

*Ecological knowledge
and
use of natural resources,
are they related?*

*A study case among tribal communities in Kodagu district
(Karnataka, India)*



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Author: Mar Grau Satorras
Director: Dra. Victoria Reyes García
Co-tutor: Msc. Francisco Zorondo Rodríguez
Partner Institutions:
Ethnoecology Laboratory (ICTA, UAB)
French Institute of Pondicherry

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Acronyms and abbreviations

- EK: Ecological Knowledge
- FIP: French Institute of Pondicherry
- FRA: The Scheduled Tribes and Other Traditional Forest Dwellers Act, 2006 (n°. 2 of 2007) and Rules (2008). Commonly known as Forest Rights Act.
- KFD: Karnataka Forest Department
- NR: Natural Resources
- RF: Reserved Forest
- SC: Scheduled Caste
- SHG: Self-Help Group
- ST: Scheduled Tribal
- TEK: Traditional Ecological Knowledge
- OBC: Other Backward Castes
- VFC: Village Forest Committee

1. INTRODUCTION

1.1. Presentation

Persons interact with nature through different ways. Often researchers assume that cognitive and practical ways are related, but few studies analyze in detail this association. This study aims to analyze this assumption, evaluating quantitatively whether cognitive and practical linkages with nature are associated.

The study of the relation between people and nature is complex and frequently their approaches depend on the scale and the discipline methodology. From this interaction born different pairs of concepts: society and environment; culture and nature; social sciences and natural sciences... We advocate here for an interdisciplinary approach and to understand those pairs as a whole, what some authors have called the humans *in* nature or the social-ecological systems (Berkes et al 1998). Inside these whole-pairs concepts grow the different material and non-material, direct and indirect social-ecological linkages as the ecological knowledge, the use and management (traditional or not) of the ecosystems and their services, the beliefs over the nature...

Hence, this study is focused in two particular ways to be related with nature: on the one hand through cognitive way (that we approach as **ecological knowledge**), on the other through practical or material way (that we approach as **use of natural resources**). And we address the following research questions: i) Are these two ways related? In other words, a major use of the natural resources would imply a greater knowledge of these and, vice versa, a greater ecological knowledge would contribute a mayor use of natural resources?; and ii) Is this relation behaving equally for all kinds of natural resources?

First question will assess the association between ecological knowledge (EK) and use. Here use of NR would be captured through two different indicators of consumption and collection. The use of NR provides to the individual humans the information about where, when, how and which are these ecological elements; in other words, would provide ecological knowledge. At the same time, the representation of in words and thoughts of the NR also would facilitate the use of them (always taking into account that other factors, as the access and abundance would allow). Thus, as much knowledge of the NR they store is supposed to be high the use done. And as much use, more knowledge will be stored. Thus, the relationship between use and EK should be understood as a bidirectional association.

Second question attempts to capture whether the natural resource context modifies the knowledge that people store about it or their use and the consequent association. We grouped

the NR in two categories, according to the purposes that people do, contemplating a group of self-consumption (or for local market) products and other of marketable products. We attempt to test separately the association and to corroborate whether the model is valid for both groups, or for which one it is. In this direction, Millennium Ecosystem Assessment (2003) recognizes that biodiversity and ecosystems also have intrinsic value and that people take decisions concerning ecosystems based on considerations of well-being as well as intrinsic value.

To answer these questions, we carried out a study with people that had different levels of contact with nature. Our study case is focused among individuals of a similar socio-cultural group, the tribal communities, and is situated in Kodagu (an Indian district). This area is characterized by a mega-diverse landscape mosaic and with different access restrictions among protected areas, facts that would capture a major variability of people-nature relation cases and therefore, allowing to answer properly the aim of our research.

Thus, this study attempts to contribute to quantitative ethnoecological research, bringing new clues about the relation between use and knowledge. Although this relation is assumed to be positive, few studies have evaluated it empirically (see Literature Review section). The verification of this association could be applied in studies about the erosion of ecological knowledge that requires long-term data, then studying the loss of use as a proxy variable for loss of knowledge (Reyes-Garcia et al 2005).

Also this study provides from a model to understand and assess quantitatively these two ways of interaction with nature. In this sense, the methodology of our study is interesting because evaluates the use of natural resources creating two indicators (for consumption and collection), and not as more commonly used in the literature through a single indicator about the number of uses associated to every natural resource.

Finally, the location of the study in tribal communities (formed by socio-cultural groups historically disadvantaged) and in an area within a biodiversity hot-spot (but subject to market and anthropic pressures) it becomes a challenge. Our study reports the local strategy of resource management with quantitative data, specifically evaluating three dimensions: the consumption, collection and knowledge of some of their local resources. This report contributes indirectly locally in two areas: first, about biodiversity conservation issues, considering the relations among local inhabitants with their local environment; second, analyzes the livelihoods fulfillment by the local people, historically dependent on the forest.

1.2. Objectives

The **general objectives** are:

1. Evaluate the association between ecological knowledge (EK) and use of natural resources (NR).
2. Assess the association between ecological knowledge and use of different groups of NR.

The **specific objectives** are:

1. Study intra-cultural variation in levels of individual ecological knowledge (Dependent Variable)
 - a. Evaluation of the ecological knowledge level
2. Study intra-cultural variation in use of the different natural resources (Explanatory Variables)
 - a. Quantified assessment of use: indicators of consumption and collection
 - b. Evaluate access and abundance (potentiality of use)
 - c. Identify and evaluate the control variables that influence the model
3. Test the association between EK and use at the general level (all resources pooled)
 - a. Carry out an statistic treatment of the relation
4. Test the different associations EK-use among groups of NR
 - a. Test the association between EK and use for each group
 - b. Identify which are the differences inter-groups and intra-groups
5. Comparison and discussion of the results

1.3. Theoretical framework

a. Humans - nature, how to understand this relation

The present study tries to analyze two of the multiple linkages between people and nature. But, how are working the links between humans and nature? How we conceptualize the operational system? This section doesn't aims to answer these questions that still are (and are going to be) in continuous research evolution. Nevertheless, we give an overview of the framework used to conceptualize our study system.

The relationship between ecological and social system has been studied by several disciplines. Trying to link environment/society (or nature/culture) and cross the gap created for excessive cognitive specialization have born during the last century different interdisciplinary disciplines such as human ecology, ecological economics, environmental history, political ecology, ethnoecology... Being ecology as the principal "infected focal point" (Toledo et al, 2007).

Thus, the human and natural linkages have multiple approaches, depending in the discipline from which are analyzed. Also as we commented the scale of analysis influences the scenario. We take here two approaches of the society-nature relation and they would be applied during the development of the study: first through the study to resilient social-ecological systems carried out by Berkes and Folke (1998)¹ and second, through the concept of appropriation from Toledo (2008) and rural metabolism.

The compilation book 'Linking Social and Ecological Systems' (Berkes and Folke 1998) provides a conceptual framework for analyzing the **linkages between social and ecological systems** for resilience and sustainability. As a framework helps to think about phenomena, and in this book is used to analyze the interdisciplinary and international reported case-studies. Basically they consider four sets of elements to describe social-ecological system characteristics and linkages: ecosystem, people and technology (user communities of NR and technology employed by them), local knowledge and property rights (institutions and different regimes of property). These elements interact among them with a pattern of interactions and give as a result outcomes which can (or not) lie to sustainability. Highlight that these framework has overlapping regional, national and global influences (Berkes and Folke 1998).

Thus, from this conception it might be deduct that relations between society and nature are multiple, complex and interdependent. The four sets of elements would be interacting with

¹ They develop other frameworks also in other publications (*e.g.*, another possible framework is presented in Berkes et al. 2003).

different patterns and at different temporal and spatial scales. For this reason, we use this framework to describe our concrete social-ecological system and from this specific “state of affairs-picture” we would deduce which are the possible linkages between people from tribal communities and their local environment. This task would be done after the presentation of the context of our study case (see in Context section *Our social-ecological system*).

Second, we take the analysis of **rural metabolism** did by Toledo (2008)², where the **appropriation** is the central concept³. Appropriation of nature is defined as the extraction of a nature fragment to become a social component and is commonly identified in the literature as “use”, “exploitation”, or “management” of “natural resources”, “ecosystems”, “environments” or “landscapes”. Thus, the appropriator is the person that carries out this act. Toledo defines the social metabolism as the ensemble of actions through which human societies (independently of their temporal and spatial situation) carry out the appropriation, transformation, circulation, consumption and excretion of materials or energy to the nature (Figure 1).

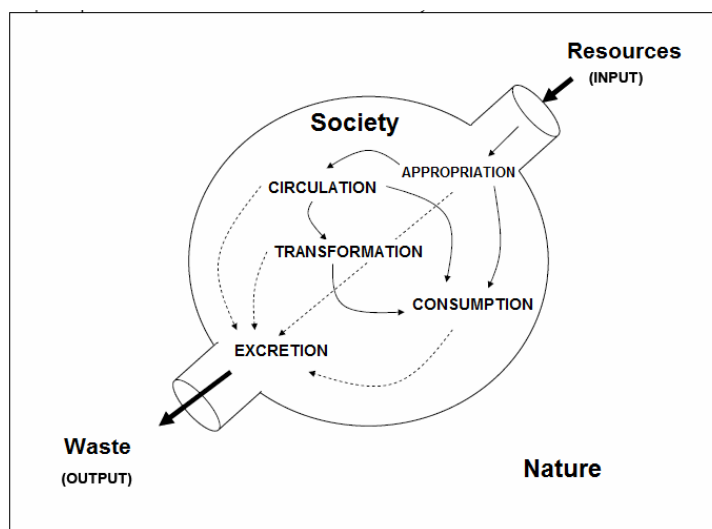


Figure 1. The five processes (acts) of the metabolism between humans and nature
Source: Adapted from Toledo (2008)

Whereas some of these metabolic acts are done through economical exchange (therefore being an exchange among people, inside the social organism); appropriation and excretion are ecological (or material) exchanges between human society and nature. When only ecological exchanges occur, the appropriator consumes all that produces (and vice versa, produces all that would consume). For instance, this kind of relationship with nature was frequent in societies as the domestic communities or the ancient (and some actual) tribes and clans. Nevertheless, in the

² Other authors also consider the analogy of metabolism to describe the interactions between society and environment (e.g., Schmidt 1976; Martinez-Alier and Schlüpmann 1991; Fischer-Kowalski and Haberl 1998; or Foster 2000).

³ As our analysis is settled in a rural area we use this concept. We don't take into account approaches focused on urban and industrial metabolisms, but as likely as not are also affecting our study case.

moment that some of these appropriation fragments start to circulate (so, transits to the social space) the appropriation would depend of two overlapping spheres: ecological and economical. Then, the efficacy of the appropriator would be determined by his ability to get enough flows and services from the social space, which at the same time would depend of the kind of agents which the appropriator interacts (Toledo, 2008). And these agents (as communities, cooperatives or markets) have multiple scales (Figure 2).

