to improve and add value

	Caiçara artisans enjoy making baskets; the elders especially, are concerned that this knowledge may get eroded. There is space for improving and adding value to local products, especially in that Caiçara artisans have an endogenous potential to create new products, and that a community-based tourism program is being developed in the Reserve.		to their local products. As an example, local stories, poems and beliefs, which are embedded in local culture, can be attached to products as information material, to teach tourists about the Caiçara culture and presence in the Reserve.
(3) To understand canoe making as a process of cultural heritage	Canoes are an appropriate technology for some fishing techniques, contributing to food security. They are not easily replaced by fiberglass or aluminum boats. Canoe making fosters relationships of the Caiçara with the forest and with other community members.		This chapter contributes knowledge to the ongoing process of recognizing Caiçara canoes as cultural heritage. It adds information that dugout canoes are important as material heritage, as well as appropriate technology for some fishing techniques. It adds information that dugout canoes are important as non-material heritage, as canoe making is linked to the Caiçara relationships with the forest and with other community members.
(4) To identify Caiçara understandings and motivations for conservation and stewardship	Caiçara people have their own understandings of conservation based on a holistic view, shaped by natural, cultural, historical and political elements of their landscape. This concept includes the maintenance as well as the evolution of	There is a gap in the literature regarding the Caiçara notion of conservation. This chapter shows that the term conservation is, for Caiçara people in Praia do Sono, different from the Western view of	The chapter generates knowledge that can be used as tool for researchers, NGOs and managers, namely: 1) themes that frame the Caiçara conservation concept; 2) examples of conservation projects that may be

in the Juatinga Ecological Reserve	social, cultural, ecological, and economic aspects and relationships within their territory. Six themes emerge from the findings, namely: culture, traditional and local ecological knowledge, social cohesion, "taking care of the land," people-nature relationship, and aesthetic, spiritual and recreational values. Participants have stewardship traditions for the land, and interest to partake in projects they believe would benefit people-nature relationships. These projects relate to training local people as environmental guides, teaching the value of places in the landscape in local schools, increasing awareness of local biocultural diversity to tourists, and fostering community initiatives.	conservation. Culture, traditional and local ecological knowledge, social cohesion, "taking care of the land," people-nature relationship, and aesthetic, spiritual and recreational values emerge as themes within Caiçara conservation.	applied in the Juatinga Ecological Reserve.

6.3. Major contributions of the thesis

The contributions of the thesis are in both theory and practice (see Table 1), providing knowledge for future steps toward the Reserve's recategorization and the development of a management plan for protected areas in the Reserve, and the management plan of the Cairuçu Environmental Protection Area, a federal protected area which overlaps the Juatinga Ecological Reserve. The Juatinga Ecological Reserve does not yet have a management plan (even 16 years after its enactment), but as it overlaps the Cairuçu Environmental Protection Area, it should comply with the management plan of the latter approved in May 2018 (Brasil 2018).

6.3.1. Theoretical contributions

My research contributes to theory in the field of landscape ethnoecology, showing the importance of Caiçara people securing access to their landscape in its entirety, as such access enables harvesting materials with the appropriate properties needed for cultural products and contributes to the sustainable use of resources. My research also adds theory to the field of traditional and Indigenous knowledge, unpacking components of Caiçara conservation, which includes a series of themes, framed in a Caiçara worldview.

There is a growing body of literature in the field of landscape ethnoecology, and this literature has focused on knowing where plants grow to show how multiple species and habitats are connected. There is a gap in knowledge about how people may select and use different individual forms and variations of the same species within spatial and temporal diversity. In Chapter 2, I show how Caiçara make choices for use of resources for baskets, canoes and paddles. These choices are based on morpho-ecological variations that exist within species, and between different species found in multiple forests distributed in the landscape. These findings

contribute to the understanding that harvesting for resource-dependent people are not limited to small patches but depends on having access to the landscape in its entirety as people meet different needs from different parts of the territory.

I make the argument that landscape ethnoecology may serve as a tool for protected area planning. A protected area where people have access to less than one-fifth of their original landscape does not allow scope for people to search for the resources they need. This illuminates why one needs to think at a "landscape scale" rather than a patch scale, to allow people to carry on their livelihoods and cultural practices. The government's proposal of a fragmented landscape to ensure biodiversity conservation seems to go against the concepts of social-ecological systems in protected areas (Cumming and Allen 2017; Palomo et al. 2018). This is especially challenging when the prospective protected areas are located on the customary territories of local communities. The arrangements of the protected area, as proposed by government, will most likely impact Caiçara harvesting practices going against international policy goals (Aichi Target 14 in this case).

In the case of access to forest resources for baskets, canoes and paddles, I foresee three potential negative outcomes. First, some of the plant species used by the Caiçara are uncommon in the coastal landscape of some communities in the peninsula, and within the "islands" of the proposed Sustainable Development Reserve, where harvesting would most likely be allowed. People would still need to journey through the forested landscape to access these resources, which as part of a State Park[26], would have use restrictions. Second, the constraint to use plants within a limited range would result in resource overuse in allowed harvesting areas, without the

[26] In National, State and Municipal Parks, the use of resources is indirect, allowed only for research and tourism-based activities (SNUC 2000). For more information see Chapter 1, Table 1.

opportunity to switch or rotate harvest areas. Chapter 2 shows that Caiçara rotate areas when harvesting plants for basket making. There is evidence that rotational use contributes to sustainability, as it enables the establishment of organisms and the development of forest structures that are crucial to maintain biodiversity (Lindenmayer and Franklin 2002). There is also evidence in other case studies that pushing people's cultural activities to smaller areas may result in resource overuse. For example, Bosak (2008) described how the closure of a core zone in a protected area customarily used for livestock resulted in overgrazing and reduction of livestock. This mismanagement would go against the Aichi Target 11, which aims for effective conservation and management in integrated landscapes of protected areas. Pacheco et al. (2018) have argued that Brazil is unlikely to meet this target due to most of protected areas being in the Amazon and the poor management of protected areas in the country. Lastly, plant distribution across the entire landscape will not guarantee quality and/or morphological traits across useful plant species. As shown in chapter 2 Caiçara people differentiate between individual plants to select the ones suitable to manufacture a specific cultural product.

Spatial diversity offers resources in multiple ecotopes in a diversity of forest types (primary forests or in secondary forests at different stages of regeneration) which are changing within the Reserve landscape temporally. This temporal diversity adds to the spatial diversity with which people select resources. Barros et al. (2019) emphasizes the spatial heterogeneity of the forest that provides people to diversify resource use for food and medicinal plants (from wetlands and Cerrado areas) and wood resources (from deciduous forests and escarpment areas). However, the landscape provides both spatial and temporal diversity which complement one another. Temporal diversity, as shown by Davidson-Hunt and Berkes (2010) for forest disturbance cycles, adds complexity. As an example, Anishinaabe Peoples' landscapes may be

used for gardening, blueberry harvesting or hunting moose, depending on the succession stage following a fire (Davidson-Hunt and Berkes 2010). There is a large literature documenting the use of different resources at different stages of succession in tropical forest areas of the world (Berkes 2018).

Another topic to mention refers to the relational component of people-plants interactions (Kimmerer 2013). The use of plants by Caiçara harvesters, as presented in Chapter 2, involves a great deal of knowledge that results from multiple types of interaction among people, plants, and landscape over time. These interactions are part of Caiçara identity and are expressed in many ways (e.g. local stories and songs learned and shared, poems, embroidery, individual and social experiences in the forest, social events in the communities). The relationship that Caiçara people have with plants/species shows a component of respect which goes beyond the notion that plants are there just for their use.

In her book, Our Knowledge is not Primitive, Geniusz (2009) discusses how the ethnobotanical knowledge of Anishinaabe Indigenous Peoples, when seen from a colonizer point of view, has been often detrimental to these peoples. The focus on the utilitarian value of these plants often overlooks the meaning of plants and other constitutional dimensions of these plants in people's lives. As for example, many researchers discussed the physical proprieties of plants, forgetting their spiritual importance. In Anishinaabe culture, people have protocols for harvesting plants—offering tobacco, singing songs—depending on the plant species (Geniusz 2009).

Those with a strict positivist worldview may hold an understanding that the focus here is only that Caiçara people should have access to material to craft cultural products, and suggest, if not impose, the use of other plants and species as substitutes to the ones chosen and used by

Caiçara for their practices. This is something that resonates with Western conservation but ignores other approaches such as what is found for Indigenous and traditional peoples elsewhere.

This research illuminates Caiçara notions of conservation, which may differ from Western conservation approaches as shown in chapter 5. The literature shows examples of how different worldviews for conservation may bring conflicts among Caiçara and other stakeholders (Simões 2015; Castro 2017). Western conservation seeks to maintain biodiversity at genetic, species and ecosystem levels, with protected areas as the main tool to maintain this biodiversity (Gaston et al. 2008). Caiçara conservation, on the other hand, is based on a holistic view, shaped by natural, cultural, historical and political elements of landscape. Although there is evidence that Caiçara knowledge can be important for the conservation of the Atlantic Forest (Hanazaki et al. 2000; Hanazaki 2003), a deeper understanding of components of Caiçara conservation was lacking in the literature. Similar to Western conservation, Caiçara people show concern for overexploitation of fish populations (Chapter 5, theme 5.3.3) and the maintenance of habitats for fish species (Chapter 5, theme 5.3.6). Caiçara conservation also values nonmaterial benefits from nature (Chapter 5, theme 5.3.6), which resonates with the ideas proposed by Kareiva and Marvier (2012) and Palomo et al. (2014), for whom protected areas need to incorporate a social-ecological approach and include concepts from ecosystems services that contribute to human wellbeing. These findings address Aichi Target 14, which is about safeguarding and restoring ecosystems that contributes to health, wellbeing and needs of people, including Indigenous peoples.

Although the concepts of protected areas have been evolving in terms of type of management, size, landscape management, use of knowledge, and involvement of local people (Palomo et al. 2014), more effort is needed to include Indigenous and traditional knowledge

systems in management. Caiçara conservation, as shown in this research, includes the understanding that people are part of nature and the territory. Caiçara conservation calls for valuing local culture, including the maintenance and transmission of knowledge among community members (Chapter 5, themes 5.3.1 and 5.3.2). This worldview is shared by many Indigenous and traditional peoples elsewhere in the world (Berkes 2018).

6.3.2. Practical contributions

The management plan is the document that provides guidelines for the use and management of resources, as well as zones with diverse levels of access within a protected area. The most recent regulation published by the Brazilian government for the elaboration of management plans safeguards the rights of traditional people in terms of recognition and respect of their knowledge, acknowledging that traditional territories are spaces for social, cultural, and economic practices of traditional people in sustainable protected areas (Art. 11, Brasil 2017). For Sustainable Development and Extractive Reserves, in particular, this regulation mandates mechanisms to secure the meaningful participation and leadership of traditional and local people in governance.

This thesis provides a practical starting point for managers and researchers to implement conservation programs that could be more relevant to people in the Reserve, incorporating local perspectives and showing the local worldview (see Table 1, Chapter 5). It also illuminates, in chapter 2, the importance of access to the entire Reserve landscape for harvesters and makers of three cultural products: baskets, canoes and paddles. As an example, *Philodendron bipinnatifidum* for basket and *Pausandra morisiana* for paddle making are common within the "islands" of the proposed Sustainable Development Reserve where harvesting would be allowed.

These findings may inform and encourage managers and policy makers to consider the importance of such access to people, in the ongoing recategorization of the Reserve, and in the future management plans of recategorized protected areas. This is especially important in a scenario where the Reserve may give space to a Sustainable Development Reserve.

Canoes are the appropriate technology for some fishing techniques (e.g. mullet fishing), and provide diet diversification and food security. Recommendations to preserve canoes and canoe making are provided: to support activities to restore and paint the existing canoes in order to extend their lifetime (the price of these services may be a discouragement for some of the canoe owners), to encourage educational initiatives with the youth, and to promote meaningful participation of canoe makers in policy decisions regarding the legal use of trees in the Reserve. This last topic should be taken as a two-way approach, where all the involved stakeholders share and build knowledge towards the legal use of trees in the Reserve.

The findings in chapter 3 also show an endogenous potential among Caiçara artisans to develop creative products—baskets—as people are adapting to the contemporary context. A biocultural design approach could help local communities to improve design, add value to their local products and benefit from their biocultural diversity (Davidson-Hunt et al. 2012). Suggestions to create social spaces of opportunities are: (1) to partner up with designers (and other professionals) to collaboratively improve the quality of baskets, and (2) to attach information material to products, to give information that is usually "hidden within the finished baskets." Local stories, time spent to harvest, species used, time spent to make, the making process, are just few examples of what could be used to add value to cultural products, giving potential to increase the income of basket makers. These recommendations can be applied in a recent program of community-based tourism, which is being developed by some community

members, as an alternative to the current tourism model taking place in some communities in the Reserve.

6.4. Caiçara knowledge into the formal management of the Reserve

The chapters of this thesis show that Caiçara have landscape knowledge and a connection with their land, which contributes to local stewardship and form their identity as Caiçara traditional people. How can this knowledge and management practices be considered in the current and future structures of formal management of the Reserve? A good place to start is by acknowledging that stakeholders, including Caiçara, may have a particular worldview of use of resources in their landscape and conservation (as shown in Chapters 5 and 2 respectively). Bockstael et al. (2016) illustrate some of the problems of lack of local participation in the revision of the management plan of the Serra da Bocaina National Park in Paraty. One of the problems reported was the use of a pre-determined set of rules in the process, which left little space for the inclusion of Caiçara knowledge in this regulation (Bockstael et al. 2016). As such, local people should also have opportunities to learn about Western conservation, while researchers and managers about Indigenous and traditional conservation and resources management (Bockstael et al. 2016).