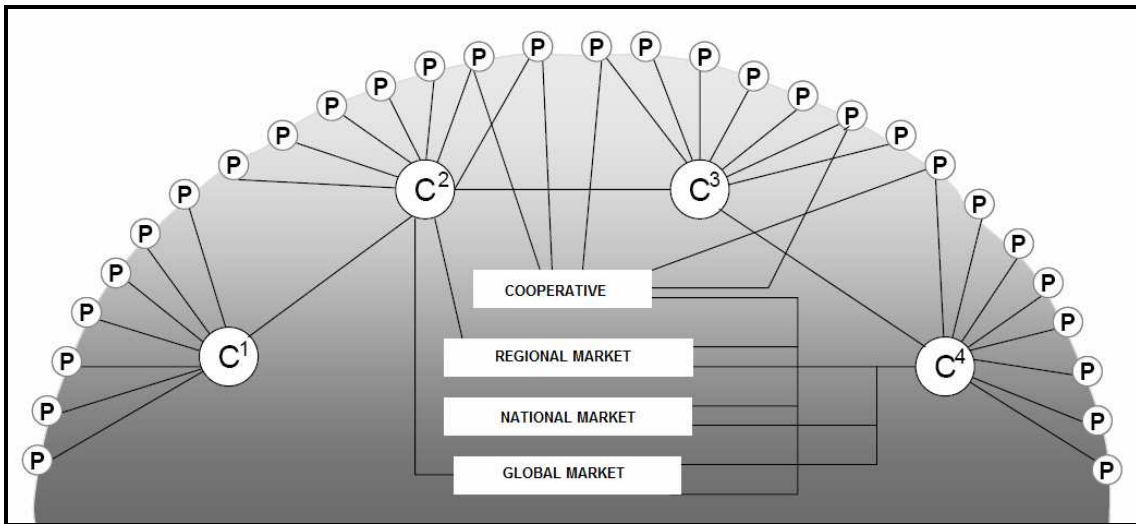


Figure 2. Possible economical exchanges of diverse appropriators (P).
 Note: C means communities.
 Source: Adapted from Toledo (2008)

However, in the contemporary context, the most common appropriator is doing not only the ecological exchanges. They would also exchange with other agents (as other people, other communities or markets) and thereby would transfer this nature fragment to the social space. Hence, appropriation would be usually influenced by the next (economical) actions of circulation, transformation and consumption.

In our study, we take into account this consideration when we analyze the different natural resources. We consider that in some resources the appropriation is just an ecological exchange. But in some other NR the appropriation would be strongly affected by the next economical processes and not merely by the ecological exchange. Thus, we would understand that one person (appropriator) could have practice both kinds of appropriation depending on the NR which he relates. For this reason we try (although it will depend on each user) to analyze natural resources that provide both situations, those that would be just for self-consumption and those that would be also for commercialization (so, that would be transferred to the social space).

Furthermore, Toledo (2008) also distinguishes between two dimensions of the appropriation: material (or tangible) and symbolic (or non-tangible). The non-tangible appropriation is the ensemble of actions through which humans are articulated with nature through beliefs, knowledge, perceptions, imagination, intuition and aesthetics. And Toledo and González de Molina (2007) affirm that “both dimensions are reciprocally conditioned during the metabolic process”.

Thus, the appropriation could be understood through two dimensions that include material ways and cognitive ways (within as Toledo called, non-tangible or symbolic). In our study case, we would evaluate empirically whether these two dimensions are or not associated, taking into account the previous framework and positions in the metabolic process.

Finally, we try to analyze simply the system human-nature, taking into account the NR and individual perspective (Figure 3). As we are not analyzing all the complex social relations and we concrete the analysis to an individual level. From this point of view we consider that a person has relation with a natural resource through cognitive and material ways. As we commented, we proxy cognitive as ecological knowledge of this NR. However, the material ways can be multiple. Here we define the material way taking into account the input and output flows: i) how the person gets the product; ii) what is the person doing with the product. Possible inputs are the collection (what would be the tangible appropriation in Toledo 2008) or as a result of economical exchanges (with other people or directly from the market). Possible outputs would be the self-consumption or to do economical exchanges (commercialize the product or to get wages).

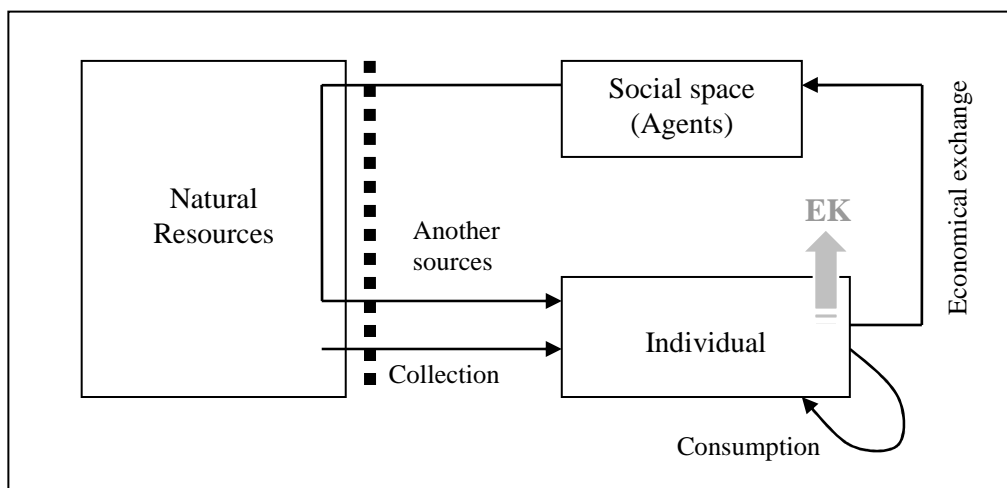


Figure 3. Diagram of possible relations between an individual and the local natural resources.

Source: Own elaboration.

Notes: i) The agent should be understood as people (other than the informant), economical institutions (market) and other institutions (as government, cooperatives, NGO). ii) We don't consider the other monetary, information, ecosystem services... flows involved. iii) The discontinuous line means the potentiality of use of the NR (access and abundance)

This is the most common framework, were a same person could have both kinds of appropriation. Nevertheless in some cases, the process could be without interacting with other social spaces and, therefore, being first kind of appropriation (Figure 4.a). And some other cases the person could be involved only in economical exchanges (Figure 4.b and 4.c). Is the EK influenced among these different cases? That's what our second objective would try to answer.

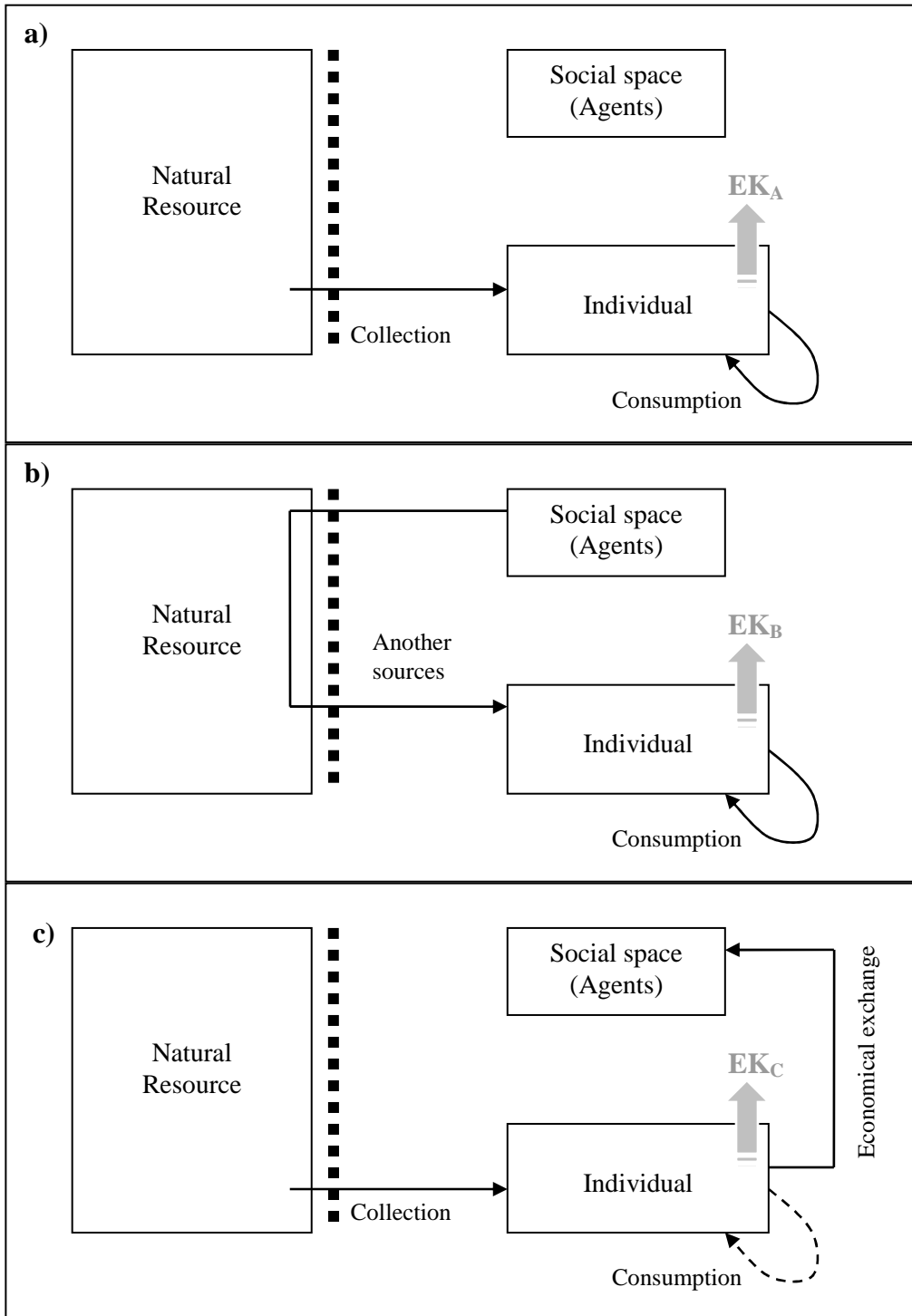


Figure 4. Three possible cases of relations individual - NR.

- a) Only ecological exchange and self-consumption;
- b) Consumption and economical exchange;
- c) Ecological exchange and posterior economical exchange (through commercialization or labour), also could be combined with consumption.

b. Tradicional Ecological Knowledge

Traditional Ecological Knowledge (TEK) is defined as ‘a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment’ (Berkes, 1999 SACRED ECOLOGY). Ethnoecology is a discipline between anthropology and ecology that have as axis the concept of TEK.

Local, indigenous or traditional knowledge refers to ecological understanding built, not by experts, but by people who live and use the resources of a place (Warren et al. 1995). The attribute *traditional* is used to refer to historical and cultural continuity, recognizing that societies are constantly redefining what is considered ‘traditional’ (Berkes et al. 1998). *Indigenous knowledge* (IK) is used to mean local knowledge held by indigenous peoples, or local knowledge unique to a given culture or society. (Warren et al. 1995). Finally, *local knowledge* may be used as the knowledge generated through observations of the local environment in any society, and may be a mix of practical and scientific knowledge (Olsson and Folke 2001).

As Reyes-García et. al. (2006) pointed out TEK can be distinguished with two different dimensions: theoretical (intellectual ability) and practical (ability to put knowledge into practice). Here, we proxy *ecological knowledge* with the theoretical dimension. To construct the index we use ecological data (matching ecological textbook information), thereby we are not considering other domains of TEK as knowledge by cultural consensus, skills or beliefs. To understand the born of the concept see Table 1.

Table 1. Indices of TEK: definition of methods to collect raw data and construct indices.

	Method to collect raw data	Method to construct index	Index	Definition
THEORETICAL DIMENSION	(1) Multiple-choice task on uses of wild plants	Cultural consensus	<i>Cultural knowledge of uses</i>	% of individual questions coinciding with the most frequent response in the group
		Matching with experts	<i>Agreement with experts</i>	% of individual questions matching with the answers from elders in the group
	(2) Multiple-choice task on ecology of wild plants	Cultural consensus	<i>Ecological cultural knowledge</i>	% of individual questions coinciding with the most frequent response in the group
		Matching ecological data	<i>Ecological knowledge</i>	Number of responses on plant ecology matching textbook information.
PRACTICAL DIMENSION	(3) Interview of reported use of plants	Data aggregation	<i>Average plants used</i>	Average number of plants brought to the household per day
		Data aggregation	<i>Total plants used</i>	Number of plants brought to the household/entire search period
		Richness index	<i>Total species used</i>	Total number of different species brought to the household/entire research period
	(4) Questionnaire on skills	Data aggregation	<i>Skills using plants</i>	Self-reported number of plant-made items that the participant reported knowing how to make

Source: Reyes-García et. al, 2006

To sum up, our study is focused on *ecological knowledge* hold by any local inhabitant, that can be or not resource user. Although these are nonindustrial or “less technologically advanced”, local and indigenous societies, we prefer don’t undertake the concept using the terms of traditional, local, indigenous or folk knowledge.

c. Defining Ecological Knowledge

Ecological knowledge (EK) is *per se* the theoretical or objective knowledge of the living organisms in their environment. For this study, we understand the ecological knowledge as a cognitive linkage between humans and nature. But to make operational this definition we need to understand what means “ecological” and what means “knowledge”. Here is described briefly.

Miller (2002) defines resource as anything we get from the physical environment to meet our needs and wants, but they become resources only because our ingenuity, economic system and cultural beliefs. Thus, the existence of different Natural Resources (NR) is actually evident, but to use them also is necessary to know about their existence. In this study, we understand Ecological knowledge as the specific knowledge of the biotic and local NR.

From epistemology we take the definition of knowledge as the relationship established among a subject and an object, where the subject mentally captures (called apprehension) the object’s reality. In other words, *the EK would be the apprehension of the Natural Resource’s reality*. Following the knowledge theory, the establishment of concrete sources of knowledge has divergences among authors (Descartes, Spinoza, Leibniz, Locke, Hume, Kant, Berkeley, Hegel, Russell, Ayer, etc.). However, mostly exists the consideration of these four sources: perception (or knowledge by acquaintance, name proposed by Russell, 1986); memory as a kind of experience way; own reflection, or self consciousness, that produces immediate evidence; and the discursive or analytic reason that produces mediate evidence. In this study, we don’t consider separately the sources of knowledge, however would be interesting to analyze in future research the complex network of factors involved in each source.

d. Defining use of Natural Resources

Taking into account the established framework (see above Figure 3) we would define the use of natural resources as the material interactions between the individual and the NR. Specifically, we take into account three different acts: collection (the material appropriation in Toledo 2008), consumption (or uses), and economical exchanges (as commercialization, purchasing or get wages working with the NR).

Thus, we don’t contemplate other interactions as some other management activities of the NR.

Finally, also we consider that the collection of natural resources would be influenced by the potentiality of use. Hence, access and abundance of the NR would play an important role modelling the potentiality of the resource user to collect it.

1.4. Literature review

Researchers from quantitative ethnobotany have measured the ecological knowledge with several methods and indexes (see a compilation in Reyes-García et al. 2007). Also knowledge of natural resources has been approached as depending on demographic characteristics such as age, sex, kinship relations, ethnicity, and position in a social network (*e.g.*, Atran et al. 2002) and on distance from cities or natural resources (Begossi 1996; Reyes-García et al. 2005). But is EK associated with the use of NR?

Figueiredo et al. (1997) did an ethnobotanical study about diversity of medicinal plants used among communities and they equated the knowledge as the uses. They approached the index capturing the number of uses. Other researchers also have equated the diversity of plants used with the knowledge (Rossato 1999). All of them consider that use and knowledge are associated.

However, some other studies show that not always are correlated. For instance, Begossi et al. (2002) conducted 449 interviews at 12 Caiçara communities and they found that whereas women cited more plants than men, they had fewer and heterogeneous knowledge of medicinal plants. Also Byg and Balslev (2001) point out that there was not always a strict correlation between ethnobotanical data elicited in surveys, actual extent of use and importance accorded to different plant uses. They conducted interviews about an endemic palm from Madagascar and they deduct from the results that “the position a product takes in mind of people is not always dependent on purely materialistic usefulness or frequency of actual use”.

Few research has been evaluating whether this knowledge-use relation was or not associated. Reyes-García et al. (2005) using individual-level data from 132 adults living in two villages in the Bolivian Amazon, the Tsimane’, compared indigenous knowledge with uses of wild and semi-domesticated plants. They found positive association in the pooled sample and the isolated village, but not in the village with less dependence to the forest. They approached the knowledge, through the knowledge of uses (as many uses knew the informant, more knowledge) and the number of uses as the actual uses.

In this study, we focus on ecological knowledge but we approach it through the ecological features, allowing to distinguish it from uses. Secondly, we measure the number of uses (a

common variable in all previous cited literature). Third, we also contemplate the collection days, as indicator of use of the NR.

2. STUDY CASE: CONTEXT

2.1. Geography: location

The study is located in **Karnataka**, the south-western Indian state⁴, which borders in the north with the states of Maharashtra and Goa; Andhra Pradesh is to the east; Tamil Nadu and Kerala to the south, while the Arabian Sea forms the western boundary (Figure xx). Has an area of 191,791 km² (Karnataka Report, 2005) and 53 million population (Census 2001), which constitute respectively, 5.83 % of the total Indian area and 5.13% of India's population, being the ninth largest Indian state in population. About 66 % of the population in the state lives in rural areas (Karnataka Report, 2005). Although the primary sector has been decreasing their weight in the economy (contributed the 60% of the state GDP in 1960 and only the 26% in 2001), the 56% of the workforce is still agricultural jobs (Census 2001).

Karnataka state is administratively divided into 27 revenue districts (Figure 5). The settle sample collection is located in the second smallest district: Kodagu.

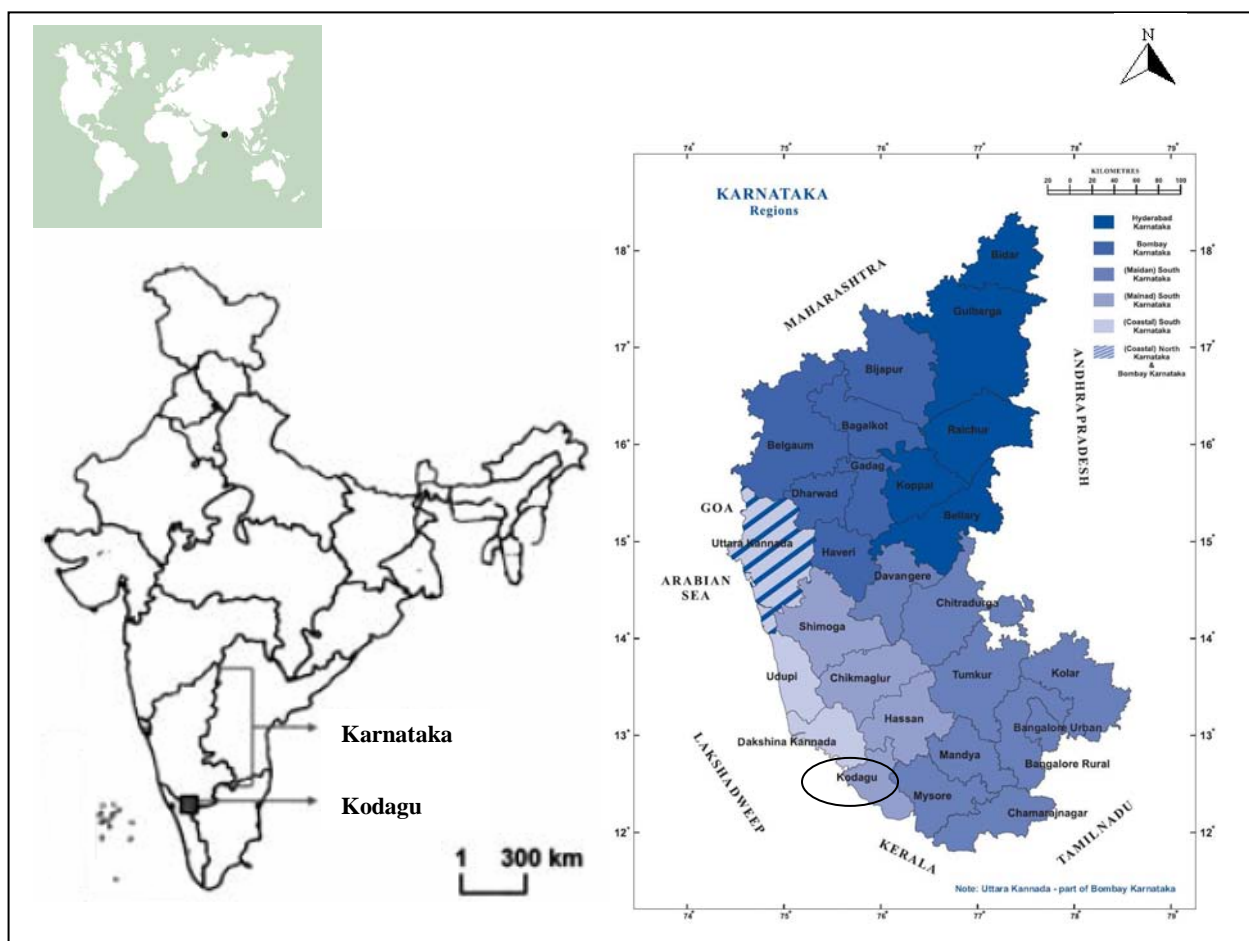


Figure 5. India and Karnataka with the administrative divisions.

Source: Baghwat et. al. (adapted), Karnataka Report (2005).

⁴ India is a republic composed by 28 *states* and 7 United Territories. Each state is administratively divided by several *districts*. Each district has also administrative divisions (called *taluks*) and finally, each *taluk* is a composition of various municipalities, called *panchayat*.

The district of **Kodagu** (with the anglicized name of *Coorg*) has some peculiarities: compared with other Karnataka states is small in terms of population and surface. In Kodagu coffee is one of the major drivers of the regional economy, the landscape, and even the cultural identity of the district (García et. al. 2009). Having own history⁵ independently of the neighboring districts, Kodagu became part of Karnataka State in 1956 and still now conserves a noticeable identity (see Richter 1870; Muthanna 1971 to have an overview about the history of Kodagu).

Table 2. Basic Kodagu's characteristics: demographical, geographical and economical.

Basic characteristics	
Total population (inhab.)	548, 561
Rural population	473, 179 (86.26%)
SC population	67,422 (12.4%)
ST population	46,155 (8.4%)
Cultivators	7.9%
Agricultural labourers	4.3%
Workers in household industries	0.9%
Surface	4102 km ²
Main economical activities	Agriculture, coffee

Source: Census 2001, Karnataka Report (2005)

Administratively, Kodagu is divided into three *taluks*: Madikeri, Somvarpet and Virajpet (Figure 6). The settle sample collection has been focused on the southern **Virajpet** Taluk.