A "…collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-oriented understanding of that problem" (Armitage et al. 2011:996) defines co-production of knowledge. The idea behind this approach is to strengthen the acceptance of Indigenous and traditional knowledge in its integrity, for political, scientific and/or ethical motivations (Ballard et al. 2008, Tengö et al. 2017), rather than simply using it as a source of data to be compared with scientific data, or as an

alternative source of information when scientific data are lacking (Sheil and Lawrence 2004; Gilchrist 2005).

A mechanism for co-production of knowledge suggested is the multiple evidence base approach (MEB) which facilitates "legitimate, transparent, and constructive ways of creating synergies across knowledge systems" (Tengö et al. 2014:1). The multiple evidence base approach considers that Indigenous, local and scientific knowledge generate different types of knowledge, both useful and valid for the sustainable management of ecosystems. It is an approach to help establish a true dialogue among different knowledge holders with different perceptions. The Hin Lad Nai Pollination Dialogue Group emerged as a group discussion to reflect on the key messages of one of the Pollinators, Pollination and Food Production assessment, which was the first pilot for developing mechanisms to include Indigenous peoples in a global environmental assessment (IBPES 2016; Malmer et al. 2019). A series of components was proposed to involve the participants in dialogue: seminar, Free Prior and Informed Consent (FPIC), walking workshop to engage with the landscape with experts, and the use of posters as boundary objects to amplify knowledge systems (Malmer et al. 2019). As explained in Chapter 5, boundary objects have "… their structure is common enough to more than one world to make them recognizable as a means of translation. The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds" (Star and Griesemer 1989: 393). These are tools to better understand the inequalities in power among the different ways of knowing.

In this research, some of the methods resembles the methods used by the Hin Lad Nai Pollination Dialogue Group: Free Prior and Informed Consent; walking in landscape with

Caiçara makers of three important cultural products; and the use of photos for a photovoice exercise. These were taken by Caiçara participants with different backgrounds, and helped participants and researcher engage in dialogue to share perceptions of forested landscape, species, conservation, cultural practices, landscape, and cultural identity. The photos used as boundary objects also helped Caiçara people to share information and different worldviews among themselves. Zurba et al. (2019) argues that boundary objects are a great means to facilitate communication between community members (e.g. of different generations) around different understandings in the communities.

Boundary objects are also great tools for knowledge co-production (Zurba et al. 2019) as they help to look at intangible themes, such as social-ecological systems and human wellbeing (Masterson et al. 2018), local perceptions of environmental changes (Bennet and Dearden 2013) and Indigenous conservation (Bosak 2008; Beh et al. 2013; this thesis). Boundary objects help explore perspectives that would be difficult to explore with other methods, such as semi-structured interviews (Masterson et al. 2018). Other examples of boundary objects that facilitate the dialogue between different groups of people include participatory art (Zurba and Berkes 2014; Rathwell and Armitage 2016; Islam et al. 2017) and participatory mapping (Chambers 2006; Rambaldi et al. 2007).

At the XVI Congress of the International Society of Ethnobiology held in Brazil in August 2018, the Mundukuru Indigenous Peoples presented the results of a participatory mapping exercise. They explained how a hydroelectric dam that would flood 7% of their land could negatively impact their social-ecological system and the cultural practices in their customary territory[27]. They chose participatory mapping as a tool to negotiate with the

[27] More information can be found in: https://br.heartoftheamazon.org/

government that this 7% flooding would significantly compromise the habitats and food chains of aquatic species in the Tapajós River in the Brazilian Amazon. Participatory mapping has been widely applied to deal with conflicts of land use in territories of communities in Brazil[28]. But there is a lack of studies using other methods, such as photovoice and participatory art, to co-produce knowledge that may help to tackle environmental matters and to improve the understanding between communities, researchers and other stakeholders (Tengö et al. 2017).

Canoes and baskets, the main subject of chapters 3 and 4, respectively, can also be considered boundary objects. Some of the methods used here—basket making workshops and experiences in the Reserve landscape with Caiçara experts—helped participants to "translate" the significance these cultural items have for Caiçara people and why they are so interconnected with a Caiçara identity. Canoe and basket making are expressions of people-landscape relationships in multiple dimensions. Something that is often difficult to understand if you are not familiar with that landscape or have a different relationship with that (e.g. as tourists, managers and researchers may see the landscape in a different way).

Boundary objects help translate ideas, but the "full potential and power of the boundary object is lost when it is removed from the context in which it was created, or if all those who created it are not instrumental in expressing what the boundary object is" (Zurba et al. 2019:14). Caiçara canoes are in the process of becoming intangible and tangible cultural heritage in Brazil but even with this notable recognition, the findings of chapter 4 show elements that are probably invisible to outsiders or those who are unfamiliar with that landscape, and all it encompasses.

[28] One of the most expressive projects involving participatory mapping in Brazil is being developed by the New Social Cartography of the Amazon Project. More information can be found in the link: http://novacartografiasocial.com.br/fasciculos/povos-e-comunidades-tradicionais-do-brasil/?cp_povos-e-comunidades-tradicionais-do-brasil=1

Baskets, on the other hand, are further away from receiving this attention, but as shown in chapter 3, there are many aspects of significance in basket making that are usually hidden behind the product when the product gets to the buyers' hands.

The left and middle columns of Table 2 lists the guidelines (translated from the Portuguese) for conservation actions for plant resources from the management plan of the Cairuçu Environmental Protection Area (Brasil 2018). This plan was adapted from an international source with guidelines based on (but not limited to) current conditions, trends, and data needed to identify key issues, with a priority listing (high, medium, low) assigned to each key issue. Although the management plan has been approved and published, with the participation of different actors, there are yet opportunities for local participation as the plan gives directions to implement actions to address each of the key issues (see middle column, "data needed"). The right column shows suggestions for creating opportunities for co-production of knowledge among stakeholders in the Reserve. These opportunities were based on findings from this thesis, respecting the local worldview, and are particularly related to resources for basket, canoe and paddle making.

Table 2: Guidelines for conservation actions for plant resources approved by the management plan, and opportunities for co-production of knowledge, if local and traditional Caiçara knowledge are used.

Guidelines from the Management Plan of the Cairuçu Environmental Protection Area		**Opportunities to foster knowledge co-production (from this thesis)**
Managed resources	**Data needed**	
Current conditions: Appropriate plant material is scarce and people must search ever farther to find it. Trends: Tendency of local depletion for some species used as raw material if the present form of use is maintained.	To perform population surveys of the species most used as raw material, their use history and distributions.	Consider that environments affect morpho-ecological relations of single-species. Thus, resources for basket, canoe and paddle making may be suitable when found in one environment but not necessarily in another. Consider that resources are found within multiple environments within the Reserve. Thus, some species are found in primary forests. These include some species of lianas, suitable for cultural practices, have longer roots in primary forests. Consider that Caiçara communities do not have all the species suitable for use in the community patch.
Current conditions: Limitation in the use and access to resources for raw material in the customary territory. Trends: Further reduction of available areas.	To organize and make available information on resource management legislation, the new zoning of the Cairuçu Environmental Protection Area (APA), limits and areas for shifting cultivation, genetic heritage resources and traditional knowledge.	Develop appropriate material to communicate information with local people. Make available information regarding the local use, knowledge and management of resources across the customary landscape. Use participatory methods to collect data on landscape, participatory mapping as an example.