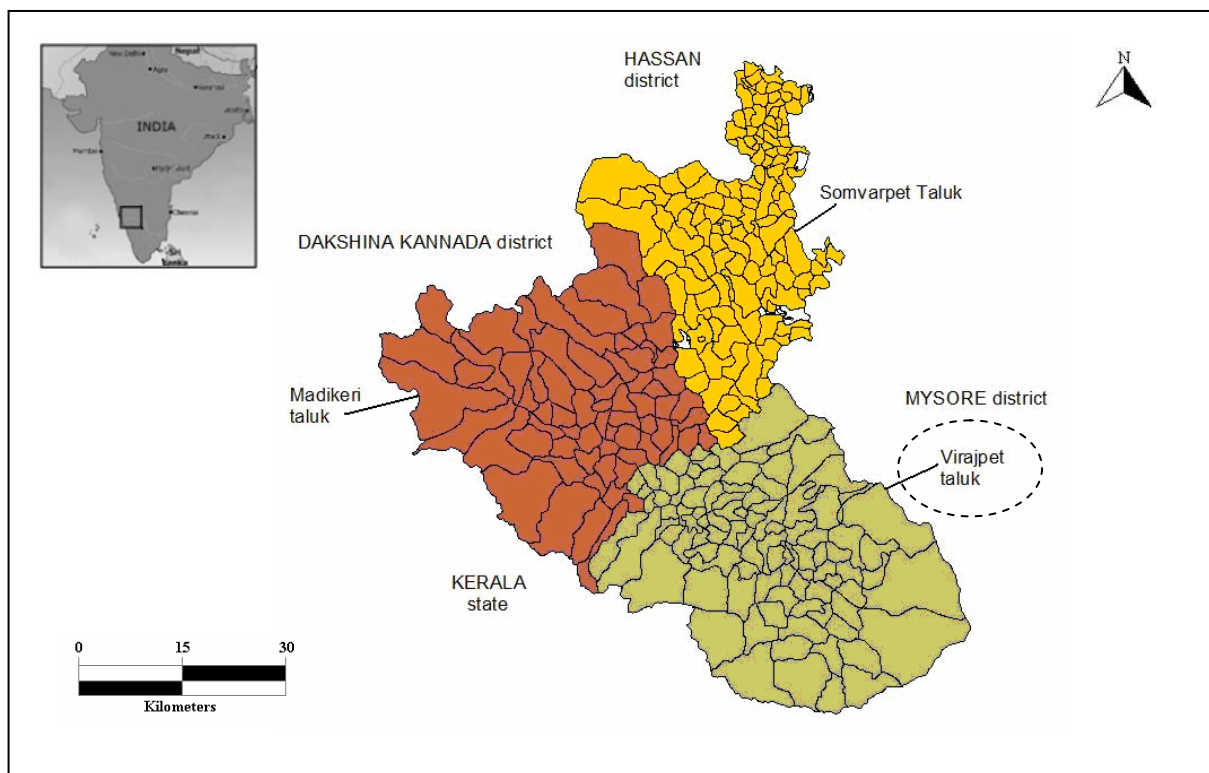


Figure 6. Administrative map from Kodagu district (taluks and bordering districts and state).

Source: Adapted from French Institute of Pondicherry GIS.

⁵ Even with the annexation of Kodagu by the British in 1834, the district kept some form of autonomy until the independence of India in 1947.

2.2. Nature: landscape mosaic and dynamics

On the south of Karnataka, the district of Kodagu ($75^{\circ} 25' - 76^{\circ} 14' E$, $12^{\circ} 15' - 12^{\circ} 45' N$) stretches on the eastern slopes of Western Ghats (situated on Figure 7), a chain of mountains of 1600km on the west coast of India. The *Western Ghats and Sri Lanka biodiversity hotspot* houses a high number of endemism and diversity, becoming a priority for biologic conservation strategies as a “Key Biologic Area” or KBA (Conservation International, 2009).

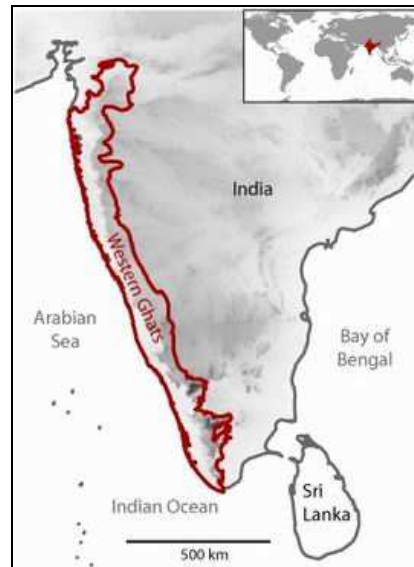


Figure 7. Western Ghats in India.

Source: Institute Français de Pondichéry (2009).

Being a mountain area, Kodagu has high altitudinal variations: from 850m (east and center area) to 1750m (west). The Western Ghats blocks the progress of the monsoon rains, consequently appears a wide precipitation gradient west-east (from 5000mm/year on the western side to less than 800mm in the east). Also the length of the dry season varies across west-east (from 4 months to 6 months). These are the reasons that explain the vegetation distribution from moist evergreen forest to moist and dry deciduous forest (see detailed descriptions on Pascal 1988).

Forest represents almost the half of the district (Figure 8), distinguishing basically three forest zones (Gerard 2001): west zone with evergreen forests disturbed and secondary deciduous in some place; centre zone with secondary evergreen forests or disturbed for plantations establishment (paddy, coffee and cardamom); and east zone, with deciduous forest (moist, dry and often disturbed until savannah status). The landscape mosaic is being geographically distributed with paddy fields occupying the lowlands and coffee plantations and forest fragments on the hilltops. Finally, a belt of forest reserves and protected areas surrounds the district. From all of them coffee is the main competitor for land use (Ninan & Sathyapalan 2003).

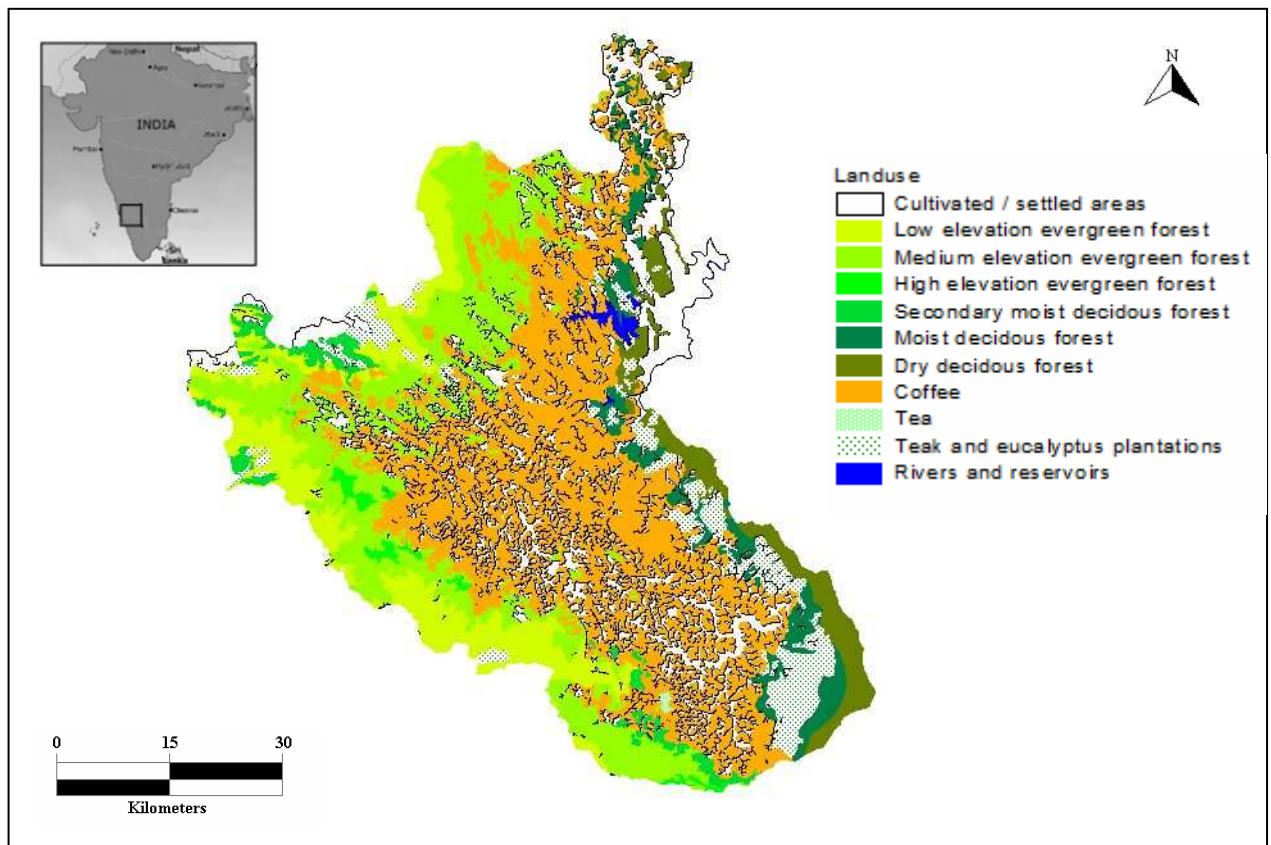


Figure 8. Landuse of Kodagu district(2007).

Source: Adapted from French Institute of Pondicherry GIS.

Over the last 30 years the *landscape mosaic* has undergone drastic changes, with coffee plantations replacing forest—essentially medium-elevation, wet evergreen forest. From 1977 to 1997 there was 30% loss of forest cover in Kodagu while the area under coffee cultivation doubled, predominantly at the expense of privately owned forest fragments (Garcia & Pascal 2006). Currently, forest, mainly in the periphery of the district, covers the 46% of the total land area; whereas the coffee plantations (locally called *coffee estates*), on Central Kodagu, cover the 33% (García et al. 2009).

The district of Kodagu produces nearly one-third of Indian coffee⁶ (Coffee Board of India, 2008), mostly in *agroforestry system*⁷ under tree cover (García et al. 2007). The tree cover shade avoids the loss of coffee floral buds during dry season (before the monsoon). Thus, coffee agroforestry systems play important role in biodiversity conservation in the district (Bhagwat et al. 2005), contributing to landscape-level connectivity between remaining forest patches. Altogether, forests and agroforests account for nearly 80% of the district (García et al. 2009). When forests were converted to coffee estates, planters usually replaced the undergrowth with coffee plants, but retained most of the original canopy trees (Ramakrishnan 2000). However,

⁶ India produces 4% of the world's coffee and is the fifth largest producer (International Coffee Organization 2008).

⁷ In this system other crops are also grown such as pepper, cardamom, oranges or paddy

currently, a massive replacement of native trees for the exotic silver oak (*Grevillea robusta*) is changing strongly this agroforest system⁸. This mono-specific agroforestral system is promoted by the farmers because can be harvested exempted of permissions (from the Karnataka Forest Department), it is fast-growing specie and good standard for pepper (Cheynier 2006). Two main factors shape the decisions to retain or fell trees in a Kodagu coffee estate (García et al. 2009): tree rights (depending on the land tenure⁹) and shade management (open up the canopy cover for irrigation and other drivers).

Hence, large scale *landscape transformation* is expected in the years to come, in the form of loss of tree cover as well as a strong depletion of biodiversity. The centre of the district will see the more drastic changes, while the periphery—especially the western side—may remain relatively untouched because it holds a belt of reserved forest and wild life sanctuaries (Garcia & Pascal 2006).

The mentioned *protected areas* are under the protection of the Karnataka Forest Department (KFD). As we pointed out earlier, the conservation issues in Kodagu are especially important, as is part of a biodiversity hotspot from one of the most richer and diverse of the terrestrial ecosystems: the moist tropical forest (Connell 1978). The Protected areas (PAs) in the study area are one national park (Rajiv Gandhi National Park commonly called Nagarahole) and three wildlife sanctuaries (Brahmagiri, Pushpagiri and Talakavery); all managed by KFD Wildlife Division. Kodagu also has Reserved Forests (RFs) mainly in the periphery; they are managed by KFD Territorial Division and some parts of RFs are jointly managed by KFD and collective management committees (Laval, 2008). Furthermore, in the central agroforestry matrix, there are over 1000 *sacred forests* that are informally managed by local communities (Bhagwat et al. 2005; Garcia & Pascal 2006).

As we commented, the issues in conservation are not only restricted to these protected areas, but the integral management of the landscape mosaic (including as national parks as human-made landscapes) as well. And this management would be absolutely linked with the sources of rural livelihoods of the local inhabitants and their relation with the nature. This study is focused on the use and knowledge of some of their local natural resources, trying to approach both aims: local conservation and provision of local livelihoods¹⁰.

⁸ Detailed studies on the study of the native/exotic agroforest systems (biodiversity and ecosystem services provided) are carried out by French Institute of Pondicherry (project: “Managing Biodiversity in Forest Landscapes”).

⁹ Explained widely in a book focused on land tenure system in Kodagu (Uthappa-Vijay, 2004).

¹⁰ Redfort and Padoch (1992) call this concept as development-oriented conservation, however we prefer don't refer to the concept of development as is ambiguous and focus on the fulfilment of rural livelihoods.

2.3. People, society and culture: tribal communities in Kodagu

a. Overview on the Indian context

Indian population has four principal axis of socio-cultural diversity: caste, language, religion and class (Guha, 2007). Also the gender shows starkest contrasts and could be considered as the fifth axis.

First, caste is the principal identity for many Indians. But, as Guha (2007) pointed out caste is a Portuguese word that conflates two Indian words: *jati* (the endogamous group one is born into) and *varna* (the place that group occupies in the system of social stratification mandated by Hindu scripture). There are 3000 and more *jatis*, but only four *varnas* (and the untouchables, the fifth and lowest strata). Two groups are recognized by the Indian Constitution as historically disadvantaged: tribes (renamed to Scheduled Tribals) and untouchables (renamed to Scheduled Caste).

About language, India has 22 official languages (India 2010) being Hindi the most known. However, in southern states, as Karnataka, the spoken and official-state language is Kannada and Hindi is not known for the majority of the population. The major religion in India is Hinduism, but there is important presence of Muslims, Christians, Sikhs, Buddhists and Jains (Guha 2007). Although in some traditional groups it has been observed a process of Hinduization (Xaxa 2003).

Finally, about class there is a massive social disparity, deep inequalities are there in landholding and income (Guha 2007). We include in this axis not only the relationship with land, also the relationship with other natural spaces. Indian environmental history (*e.g.*, Gadgil & Guha 1992) is key in identifying how and why the society-nature relations evolved. For understand the context, we want to highlight the importance of the British presence in modifying the relations with the forest. Cronon (1983) studied the colonization of New England states, and found that the early European-Indian relationship could be characterized in terms of two competing economies. The Indian economy treated the environment as a portfolio of resources and services that supported livelihoods, whereas that of the colonialists turned the environment into commodities, sequentially depleting one resource after another. Similarly, the push for valuable timber production under colonialism in India resulted in the commodification of resources serving diverse livelihood needs and the depletion of certain species (Gadgil & Guha 1992).

As the sample of the study is formed mainly by SC and tribal people, we give a brief explanation about them in the Indian history and current context.

First of all, we should clarify what means **tribal** in Indian context, because a different terminology to refer to tribes has been used over the time. The term of *adivasis* refers to the autochthonous people of the land, similarly as the term of *indigenous*. But the government of India usually has argued that ST of India are not the unique indigenous people, because other categories of people claim also to be from the antecessors (Xaxa, 2003). This fact, differs from the Latin America cases, where indigenous people is clearly distinguished with the colonialism context. However, the recognition of the right of indigenous people is also linked with the political demand of human rights and a quest of social justice with international recognition (Xaxa, 2003). Furthermore, tribes were not conceived as a caste in the Hindu hierarchical stratification, Table 3 summarizes how evolved the category of tribes until now.

Table 3. Evolution of the concept and classification as tribe.

Source: Xaxa, 2003

Period	Evolution of the concept of tribes
Pre-British	<ul style="list-style-type: none"> • This social group existed, but separately and not all tribes were included at the same category
British	<ul style="list-style-type: none"> • The term tribe was used in more than one sense: to refer to a group of people claiming descend from a common ancestor; or to refer to people or communities living in primitive or <i>barbarous</i> conditions. • Tribal and non-tribal areas had different administrative set-ups and laws in force were applicable to the general population, but not in case of groups called tribes. Special laws were framed for their governance. • The criteria for identifying a group as a tribal group were never made explicit.
Post-Independency	<ul style="list-style-type: none"> • Tribes are treated as those that are enlisted in Indian Constitution in the list of Scheduled Tribes (ST) as “tribe or tribal communities or part of or groups within such tribes or tribal communities as are deemed under article 342 to be scheduled tribes” • This enumeration provides no much clarification about the criteria, but the different census operations give an idea of the criteria (and their evolution) used to classify a tribal (or ST)

The State formation had different impacts for tribals especially on property relations, extension of political domination by tribal chiefs, centralized administration, introduction of alien practices (as elections), process of Hinduization (or Sankritization)... (Xaxa, 2003) We present on Table 4 the principal changes occurred from pre-colonial period until the present democracy. We also comment some noticeable historical processes that could help to understand the context of our study case.

Xaxa (2003) remarked that the dispossession of tribals from their land and the restriction of control over forest and forest products that occurred during colonial period pushed tribal people into the wider labour market. One of the important sectors to which tribal moved en masse was the plantation sector (Xaxa, 2003). This fact might be interesting in Kodagu, with important agricultural sectors as rice or coffee, the last one settled by British.

But things changed with the establishment of the democracy when were debated the governmental policies that should be applied to tribes. Basically, it there were two positions: isolation (*e.g.*, in Natural Parks) or the assimilation (into the mainstream). In the constitution we can find three kinds of measures that contemplate those (apparently contradictory) positions: protective, mobilizational and developmental (Xaxa, 2003). Also is remarkable that with the Independence it has been encourage the political participation through reservations, their education and the government jobs (Xaxa, 2003).

Table 4. Tribals historical trends in Pre-British, British and Post-Independency periods.

Sources: Guha (2007) and Xaxa (2003)

Period	Trends in Indian tribes
Pre-British	<ul style="list-style-type: none"> • Chiefly subsistence agriculturalists who depended heavily on the forest for sustenance • The natural resources were either individually and collectively owned and minimally tribal groups had usufructuary rights over these • Local-level tribal economy • Had long-standing relations with Hindu peasant society*: they exchange goods and services, sometimes worshipped the same Gods and had historically been part of the same kingdoms • Had no caste system and were organized in clans; and frequently they manifested less gender inequality than in supposedly more “advanced” parts of the country
British	<ul style="list-style-type: none"> • The conception of forest change (important source of revenue and profit); application of forest policies addressed to economical development and control the forest. • Introduction of private property land and the penetration of market forces • The forest where tribes lived in had been opened up to commercialization and colonization • Some parts remained untouched, but elsewhere the tribals were deprived of access to forest, dispossessed of their lands and placed in debt to moneylenders
Post-Independency	<ul style="list-style-type: none"> • The Constituent Assembly recognize their vulnerabilities and ultimately decided to designate some 400 communities as “Scheduled Tribals” • Construction of large-scale industrialization and developmental projects** that were uprooting tribals and provoking their displacement (becoming homeless and with no stable source of livelihood or income) • The economy of tribes was brought within the framework of the National Economy, therefore with food production (not gathering) and private ownership of land and labour

Notes: * Only the tribes of central India, the tribes in north-east (as Nagas) were not having this long-term relations with Hindu society. ** The most dramatic were exploitation of mineral resources, irrigation dams and power projects.

Currently the situation of tribes is still stark. In Karnataka state, the Karnataka Report (2005) alarmed about the current situation of malnutrition of ST women and children. They point as main cause their poverty levels. But also they remark: “Another cause of poor nutrition (apart of the income) could be the declining access of the tribal people to forest areas, which had earlier provided them with food rich in protein and micronutrients. Nutrition security through kitchen gardens is an intervention that would pay rich dividends.” (Karnataka Report, 2005). Another section of the same study also reported that the majority of STs in Karnataka have small units with low productivity, which are so economically unviable that landholders are compelled to work as wage labour to survive (Karnataka Report, 2005).

Apart from the Scheduled Tribes, there are 75 indigenous groups in India known as '**Primitive Tribal Groups**'. The Tenth Plan of the Central Government observes that these vulnerable communities have experienced a 'decline in their sustenance base and the resultant food insecurity, malnutrition and ill-health has forced them to live in the most fragile living conditions and some of them are even under the threat of getting extinct' (Karnataka Report 2005). In Karnataka, the Koragas of Dakshina Kannada district and the Jenu Kurubas who are concentrated in the districts of Mysore, Chamarajnar and Kodagu are classified as 'primitive tribes'.

Finally, the other lower caste recognized by the Constitution is the 'Scheduled Caste'¹¹ (SC). This category initially comprised castes that were isolated and disadvantaged by their 'untouchability'. As Guha (2007) described "The untouchables were poor, stigmatized and often receiving end of the upper-caste violence. (...) They were denied access to land and water resources; even their homes were set apart from the village." Currently, the Scheduled Castes comprise 101 castes and sub-castes, being the largest group in Karnataka (Karnataka Report, 2005). The majority of them were formerly classified as 'untouchables', but a few were non-untouchables (with history of deprivation).

¹¹ Gandhi had designated the Untouchables as 'Harijans' or children of God. Currently, this terminology is still in use in some places.

b. Overview on Kodagu context

From the main axes of Indian socio-cultural diversity presented before, we consider here two: caste and socio-economical stratus. However, these two axes do not contemplate all the social diversity of Kodagu. As Garcia et al. (2009) pointed out, communities in Kodagu include wealthy coffee planters; village elites; farmers with medium and small holdings; landless poor; small-business owners; a range of castes and religions; recent immigrants; long-term residents and indigenous communities; educated and uneducated men and women; government, private, and community institutions; and companies and NGOs. Although language and religion are important, we consider that those factors might have a lower direct impact on the use and knowledge of the natural products than socio-cultural diversity.

Caste is more perceived in rural areas where the traditional system is more alive. In Kodagu exist, among others, the following *jatis*: Kodovas, SC (Holeya – are the Adi Dravidar of Kodagu, Karnataka, Pale, Adi Dravida, Harijena, Nayakru, Parivara...), ST (as Yerava, Jenu-Kuruba and Betta-Kuruba), O.B.C (as Malayalis, Barber and Gowdas) and others. The three religious groups are, therefore, Hindus, Muslims and Christians.

We describe above the main tribal groups of Kodagu (Yerava, Jenu-Kuruba and Betta-Kuruba), as our sample is focused in tribal communities.

The **Yeravas** are conformed by four endogamous groups: Panjiri, Pania, Badava and Kaji Yeravas, from highest to lowest scale. About Yeravas (Krishna-Iyer, 1948) wrote:

“[they] are aborigines of Wynad from which they gradually **migrated** to the forests of the South Coorg. [...] are the lowest of the jungle tribes and appear to have been in a servile condition to the Betta-Kurubas from remote times”. *About slavery*: “[they] were owned by the proprietor [owner] of a small estate. They were rarely sold, but were frequently given as security for money borrowed. This was the most general mode of transferring the usufruct, and, above all others, likely to produce the greatest wretchedness. The mortgagee had the benefit of their services for the time being, and this was considered equivalent to the interest for the sum advanced. [...] They are now free”. *About the daily life*: “both husband and wife work and get food and earn **paddy** as wages [...]. [the husband] will quietly walk with his wife into the **jungle** in search of honey, fruits, roots and fish.” *About main occupation*: “is agriculture, but they have no lands of their own. [...] They have auspicious days for ploughing, sowing, transplanting and reaping. They know which rain will be beneficial for each crop. They perform no ceremonies either at the beginning or end of the agricultural operations, but they worship their implements and bullocks”.