Current conditions: Loss of traditional knowledge on medicinal and cultural plants. Trends: Decreasing use of medicinal and cultural plants by traditional communities.	Use findings from research on medicinal plants from the Federal University of Rio de Janeiro (UFRJ).	Involve Caiçara elders in activities in local schools to pass on traditional knowledge. Use other sources of information regarding knowledge on plants.
Threats: Poor management of plant materials by traditional communities. Illegal and irregular exploitation of resources.	Participatory monitoring programs for the main resources.	Start from scratch to formulate an agreement on monitoring goals. Use diverse knowledge systems (traditional, local knowledge, scientific) to develop protocols for harvesting species for basket, canoe and paddle making.
Threats: Reduced transmission of traditional practices between generations, such as shifting cultivation and use of medicinal and cultural plants. Religious conversion (medicinal and cultural plants).	An environmental education plan for conservation as a continuous action, including cultural restoration as part of a biocultural approach.	Engage local elders to pass on this knowledge to children/youth in schools. Acknowledge that Caiçara have their own notions of conservation. Promote activities, such as photovoice and participatory art and local contests, to capture the attention of children and youth.

The SNUC law requires protected areas to have zones, which specify the use, management and rules of each area, and maps indicating the zones. Kinouchi (2014) explained that for sustainable protected areas, both the social perception of the territory and the areas used by communities for sustainable use of resources should be identified, following the social organization of these communities. Zones need to be agreed on, with attention to names, values, social identity and the forms of recognition of communities to the space (Kinouchi 2014).

The zoning plan of the Cairuçu Environmental Protection Area has established four zones in the Juatinga Ecological Reserve, namely: 1) Restoration and 2) Conservation, where use of resources such as that for canoes, paddles and baskets are not allowed; 3) Restricted use; and 4) Community use, where use of resources for canoes, paddles and baskets are allowed[29]. As compared to the 2013 proposal of the government for recategorization, these Restricted use and Community use zones allow a larger area for use of resources by Caiçara communities in the Reserve. However, some resources may still not be accessible. As discussed in Chapter 2, a variation of individual plants requires access to a diversity of forest types within the Reserve landscape.

The source of the materials needed for these cultural practices are widely spread across the Reserve's landscape. Based on the findings of this thesis, it would be prudent to include as wide a range of harvesters possible in participatory mapping, in order to have meaningful participation of harvesters in the planning processes related to recategorization and future management plans of the Reserve. This is important because Brazil is a signatory to the Convention for the Safeguarding of Intangible Cultural Heritage (UNESCO 2003), and making

[29] For more information on this zoning system, see page 73 of the Plan. http://www.icmbio.gov.br/cairucu/images/stories/downloads/PM_APA_CAIRUCU_8-2018.pdf. Accessed on September 25, 2018.

of crafts does fit in this convention. Thus, Brazil has a commitment to consider the cultural practices of traditional communities, and access to resources needed by the harvesters of resources for all types of cultural practices.

Mechanisms to include Indigenous and traditional knowledge are needed at all levels of protected area planning, and the development of management plans for resources in protected areas (from the start of planning to the approval of management plans). The inclusion of traditional and local knowledge (as well as local people's participation) in formal management of resources is widely practiced in many international cases (Berkes 2018), including cases where the inclusion was found to be problematic due to methods used (Padilla and Kofinas 2014). In Brazil, there is as yet very little provision for traditional and local knowledge in formal management (Seixas 2006; Castello et al. 2009). Bockstael et al. (2016) found little evidence of opportunity for the participation of Caiçara people in the revision of the management plan of the Serra da Bocaina National Park, in what was a consultative, rather than deliberative, process. As a result, this revision was not seen as legitimate by some of the local people involved. Appendix 3 draws on findings of this research to opportunities for projects involving multi-actors in co-producing knowledge.

Several factors contribute to leaving local people out of such decisions. One of them is that government managers often do not know how to foster participation, and how to include traditional and local knowledge in formal management, even though many participatory techniques do exist (Johnson et al. 2016). Including local people merely as surveyors, with monitoring protocols based solely on scientific knowledge, does not represent knowledge co-production (Armitage et al. 2011) and resembles some ineffective projects of community-based conservation which disregarded the local interests of people. Different kinds of knowledge can

be bridged by dialogue (Tengö et al. 2014; Tengö et al. 2017), and such co-production of knowledge is a pathway to further communication, collaboration and trust-building. This two-way feedback process involves learning together, learning to adapt to changes, and improving decision-making.

However, there is no sense in working on co-production of knowledge with multiple meetings over many years, building agreements and overcoming challenges to define a plan to manage resources that resonates with all stakeholders, only to end up with government disapproval. Such a disapproval that may be caused by disbelief or skepticism of Indigenous and traditional knowledge, and/or a worldview based solely on Western science on the part of members of the government agencies. The issue of power, understood here as the ability to negotiate during the process of knowledge co-production, is one of the challenges of this process, and may prove a stumbling block if researchers and government agencies impose their perspectives as the only valid viewpoints (Pohl et al. 2010).

A change in mindset is needed to have success in co-production of knowledge in protected areas that are located on customary lands of people. In science-related fields, for instance, this could begin with the inclusion of subjects in the curricula of undergraduate and graduate courses. The article, "100 Articles Every Ecologist Should Read," from Courchamp and Bradshaw (2017) illustrates how the dimensions of humans-in-nature may be overlooked, as their list did not include a single research study with social-ecological systems. McPhearson et al. (2018) responded to the authors with a critique, stating that their article should introduce research with social-ecological systems to new students, simply because humans are components of ecosystems. In a world that has reached more than seven billion inhabitants, with human influences on every ecosystem (McPhearson et al. 2018), this is something that should not be

overlooked in academia. Such neglect may also contribute to narrow the worldview of future managers and policy makers.

6.5. Limitations of the thesis

Although an attempt was made to reach all basket, canoe and paddle makers, it was not possible to access all the communities and small settlements within the Reserve. Some of these communities are very isolated, thus difficult to reach, and accessing them depends on numerous factors such as the weather, availability of boatmen, time and financial resources. Communication through telephone and email was not always reliable, as the Reserve coverage for cell phones was inconsistent at the time of this research; some communities did not have any coverage at all.

The photovoice exercise was initially planned to involve other communities in the Reserve in addition to Praia do Sono. But after living for some time in the community, and talking to some community members, it was found that it would be difficult to conduct the exercise in additional communities within the time frame of the PhD fieldwork. This limitation was due to the lack of material and personal resources (as more cameras would be necessary, and at least one field assistant to help with the data collection), and the nature of the method, which as previously discussed demands a lot of time. Therefore, it was decided to focus on one community in order to gain in-depth understanding on Caiçara conservation (Chapter 5). This in-depth understanding was obtained through the many steps of data collection. Praia do Sono was chosen for two reasons: the community has the easiest access to downtown Paraty, which facilitated photo printing; and it is probably the most impacted community by tourism expansion in the Reserve.

6.6. Future research

Several gaps in current knowledge regarding aspects of the use of resources for cultural products such as baskets, canoes and paddles; and protected area planning were identified through the diverse stages of the PhD process. Below are some suggested topics for future research:

- Development of studies with participatory mapping as a way to build local capacity to produce knowledge on important areas of use and on territory boundaries within the Reserve
- Development of protocols for monitoring forest resources (and other resources) using knowledge co-production
- Investigations on the multiple dimensions of knowledge co-production (e.g. looking at how researchers, managers, and Caiçara understand the same events) (Armitage et al. 2011)
- Studies on population and distribution of the forest resources used for Caiçara cultural products (see Chapter 2, Table 2)
- Studies on the use of *Vanilla* spp., to understand if multiple species of this genus are used for basket making. If indeed more than a single species is harvested, to investigate harvesting levels for each species, as well as if individual basket makers have preferences (and harvest) one or multiple species of *Vanilla*.

6.7. Final thoughts

Cultural practices contribute to the identity of Caiçara people and to establish a connection to their customary territory. To safeguard this identity and to highlight the Caiçara

role in a landscape, we need to give back their history of use and management of resources, as emphasized by Adams (2002). If this is done well, it may help to provide devolution of power to local people. There is much space in the aforementioned international guidelines and Brazil's laws to assure the participation of people in the planning processes for protected areas, if these areas fall under sustainable areas of SNUC. The Reserve categorization is an opportunity to do just that.

The challenges to include traditional knowledge and to foster participation are real, but there are examples elsewhere to show that, with effort, persistence and patience from all stakeholders, it can be done with positive results for biodiversity and for people (Castello et al. 2009). Theory and case studies in fields like landscape ethnoecology, biocultural conservation, biocultural design and co-production of knowledge may give support to develop positive experiences in interdisciplinary projects to improve the efficiency of protected areas in terms of their ecological, political, economic and social aspects, in Brazil and elsewhere.

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APPENDICES

Appendix 1

Table 1: Profile of the research participants with information about the interview themes and dates of interviews, field trips, and workshops. Note that conversational interactions about plants for the three cultural products happened in other opportunities during fieldwork. The dates on the table show dates of semi-structured interviews.

Participant	Community	Age	Resource - Plants for making...			Currently active?	Has lived elsewhere?	Dates involved in the project
			Baskets	Canoes	Paddles			Interviews, Field trip and Workshop
#1 (Male)	Sono	39	**X**			Yes	No	Aug/Dec 2016
#2 (Female)	Ponta Negra	63	**X**			Yes	Yes	May/Aug 2016
#3 (Female)	Ponta Negra	37	**X**			Yes	Yes	Aug 2016
#4 (Male)	Baixio	51	**X**			No	No	Feb 2016
#5 (Male)	Cairuçu das Pedras	67	**X**			No	Yes	Dec 2016
#6 (Male)	Sono	56	**X**			Yes	Yes	May 2016
#7(Male)	Sono	33	**X**			Yes	Yes	July/Oct 2015; Feb 2016
#8 (Male)	Sono	66	**X**			Yes	No	July/Oct 2015; Dec 2015
#9 (Male)	Sono	77	**X**			No	No	Aug 2016
#10 (Female)	Praia Grande da Cajaíba	67	**X**			Yes		Sept 2015; Feb 2017
#11 (Male)	Praia Grande da Cajaíba	32	**X**			Yes	Yes	Sept 2015; Feb 2017
#12 (Male)	Ponta Negra	78	**X**	**X**		No	Yes	May/Aug 2016; Sept 2016
#13 (Male)	Sono	41		**X**		Yes	No	May 2016

#14 (Male)	Sono	43		**X**		No	No	May 2016
#15 (Male)	Ponta Negra	53		**X**		Yes	No	Aug/Dec 2016
#16 (Male)	Ponta Negra	42		**X**		No	Yes	Aug/Sept 2016
#17 (Male)	Cairuçu das Pedras	70		**X**		Yes	Yes	Dec 2016
#18 (Male)	Cruzeiro	75		**X**		No	Yes	Sept 2016
#19 (Male)	Baixio	53		**X**		No	Yes	Feb/Sept 2016
#20 (Male)	Baixio	59		**X**	**X**	Yes	No	Feb 2016
#21 (Male)	Baixio	52		**X**	**X**	Yes	Yes	Feb 2016; March 2017
#22 (Male)	Baixio	45			**X**	Yes		Feb 2016; March 2017
#23 (Male)	Cruzeiro	72			**X**	Yes		Feb 2017
#24 (Male)	Baixio	59	**X**	**X**	**X**	Yes	No	Feb/Sept 2016
#25 (Male)	Baixio	75	**X**	**X**	**X**	Yes	No	Feb/Sept 2016; Dec 2017

Appendix 2

Follow-up questions from the focus group meeting, one of the steps of photovoice process (translated from the Portuguese by DP):

a. What does conservation mean to you?
b. Is it possible to implement these projects in the community? How? [Projects mentioned by participants in prior interviews were: training tour guides, teaching local knowledge and values in school, facilitating projects initiated by the community, raising awareness of community issues such as community-based tourism]
c. What type of project (or other initiatives) would you like to be involved in the community?
d. What is the connection between culture and conservation for you?
e. How do the Caiçara way of life, culture, and traditions (may or may not) influence nature conservation?
f. What does the term territory mean to you?
g. What is the relationship between conservation and traditional territories?
h. How do the Caiçara learn conservation from past experiences (successes and/or failures)?
i. Do you think Caiçara knowledge can be incorporated into the Reserve rules and management? If so, do you think the Caiçara would follow them?
j. How can the community itself work to strengthen these rules?