Thus, as now, they were mainly agricultural workers. But, they work then (in 1948, when Krishna-Iyer published the previous text) in rice; whereas now they work mainly in coffee plantations. The rice-cultivating communities, the Kodavas and the Gowdas were settled in valleys (Richter, 1870); whereas now the owners of coffee are also the highest castes. What is also interesting from the previous text is their slavery past (also pointed out by Richter 1870), from where it might come their name (according to Krishna-Iyer *yervavu* or *yeravalu* is a Kannada word which connotes “to borrow”) and their relations with the jungle (even being the “lowest of the jungle tribes”).

About **Jenu-Kuruba** is also important to contemplate the etymology of their name, where *jenu* in Kannada means “honey”. About Jenu-Kurubas, Krishna-Iyer (1948) wrote:

“[they are] closely connected with those found in the forests of Nilgiris and Mysore. But consequent on geographical **isolation**, there is no intercourse between them”. About settlement: “They have no settled habitations, but wander about in search of honey. Their villages are clusters of huts called **hadi**. [...] Huts are made by bamboo and reed”. *About occupation*: “neither own nor cultivate land for themselves nor keep livestock of their own. [...] [the] primary occupation is **honey gathering** [...] there are two honey seasons [...] before rains [...] and after rains, when they get the kadi honey (or last honey) of inferior quality and quantity. [...] They sell to the government contractor. They are expert climbers [...], they collect at night [...] [and] they have an intimate **knowledge of the jungle** and animal habits. [...] They also work as labours on Coorg farms during rice transplanting and harvest times [paid with rice and few Rupees]”.

Although they conserve the honey gathering activity as source of income and livelihoods (Demps, 2010), they are also workers in coffee plantations (mostly in case of inhabitants resettled in communities near the plantations and far from the deep forest).

Finally about **Betta-kurubas**, *betta* in Kannada means “hill”, but when spelt with a *p* signified “rattan” (cereal) or “cane”, therefore the name may point to their occupation (Krishna-Iyer, 1948). About Betta-Kurubas, Krishna-Iyer (1948) wrote:

“[They are] from Wynad and Malabar. [...] Are said to be the modern representatives of the **ancient** [...] very **powerful** [social group or kings] in South India. [...] [After, it was a] dispersion far and wide, and many of them fled to the hills of Malabar, Nilgiris, Coorg, Wynad and Mysore. [...] They became *wild* and *uncivilized* and lost their ancient culture”. “[Now, they are] settled in a hamlet of their own and their neat bamboo **huts with structure** [...] passages [and] center [...] [with] open spaces for social and ceremonial events”. *About occupation*: “earlier they subsisted on a wasteful mode of cultivation

called **Kumri**¹². [...] They never touched a plough. All their work was done with the axe, bill-hook and hoe. The Forest Department restricted the scope of Kumri cultivation. [They] have now acquired skills as bamboo or woodcutters, which has proved to be more remunerative. [...] are also **skilful** in making mats, baskets, umbrellas, boxes and cradles of bamboo and cane". "They are lovers of personal freedom and independence. They are keen observers of Nature, giving interesting anecdotes of **jungle** life and products". About food: [they] cultivated vegetables and what whole some roots [a kind of sweet potatoes or yams] they may dig out in the jungle. Also they drink fermented juice and smoke [...]"

Socio-economically, in Kodagu we can broadly differentiate between large-scale farmers, smallholders and landless people; that usually correspond to the upper, middle and lower castes. Hence, usually, large-scale farmers are those that own the coffee estates and are *koorgis*; whereas landless people are mostly tribes, ST or OBC.

However, the distribution of land could be changing during the next years through the application of the new Scheduled Tribes and Other Traditional Forest Dwellers Rights Act (passed in December 2006 and the notification of the Rules was on 2008) which recognize the "historical injustice", strengthening the conservation regime of the forests while ensuring livelihood and food security of the forest dwelling Scheduled Tribes and other traditional forest dwellers (FRA, 2007). The law provides, *inter alia*, the right of ownership; use, access and manage the resources; intellectual property and traditional knowledge related to biodiversity. All these rights will model the interaction of these communities with the nature, changing the relationship and becoming a key factor to take into account contextualizing the present study.

In Kodagu, we can differentiate three kinds of settlements: cities, small villages and communities. The castes and socio-economical groups are dispersed on these geographical spaces. However, we have focused on one kind of settlement, the tribal communities, where there is less social disparity and the majority of their inhabitants are from the lowest caste and landless. In a given municipality (Panchayat) it can be not any community or have one, one or more than one community.

Because these communities are usually inhabited by tribal people, they are commonly named "tribal communities". However, also people from other lower castes live in, such as SC or O.B.C. Another local terminology is to call them "*hadi*", or "colony", or together "*hadi colonies*". Hadi is what Krishna-Iyer (1948) said that were called the clusters of huts by Jenu-Kurubas. Also is possible to call them as "indigenous communities", but as we argued before, this is more proper in other places (as Latin America context) than here.

¹² Kumri consists of small plots of forest land or cleared jungle which after a couple of seasons was abandoned in favour of a new plot, which they had again to clear and where they cultivated various grains, especially *ragi*. (Krishna-Iyer, 1948)

There is heterogeneity of origins and histories from each community (and each informant). Some of them are settled there from long time ago (usually inside the forest). Some others are the result of migrations from other places (inside and outside Kodagu and even from the neighboring states of Kerala or Tamil Nadu). And finally, in case of majority habited by tribals, some others were displaced from inside the forest. But, the common factor among all of them is that the main source of cash income comes from agricultural labor, and specifically, in coffee plantations. Thus, the demand of labors and the opportunity to get a –relatively- better salary (compared with other places in the state) could favorite, in some cases, the born of these settlements.

c. Tribal communities and social network

Figure 9 shows the main actors involved in the case study. The represented network could have different representation (linkages or nodes) depending on the individual and the community. But also during the time the diagram would evolve.

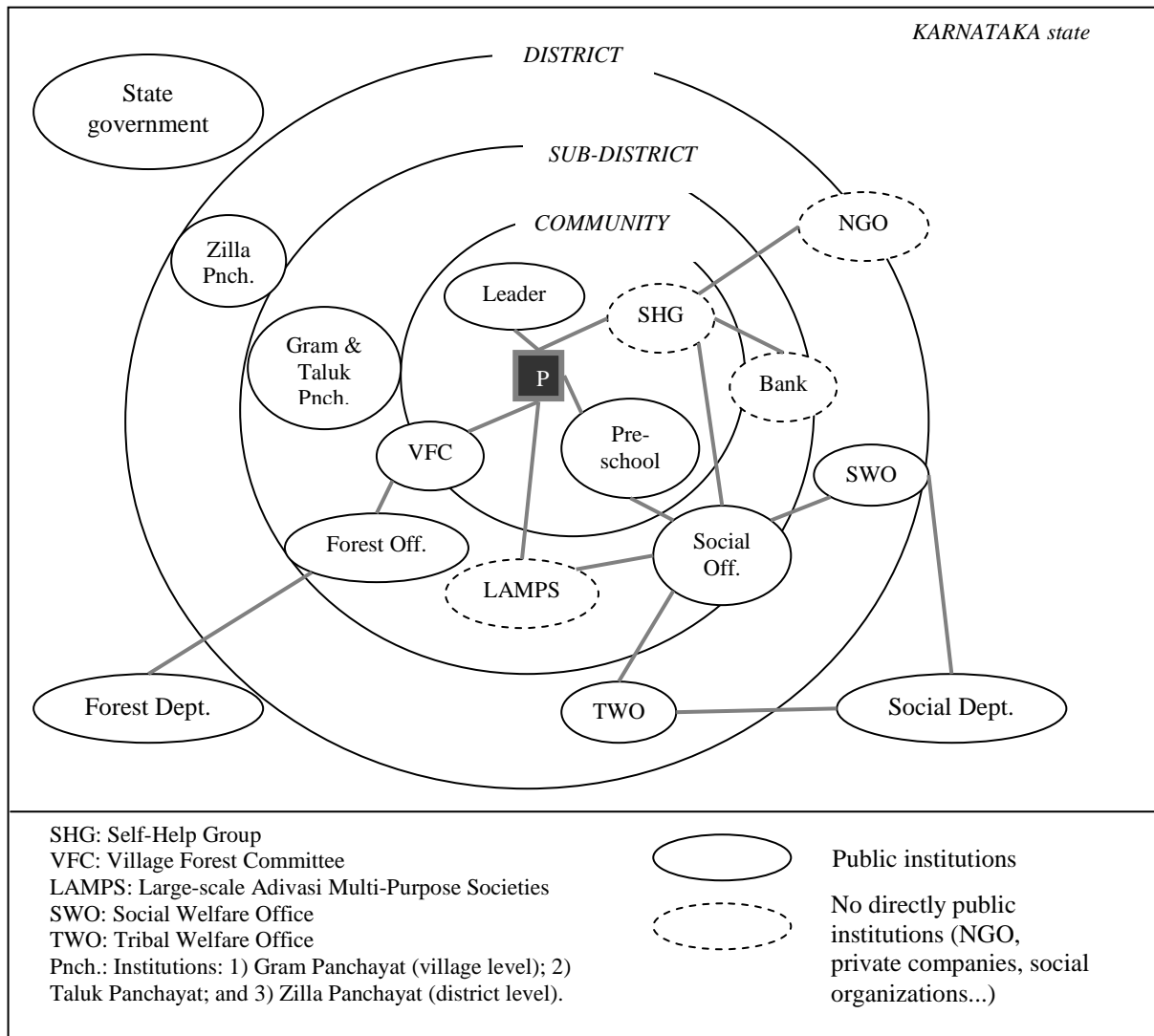


Figure 9. Diagram of the social actors network related with the inhabitants of the tribal communities in Kodagu.

Note: We don't link here the public institutions (State government, Zilla, Gram and Taluk panchayats) with others as indirectly are linked with almost all of them.

The implementation of policies at district level from the **Department of Social Welfare** is through two offices: Tribal Welfare Office (related to ST) and Social Welfare Office (related to SC, mainly). In Kodagu, both of them are located in the capital (Madikeri). The policies of both offices are applied at taluk level through the Taluk Social Welfare Office (in Virajpet taluk is located in Ponnampet).

The **Department of Tribal Welfare** was formed specifically to address the needs of STs in Karnataka. They are in charge to apply the Tribal Sub-Plan (TSP) objectives: poverty alleviation, protection of tribal culture, education, healthcare and providing basic minimum infrastructure (Karnataka Report, 2005). Poverty alleviation includes programmes in agriculture, collection of minor forest produce and tribal cooperatives (as LAMPS), animal husbandry, income generation (as self-employment programme, land purchase scheme or community irrigation scheme), micro-industries and Self-Help Groups (Karnataka Report, 2005). We describe two of the outputs of the TSP that should be taken into account in our study case:

- **Largescale Adivasi multi-purpose societies (LAMPS)** were formed in the late 1970s, with tribal people as members, to market non-timber forest products (NTFP) procured from the forests by the tribal people. It also supplies essential food commodities and consumer items to its members. At present, there are 21 LAMP Societies in Karnataka with 42,182 tribal families in the jurisdiction (Karnataka Report, 2005). In Virajpet taluk the LAMP Society is located in the eastern municipality of Thitimati and sells forest products as honey, lichens or *sigekay* (fruit of a tree). The LAMPS license provides legal access to the forest and the collection of certain minor forest products, thereby influences enormously the relation with these products.
- **Self-help groups (SHGs)** promote savings and microfinance among members, but they also have other objectives such as social empowerment and gender equity. They have radically changed the micro-credit systems in rural areas, where tribals and subsistence farmers are the main participators of these groups. Most SHGs are Women's Self-Help groups and only composed by women. Broadly, there are three categories of institutions promoting SHGs: the government (through the department of Women and Child Development), the financial institutions and NGOs. The promoting institution plays a significant role in the way an SHG develops and functions. For example, in Karnataka there is a wide range of programmes focused, among others, on the empowerment of women (without credit or subsidiary component), or on sanitation and solid waste disposal in urbanising areas, on watershed development, whereas some other are aimed on building up priority sector clientele for SHG-Bank linkage (Karnataka Report, 2005). The SHG are present in almost every tribal community we visited. They have an important role modifying the sources of income and participation of women and, therefore, they could influence the women's relation and dependence on their livelihoods.