Appendix 3

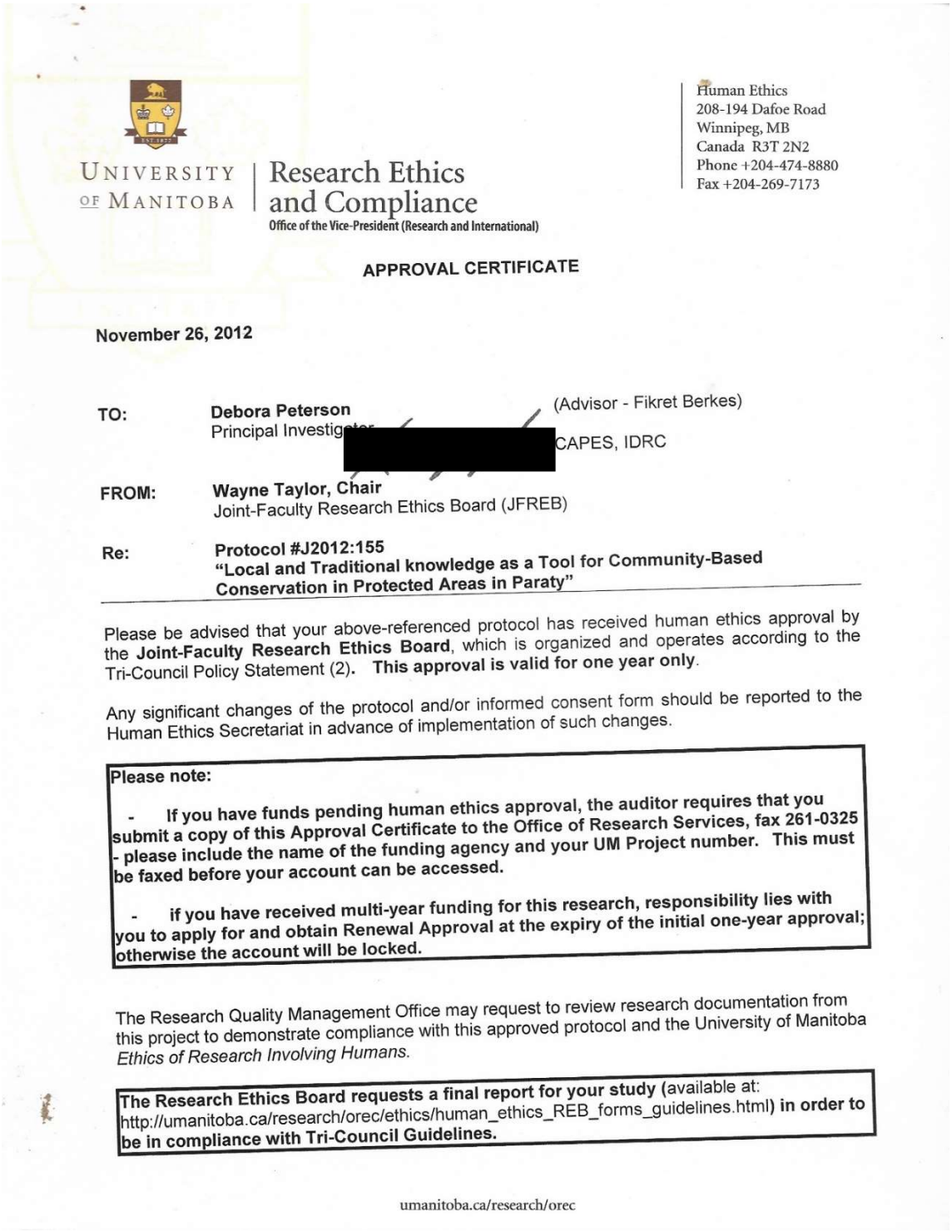
Table 1: Opportunities for multi-actors (managers, scientists, local people) for co-production of knowledge in projects in the Reserve.

KEY MESSAGES FOR MULTI-ACTORS TO PROMOTE CO-PRODUCTION OF KNOWLEDGE IN THE JUATINGA ECOLOGICAL RESERVE
• The Reserve landscape may be seen in different ways by different people with different objectives and agendas for that landscape • Caiçara makers of baskets, canoes and paddles choose the most suitable plants for their use • There is a set of plant characteristics that drive people for harvesting one or another individual plant (or parts of a plant in the case of baskets). These characteristics are related to the morpho-ecology of the plant, Caiçara culture and values and Caiçara knowledge of landscape • Not all places in forest types (primary and secondary forests in different stages of regeneration) in the Reserve provide the suitable resources for people. The access to the entire landscape is important for Caiçara harvesters and makers • The process of making products is for traditional people as important as the product itself • Taking part of the different stages of making Caiçara products enables a better understanding of the way people use and shape landscape • It is important to acknowledge that a finished product is itself only one component of a network of knowledge, social relationships and social rules built over long term in a landscape • There is potential to achieve better incomes from basket making in the Reserve. A team of multi-actors (local experts, leaders, designers, scientists, managers) can support basket makers (and those interested in learning) to improve and add value to baskets made of important species: *Thoracocarpus bissectus*, *Vanilla* sp., and *Philodendron bipinnatifidum*

- There is a group of key players working to incorporate components of culture and local knowledge to adapt the schooling system to the local reality of Caiçara. There are many opportunities to co-produce knowledge with children and teachers in this project
- There has been in the Reserve, walking-and-making workshops with basket makers and children (and other people interested). Managers should take part of these workshops. Walking workshops for understanding the qualities of a tree suitable for canoe making are other opportunities for co-producing knowledge.
- Managers taking part of initiatives like the above can build a notion of the landscape as understood by harvesters and canoe makers
- Canoes are a strong symbol of a Caiçara identity. Multi-actors can work together in a campaign to restore and maintain existing canoes (e.g. painting, fixing)
- Caiçara in the Reserve have conservation attitudes that resemble western conservation concepts, but this is only one component of Caiçara conservation
- Participatory, innovative methods (like the use of boundary objects—photos, maps, art for example) are usually better welcomed as they better fit to translate Indigenous and traditional knowledge
- As much as scholars and managers are interested in other knowledge systems (such as traditional ecological knowledge) traditional people also have interests in learning about western concepts and worldviews of conservation, culture, protected areas
- Caiçara in the Reserve have a sense of environmental stewardship for the Reserve's landscape, this is among other components a result of people-landscape relationship of generations
- There are locally-based initiatives in the Reserve, a community-based tourism project is being developed by the initiative of local key actors. Conservation actions should be aligned with local people interests and initiatives
- Training courses and certifying environmental local guides are opportunities for local income in communities involved in tourism (e.g. Praia do Sono, Ponta Negra)

Appendix 4a

Ethics Approval, Research Ethics Board of the University of Manitoba (JFREB J2012:155)



UNIVERSITY OF MANITOBA | Research Ethics and Compliance
Office of the Vice-President (Research and International)

Human Ethics
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Winnipeg, MB
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Fax +204-269-7173

APPROVAL CERTIFICATE

November 26, 2012

TO: **Debora Peterson** (Advisor - Fikret Berkes)
Principal Investigator [redacted] CAPES, IDRC

FROM: **Wayne Taylor, Chair**
Joint-Faculty Research Ethics Board (JFREB)

Re: **Protocol #J2012:155**
"Local and Traditional knowledge as a Tool for Community-Based Conservation in Protected Areas in Paraty"

Please be advised that your above-referenced protocol has received human ethics approval by the **Joint-Faculty Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement (2). **This approval is valid for one year only**.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Please note:

- **If you have funds pending human ethics approval, the auditor requires that you submit a copy of this Approval Certificate to the Office of Research Services, fax 261-0325 - please include the name of the funding agency and your UM Project number. This must be faxed before your account can be accessed.**

- **if you have received multi-year funding for this research, responsibility lies with you to apply for and obtain Renewal Approval at the expiry of the initial one-year approval; otherwise the account will be locked.**

The Research Quality Management Office may request to review research documentation from this project to demonstrate compliance with this approved protocol and the University of Manitoba *Ethics of Research Involving Humans*.

The Research Ethics Board requests a final report for your study (available at: http://umanitoba.ca/research/orec/ethics/human_ethics_REB_forms_guidelines.html) **in order to be in compliance with Tri-Council Guidelines.**

umanitoba.ca/research/orec

Appendix 4b Consent Form (Portuguese) - Basket, canoe and paddle makers

Termo de Consentimento Livre Esclarecido (TCLE)

Eu, Débora Peterson, sou estudante da Universidade de Manitoba, no Canadá. Estou desenvolvendo um trabalho para compreender quais são as plantas que vocês usam para a confecção de artesanato como cestarias, e construção de canoas. O título desse trabalho é: "o conhecimento local dos Caiçaras como uma ferramenta para a gestão colaborativa e a conservação da biodiversidade em unidades de conservação de Paraty, Rio de Janeiro". Estão envolvidos neste projeto os professores Dr. Fikret Berkes e Dra. Natalia Hanazaki, meu orientador e co-orientadora respectivamente, entre outros pesquisadores, que eventualmente possam estar presentes na entrevista.

Com este trabalho quero aprender com vocês sobre plantas usadas para o artesanato e o feitio de canoas no passado e atualmente. Além disto, quero entender características importantes destas plantas, como por exemplo o local onde são encontradas na floresta. Estas informações serão úteis para entender os conhecimentos tradicionais dos caiçaras sobre o uso de plantas na Reserva Ecológica da Juatinga, identificar as espécies utilizadas e saber sobre as transformações que ocorreram ao longo do tempo relacionadas a este assunto. Esperamos com estas informações poder contribuir com o resgate e a valorização do conhecimento associado à confecção de artesanto e canoas, que é algo que está se perdendo ao longo das gerações. Para que este trabalho possa ser realizado, gostaríamos de pedir autorização para entrevistá-lo(a) e, se necessário, tirar algumas fotos e coletar pequenas amostras da madeira usada na construção da sua canoa. Pretendemos também, coletar algumas amostras de plantas (folhas e frutos) que serão levadas para o laboratório, apenas para serem identificadas. Caso sinta-se desconfortável em participar da pesquisa, ou por qualquer outro motivo, o (a) senhor(a) pode parar nossa conversa ou desistir de participar do trabalho a qualquer hora, sem nenhum prejuízo pessoal. As entrevistas serão gravadas e registradas de forma escrita. Para sua segurança será mantido seu anonimato. Não há qualquer risco ou despesa para participação na entrevista. É importante destacar que não temos nenhum objetivo financeiro e que os resultados da pesquisa serão passados a vocês e só serão usados para comunicar outros pesquisadores e revistas relacionadas à universidade.

Caso tenha alguma dúvida basta perguntar, ou entrar em contato. Caso tenha interesse em saber dos resultados dessa pesquisa, ficaremos muito felizes em compartilhá-los. Você pode entrar em contato através do email: deborapeterson@yahoo.com.br ou, através de um dos endereços abaixo:

*Natural Resources Institute, 303-70 Dysart Road, University of Manitoba, Winnipeg, MB, Canada R3T 2M6, Telefone: +01 (204) 474-9050.

*Laboratório de Ecologia Humana e Etnobotânica, CCB/ECZ, Universidade Federal de Santa Catarina, Florianópolis/SC, CEP88010-970. Telefone: (48) 3721-9460.

Entrevistado: Depois de saber sobre a pesquisa, de como ela será feita e como os resultados serão usados, do direito que tenho de não participar ou desistir dela sem me causar prejuízo, eu concordo em participar.

_____

Entrevistado

_____ _____

Entrevistador Local e data

Appendix 4c Consent Form (Portuguese) – Photovoice participants

Termo de Consentimento Livre Esclarecido (TCLE)

Eu, Débora Peterson, sou estudante da Universidade de Manitoba, no Canadá. Estou desenvolvendo um trabalho para compreender qual é o entendimento que os Caiçaras detêm sobre conservação e quais são as suas motivações para conservação. O título desse trabalho é: "o conhecimento local dos Caiçaras como uma ferramenta para a gestão colaborativa e a conservação da biodiversidade em unidades de conservação de Paraty, Rio de Janeiro". Estão envolvidos neste projeto os professores Dr. Fikret Berkes e Dra. Natalia Hanazaki, meu orientador e co-orientadora respectivamente, entre outros pesquisadores, que eventualmente possam estar presentes na entrevista.

Com este trabalho quero aprender com vocês os seus entendimentos sobre o termo e as práticas caiçaras de conservação. Estas informações serão úteis para entender aspectos da visão de mundo, perspectivas e os conhecimentos tradicionais dos caiçaras na Reserva Ecológica da Juatinga. Esperamos com estas informações poder contribuir com o resgate e a valorização do conhecimento associado à este tema nesta região. A investigação do entendimento caiçara sobre conservação pode auxiliar nos diálogos entre diversos setores (pesquisadores, órgãos governamentais etc.) para políticas públicas na Reserva. Para que este trabalho possa ser realizado, gostaríamos de pedir autorização para entrevistá-lo(a) e, se necessário, tirar algumas fotos. Também pedimos autorização para usar as fotos que vocês produzirem durante esta pesquisa para a tese, conferências, e divulgação do trabalho (em forma de exposição ou livro). Caso sinta-se desconfortável em participar da pesquisa, ou por qualquer outro motivo, o (a) senhor(a) pode parar nossa conversa ou desistir de participar do trabalho a qualquer hora, sem nenhum prejuízo pessoal. Se o (a) senhor (a) permitir, as entrevistas serão gravadas e registradas de forma escrita. Para sua segurança será mantido seu anonimato. Não há qualquer risco ou despesa para participação na entrevista. É importante destacar que não temos nenhum objetivo financeiro e que os resultados da pesquisa serão passados a vocês e só serão usados para comunicar outros pesquisadores e revistas relacionadas à universidade.

Caso tenha alguma dúvida basta perguntar, ou entrar em contato. Caso tenha interesse em saber dos resultados dessa pesquisa, ficaremos muito felizes em compartilhá-los. Você pode entrar em contato através do email: deborapeterson@yahoo.com.br ou, através de um dos endereços abaixo:

*Natural Resources Institute, 303-70 Dysart Road, University of Manitoba, Winnipeg, MB, Canada R3T 2M6, Telefone: +01 (204) 474-9050.

*Laboratório de Ecologia Humana e Etnobotânica, CCB/ECZ, Universidade Federal de Santa Catarina, Florianópolis/SC, CEP88010-970. Telefone: (48) 3721-9460.

Entrevistado: Depois de saber sobre a pesquisa, de como ela será feita e como os resultados serão usados, do direito que tenho de não participar ou desistir dela sem me causar prejuízo, eu concordo em participar.