The **pre-school** (or *anganuari*) is an important local node from public institutions to be linked with a community. They have different functions: education (children from 3-6 years old), nutrition (pregnant women and children younger than 6 years old), healthcare (mainly, to children and pregnant women), database (carrying out the census) and other activities depending on the governmental schemes. Therefore, they link with several governmental departments in different areas as education, health, welfare, census or women and child welfare, besides to be in contact with the local institutions (at municipality, taluk and district level).

In 1865 through the Reserved Forest Act when all the Kodagu's non-privately-held forested lands were appropriated¹³ by the Government -under British rule- and managed by the **Forest Department** (Laval, 2008). This reflects the historical process explained on previous sections. In the beginning the Karnataka Forest Department's (KFD) main tasks were supervising the introduced forest work and exploitation (teak plantations, fire clearings, making roads...). Usually these works were done by tribal population originating from those forests as Yeravas and Kurubas (some other research studies are currently trying to clarify these processes). Nevertheless, with the introduction of conservationist laws (1970s-1980s), also the role of KFD has changed, passing to be the controller of the access and use of the forest resources (Laval, 2008).

The **Village Forest Committee (VFC)** aims to a collective action for natural resources management. VFCs are set up by KFD, and currently they are under Karnataka Sustainable Forest Management and Biodiversity Conservation Project (2005-06 to 2012-13), that plans the creation of VFCs, EDCs (Eco-Development Committees) and Self-Help-Groups (Laval, 2008). Indian Institute of Bio-Social Research and Development NGO assists the department in the KSFMBBC Project (Laval, 2008). Only in the tribal communities in direct contact with the forest there are committee members of the VFC.

Some of the **NGO** working in Kodagu and related to the topic of our study are: Coorg Wildlife Society, Center for Environmental Education, Wildlife First, KLFT-Forest Trust, Coorg Organization for Rural Development (CORD), IBRA, Center for Tribals and Rural Development Trust (CTRD) and Foundation for Revitalisation of Local Health Traditions (FRLHT).

There is not a clear social organization among the community members. The only reported case of own decision-making process observed is on communities composed by a high number of Jenu-kurubas that have as a responsible an experienced man (called the "**leader**"). For the rest of the communities it has not been reported other visible systems to make decisions (collective, individual or hierarchical). Also the Panchayat members of the community area, play an important role linking the community with the public institutions.

¹³ As in other parts of India, while the settled farmers kept their rights on the different land tenures (with some changes later on), tribal people moving inside forests were deprived of their rights on the territory they used to live in (Laval, 2008).

d. Tribal communities and forest

The communities are also heterogeneously dispersed on the space and have not a fixed population and internal patterns. Thus, a community can be formed by four houses or by more than hundred. In reference to the forest we can differentiate between communities: inside, in the border or outside the forest.

The *communities living inside the forest* have different patterns of life depending on the kind of forest where are living. But generally, they are basically tribal people and more depending on forest than the communities outside or in the border. Their antecessors were living in similar settlements and area. Depending on the kind of forest, it can be identified different trends.

In National Park, the communities are formed by tribal people that still maintain subsistence activities based on the livelihoods provided from the forest. Those communities are strongly in contact and depending on Forest Department¹⁴. Secondly, the communities in Reserved Forest (RF) have not the same life style, the RF has not as restrictions as the National Park, but also has many activities forbidden. Also in that case, the Forest Department has an important influence on the community, as they are living in a land that belongs to KFD. We reported in more than one case, people from these communities explaining the difficulties to get government house or other public facilities, because Forest Department was impeding the work of other government departments. Through direct field observations it has been possible to observe that the majority of the houses from this kind of communities are huts (made by bamboo and clay and covered by paddy). Thirdly, a minority of communities are living in other forests as Sacred Forest. As we explained in previous section, a Sacred Forest is conserved for religious causes and usually belongs to a temple, for this reason most of these communities are linked to their respective temples. In some cases they are working in the temple, but also in some others the relationship between the community and their temple has some conflicts.

There are *communities living in the border* from a forest, therefore National Park, Reserved Forest or other forests. Although the majority of the people are tribals, it starts to appear some family from other castes. As the forest is near them they are still depending on the forest for some activities (mostly, to collect firewood). However, the kind of forest will condition strongly their access and, consequently, their linkages. Thus, the relationship with the Forest Department would be basically influencing their access to the forest. They are not settled there from many generations and usually come from a mixture of origins, *e.g.*, the first houses came from families moved from inside the forest and the new families migrate there from other villages, but in both cases to work in a coffee plantation. Those communities have usually a mixture of

¹⁴ Our sample collection was not done among them and for this reason we have not much information.

houses build from the government with solid materials and huts (usually, from recent migration).

Finally, the *communities living far from the forest* are basically communities of coffee workers. These communities are composed by tribals, ST and O.B.C. They are near the plantations, as they were settled mainly for the purpose to work there. However, in some cases, they are starting to have other sources of income different of the agricultural work. As they are far from the forest, they have no relation with Forest Department. Otherwise, they have much more relation with other government Departments and public institutions that provide them the main facilities (bore and open wells, electricity, toilets, houses, road...).

2.4. Social and ecological system

Finally, to summarize the main characteristics exposed below, we purpose to use the concept of social-ecological system, as a multidimensional system where natural and social spaces do not have a sharp and immobile border. We use the framework proposed by Berkes et. al. (1998) and explained on Introduction Chapter to characterize the study system briefly:

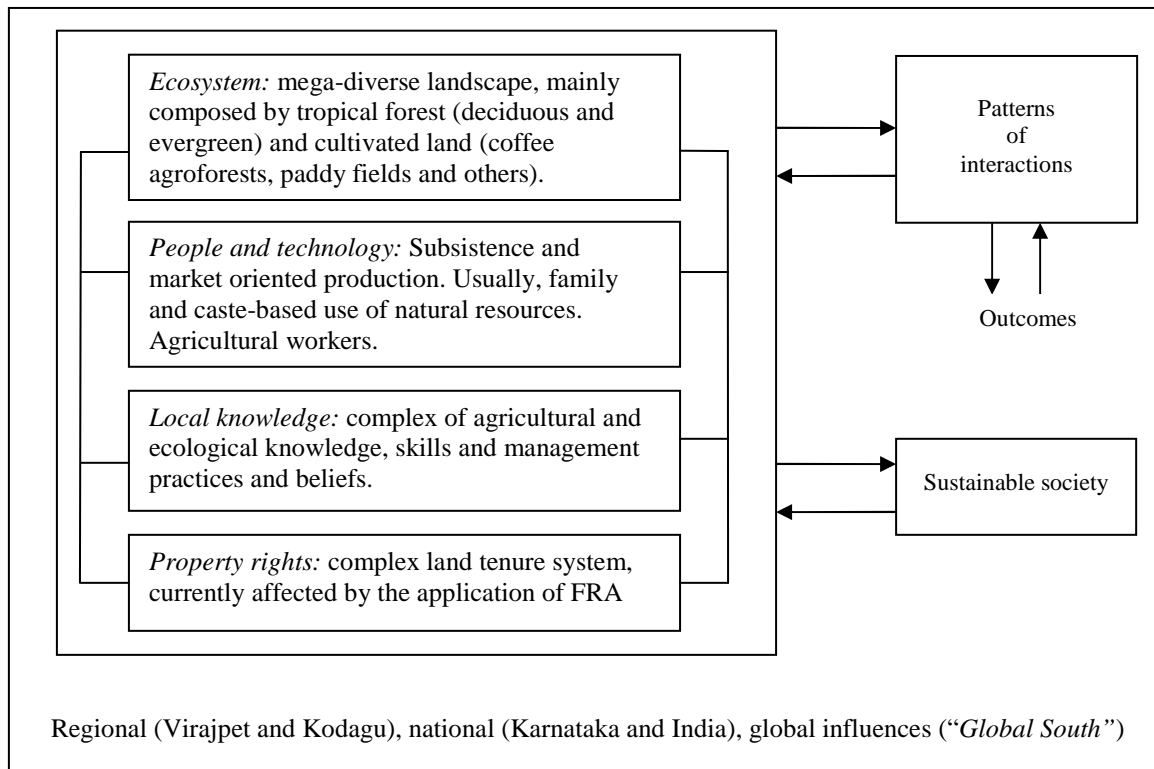


Figure 10. Social-ecological system studied.

The four sets of elements would interact creating the actual social-ecological landscape. We would focus on the knowledge and use of the ecosystems by the people. To understand these interactions we would get involve in each one of the previous sets, as the property rights that would condition the access to agricultural land and, therefore might influence the use of agricultural products. The knowledge and use would be referred to the ecosystems. And people (users of NR) and knowledge are the main topics of our study.

3. METHODS

3.1. Framework research projects

a. Managing Biodiversity in Mountain Landscapes and POPULAR project

This undergraduate thesis project was conducted in the framework of the project “Managing Biodiversity in Mountain Landscapes”, part of the Ecology Department from the French Institute of Pondicherry (Tamil Nadu, India). Linking forestry, agroforestry and livelihoods, the project is interested in the impacts of innovative management strategies, which associate biodiversity conservation with local development, on environment, landscape and lifestyle of actors involved in coffee-based agroforestry systems in the Western Ghats of India.

The general objective of the project is to answer this question: What will be the impacts of new public policies in terms of biodiversity, livelihoods, management practices and landscape dynamics? To answer the question, the project takes the example of the coffee based agroforestry system of the Western Ghats and addresses these three specific research objectives: 1) coffee and environmental services: how to reward farmers that provide global and local environmental services?; 2) geographical indications and biodiversity: how can a market tool help maintain cultural and biological diversity?; and 3) biodiversity and governance: how can public policies (e.g. tree ownership rights) and local practices interact in a virtuous way? Our research program is being incorporated in the last objective.

Furthermore, each of the components of the project is part of a broader, international research project backed up by the European Union (CAFNET programme) and the French "Agence Nationale de la Recherche" (BIODIVALLOC and POPULAR). This thesis is part of the POPULAR project (*Politiques publiques et gestions paysannes de l'arbre et de la forêt / Public Policies and Traditional Management of Trees and Forests*). Through a joint approach by local practices of natural resource management and public policy related to sustainable development, POPULAR project estimates how the confrontation between the endogenous evolution of these practices and trajectories traced by the implementation of policies public brings sustainability.

b. PhD thesis: Natural Capital and Human Well-being

The present project was also conducted in coordination with the PhD thesis “The Contribution of Natural Capital to Human Well-being. A case study among indigenous communities from Kodagu district (Karnataka, India)”. Francisco Zorondo-Rodríguez is this Ph.D in Environmental Sciences at the Autonomous University of Barcelona, Spain (2008-2010). This project shared the fieldwork and therefore the design of the field methodology with this Ph.D. A brief description of his work and framework is detailed below.