_____

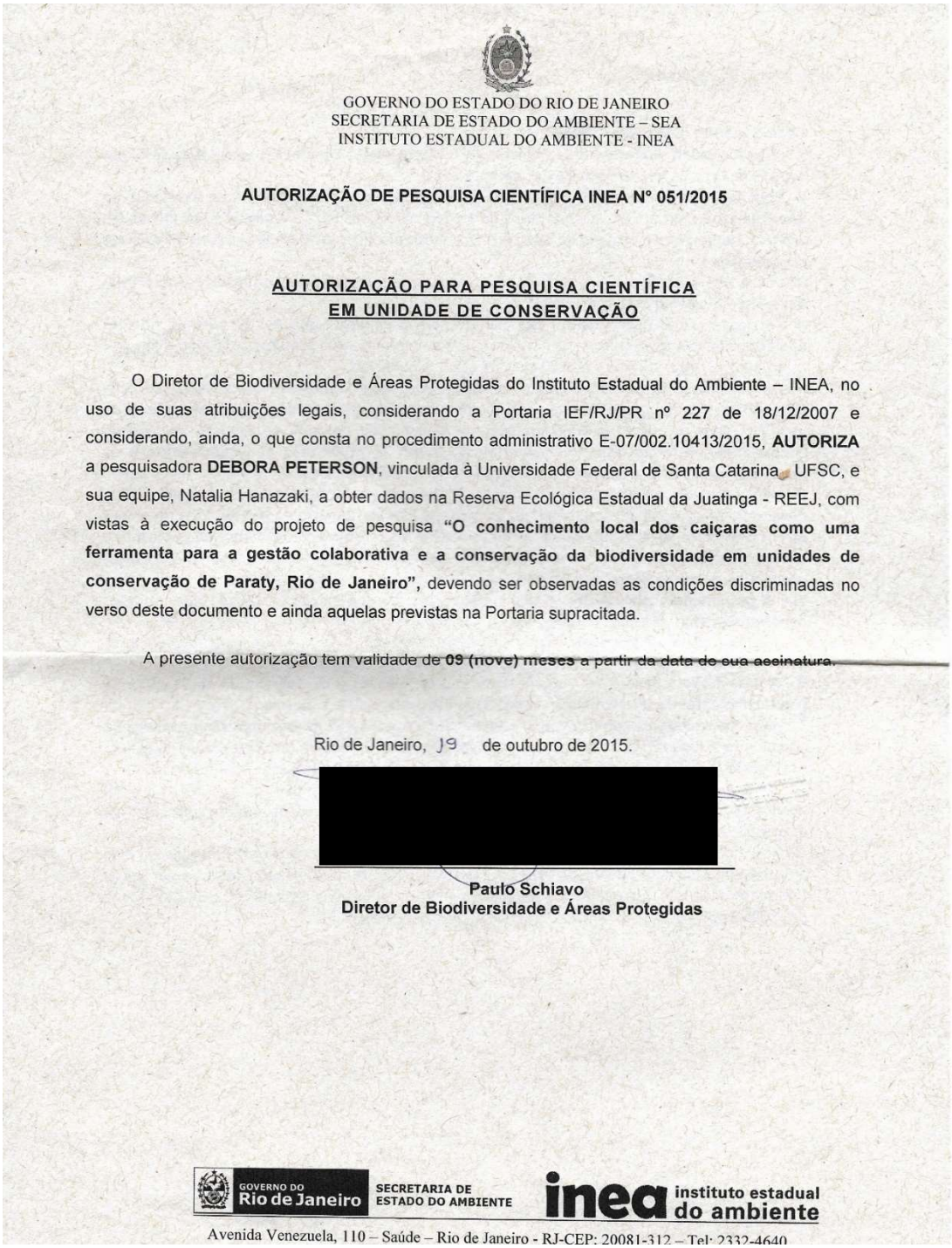
Entrevistado (nome e assinatura)

_____

Entrevistador (nome e assinatura) Local e data

Appendix 5a

Project approval by INEA, the state governmental agency that regulates the Juatinga Ecological Reserve (Research Permit INEA 051/2015).



GOVERNO DO ESTADO DO RIO DE JANEIRO
SECRETARIA DE ESTADO DO AMBIENTE – SEA
INSTITUTO ESTADUAL DO AMBIENTE - INEA

AUTORIZAÇÃO DE PESQUISA CIENTÍFICA INEA Nº 051/2015

AUTORIZAÇÃO PARA PESQUISA CIENTÍFICA EM UNIDADE DE CONSERVAÇÃO

O Diretor de Biodiversidade e Áreas Protegidas do Instituto Estadual do Ambiente – INEA, no uso de suas atribuições legais, considerando a Portaria IEF/RJ/PR nº 227 de 18/12/2007 e considerando, ainda, o que consta no procedimento administrativo E-07/002.10413/2015, **AUTORIZA** a pesquisadora **DEBORA PETERSON**, vinculada à Universidade Federal de Santa Catarina - UFSC, e sua equipe, Natalia Hanazaki, a obter dados na Reserva Ecológica Estadual da Juatinga - REEJ, com vistas à execução do projeto de pesquisa **"O conhecimento local dos caiçaras como uma ferramenta para a gestão colaborativa e a conservação da biodiversidade em unidades de conservação de Paraty, Rio de Janeiro"**, devendo ser observadas as condições discriminadas no verso deste documento e ainda aquelas previstas na Portaria supracitada.

A presente autorização tem validade de **09 (nove) meses** a partir da data de sua assinatura.

Rio de Janeiro, 19 de outubro de 2015.

[redacted]

Paulo Schiavo
Diretor de Biodiversidade e Áreas Protegidas

GOVERNO DO Rio de Janeiro SECRETARIA DE ESTADO DO AMBIENTE inea instituto estadual do ambiente

Avenida Venezuela, 110 – Saúde – Rio de Janeiro - RJ-CEP: 20081-312 – Tel: 2332-4640

Appendix 5b

Approval extension by INEA, the state governmental agency that regulates the Juatinga Ecological Reserve (Research Permit INEA 051/2015).

GOVERNO DO ESTADO DO RIO DE JANEIRO
SECRETARIA DE ESTADO DO AMBIENTE – SEA
INSTITUTO ESTADUAL DO AMBIENTE - INEA

ADITIVO À AUTORIZAÇÃO
DE PESQUISA CIENTÍFICA INEA Nº 051/2015

O Diretor de Biodiversidade e Áreas Protegidas do Instituto Estadual do Ambiente – INEA, no uso de suas atribuições legais, considerando a Portaria IEF/RJ/PR nº. 227 do dia 18/12/2007 e considerando, ainda, o que consta no administrativo E-07/002.10413/2015, **AUTORIZA** a pesquisadora Debora Peterson a:

1. Prorrogar a pesquisa por mais **12 meses**;
2. Realizar entrevistas com guarda-parques, funcionários e gestor da Unidade de Conservação, desde que previamente autorizado por casa um dos entrevistados.

Ficam mantidas as condicionantes e demais disposições da referida autorização.

Rio de Janeiro, 05 de Janeiro de 2017

[redacted]

Paulo Schiavo
Diretor de Biodiversidade e Áreas Protegidas

Avenida Venezuela, 110 – Saúde – Rio de Janeiro - RJ-CEP: 20081-312 – Tel.: 2332-4640