Understanding how natural capital contributes to human well-being is a pivotal issue both for social development and for biological conservation. However, the scientific literature about the contribution of natural capital to human well-being is scarce and often it refers to human well-being as a single indicator more than a multidimensional concept. Zorondo-Rodríguez, based on a multidimensional human well-being approach, attempts to evaluate the contribution of natural capital to human well-being among communities from Kodagu District (Karnataka, India) in the Western Ghats. The study is focused on the analysis of quantitative and qualitative data from local communities. Specifically, 1) assesses the relationship between access to natural resources and the well-being of local people and 2) explores the contribution of natural capital to the dimensions of the human well-being. This study will contribute to theoretical and practical knowledge about the relationship between human well-being and natural capital.

3.2. Sample selection

To define our social-ecological system, we selected the sample in order to satisfy two requirements: i) control of plausible external factors and ii) to find variability on the relationship between people and nature.

The control of plausible external factors was achieved by selecting villages with a relative homogeneity on the administrative organization and socio-cultural background. First, all the individuals included in our sample were living in Virajpet taluk. The selection based on taluk level allows to control for many governmental policies and programs carried out in Kodagu that might influence the ecological knowledge and the relationships between people and nature (e.g. training on honey collection, environmental education, and control on natural resources collection). Second, we focused the research mainly on people from Schedule Tribes and Schedule Caste, because this would allow having a relative homogeneity in the socio-cultural background in the sample. We also focused on tribal communities (their main characteristics are explained in Context section) in order to achieve a selection of individuals from Schedule Tribes and Schedule Caste.

To find variability on the relation between people and nature, we selected individuals living in communities located in three areas: inside the forest, border of the forest, and outside of the forest. Also, Virajpet is the *taluk* that offers a higher diversity of landscapes (see Figure xx in Context section).

The process to select the sampled communities has been done through three different phases. First, we selected the tribal communities. Through an institutional list (facilitated by the Tribal Welfare Office from Madikeri) were identified the communities located in Virajpet taluk.

Second, the communities were spaced out in a Kodagu map with information about administrative organization and land use during 2007 (GIS from French Institute of Pondicherry). Third, we listed randomly the communities giving a correlative number from top to down. Fourth, we visited the first twenty-five communities in order to introduce ourselves and the study to the people, and to know whether with these communities selected would have an enough sample for the study. During the visit, we also confirmed the presence and composition of Schedule Castes and Schedule Tribes among the communities' inhabitants and the communities' location in relation to the forest (inside, border, or outside). In the case that a community should be replaced by another one, we selected a new community through the correlative number given in the list.

The communities selected are fifteen: Bomadu coloni, Devarapura coloni, Edathore coloni, Jangal hadi, Jangal hadi coloni, Karehadlu, Kllathmadu coloni, Kluthodlu, Lakunda, Mukthara coloni, Nayimanne, Neharu coloni, Ramacoloni, Rashmehadlu, Thatekere, Thate-kurubara (Figure 11). The main characteristics of these communities are summarized in Table 5.

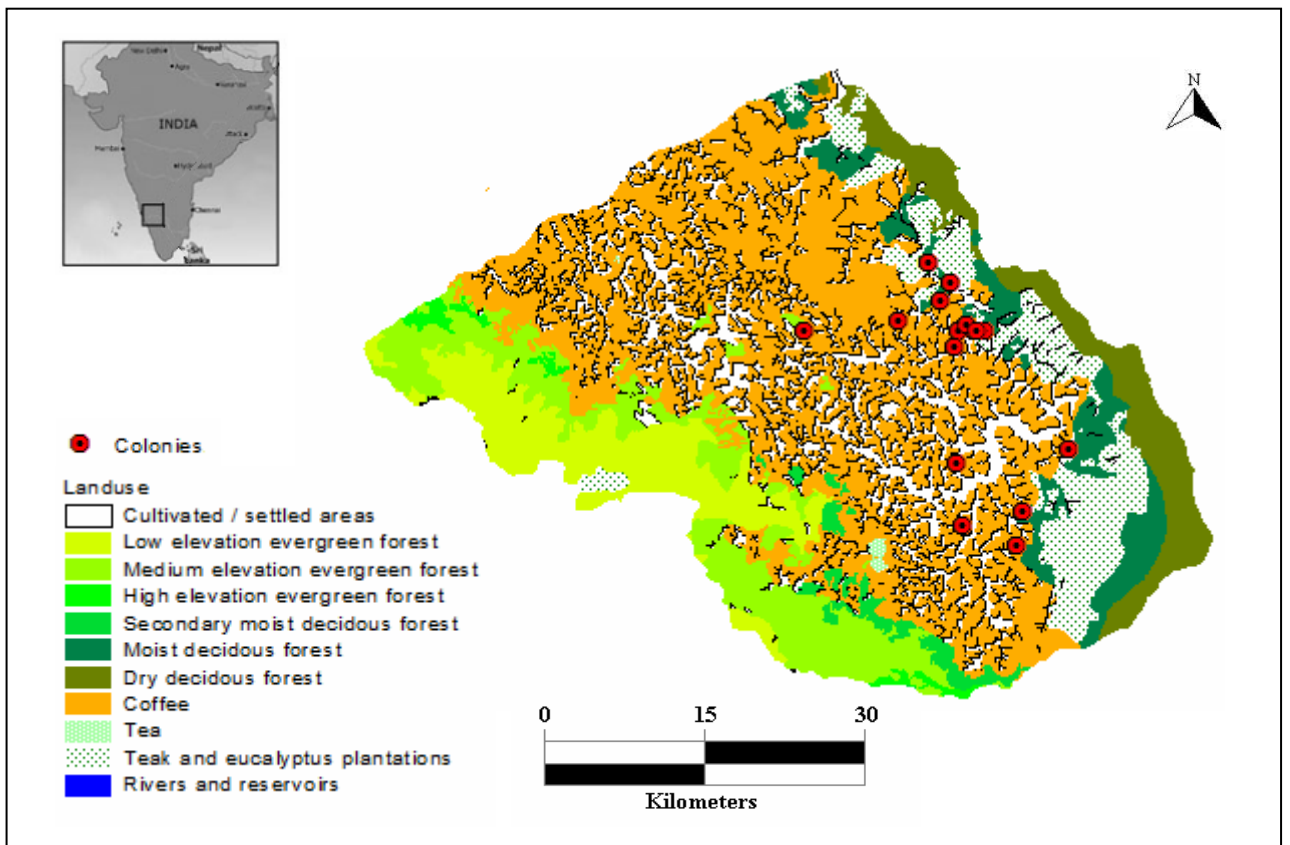


Figure 11. Map of selected communities for the study.
Source: Adapted from French Institute of Pondicherry GIS.

Table 5. Communities description: basic characteristics of location from the forest, number of houses and inhabitants, and present *jatis*.

Community	Panchayat	Location	N° of houses	Popu-lation	<i>Jatis</i>	Sources of information
Rasmehadlu	Thithimathi	Inside forest	127	595*	ST (yerava, jenukuruba and bettakuruba)	Panchayat, leader
Bommadu	Nalkerri	Border	127	501*	ST (jenukuruba)	Panchayat, Pre-school
Devarapura	Devarapura	Border	150	350^	ST (jenukuruba, yerava and bettakuruba)	Panchayat, leader
Jangal Hadi & Jangal Hadi coloni	Thithimathi	Inside forest/Border	86	344*	ST (jenukuruba, yerava) and SC (panika)	Panchayat, Pre-school
Karehadlu	Devarapura	Inside forest	138	300^	ST (jenukuruba, bettakuruba, harijana, yerava), SC and OBC	Panchayat, Pre-school
Thatekere	Nittur	Border	41	190*	ST (jenukuruba)	Pre-school, leader
Mukthara	T.Shitigeri	Outside forest	33	150*	ST (yerava), SC (parivaras and others), OBC (malayalis)	Panchayat, leader
Neharu coloni	Devarapura	Border	23	132	ST (yerava and bettakuruba) and SC	Panchayat, Pre-school
Nayimanne	Thithimathi	Outside forest	34	124*	ST (yerava, jenukuruba and bettakuruba)	Panchayat, Pre-school
Lakunta	Kanur	Outside forest	28	112	SC, ST (yerava and jenukuruba), christians and muslims	Panchayat, Pre-school
Kallathmadu	Kallathmadu	Outside forest	17	78	ST (yerava) and SC	Pre-school
Edathore	Thithimathi	Outside forest	10	36*	ST (yerava), muslim and OBC (malayalis)	Panchayat
Ramacoloni	Kanur	Outside forest	15	35	ST (yerava), SC and other caste	Panchayat, Pre-school
Kluthodlu	n.i.	Outside forest	12	25	ST (yerava)	Only field observations
Thatekurubara	n.i.	Inside sacred grove	5	20	ST (bettakuruba)	Only field observations
Total			846	2994		

Note: the numbers of population and households are approximate as the source was mostly orally, some of them based on census of 2007 (^) and census of 2009 (*). Those numbers that are in cursive mean that are extrapolated from the direct field observations or from the informants.

Abbreviations: ST (Scheduled Caste); ST (Scheduled Tribals); n.i. (No information)

In each selected community we selected the households to be interviewed at random. To select the houses the community was divided by two different areas, where in each area worked one researcher and one translator. Each of these two teams did the same protocol: starting with the first house of their area through a random selection (with a probability of 0.75 of selection) the house was selected or not. If the house was not selected the team went to the next one to do the same process, repeating until a house would be selected. If nobody was there, or they were not accomplishing the criteria or they didn't want to be interviewed, the team would select the next house and would try to find there an informant. This procedure will be repeated until find an individual.

To select the informant they should accomplish certain criteria: be older than 16 years old and be a member of the selected household. When the household was selected, the interviewers asked for a member of the household that accomplished the mentioned criteria and was willing interviewed in that moment. If more than one volunteer was available, we selected the person to be interviewed by flipping a coin.

The minimum size of the sample was determined by statistic criteria, according to the objectives. As our model uses eight different variables, the sample should have a minimum of 15 cases for each variable; therefore globally the sample should compile a minimum of 120 individuals. In total, our sample included 187 informants, thereby exceeding the minimum and leaving leeway enough to build the final model.

According to the demographic data shown in Table xx, our sample would represent a 6.25% of all the population of these communities. As every survey was done in a different household, the sample would represent the 22.10% of the all the households.

3.3. Methods of data collection

We collected data during January–April 2010. Data collection methods included questionnaires and exploratory ethnographic interviews. Moreover, during the development of the fieldwork we added interesting direct field observations. We conformed two research teams working independently in the field. Each team (see Photograph 1 as example situation) worked with a translator from English to Kannada (Karnataka’s official language) who had previous experience in this kind of research and in the area.

Photograph 1. Developing the questionnaire (informant, translator and researcher).



The **questionnaire** (Appendix 2) was divided into three different sections: 1) socio-economical and demographical variables, 2) ecological knowledge test and 3) use test. The creation of the questionnaire and the justification of how we would approach the variables is explained in the following subsections. Previous to the administration of the questionnaire, we tested all sections in a different sample in order to know whether the questions were understandable (by the informant and the translator), captured the expected information and were ordered in a conformable and correct way.

To select the natural resources for our knowledge and use tests we used a previous database that contained natural products of the area locally used (Zamora 2009). Results from this previous study classified the natural products locally available into different categories. Based on this information, we have randomly selected resources from each category. After collecting information on the available ecological information and testing the questionnaires, we selected the following natural products for the interview: mango tree, *mara genasu* (local name, also is known in other parts of the world as cassava), coffee, coconut tree, pepper, bamboo and soap nut.

The questionnaire was complemented with **ethnographic interviews** used to understand other gaps and the overall context. Whereas the questionnaire was asked to the people from the communities, the interviews were done to the leaders of these communities and their pre-school teachers; the local authorities (*Gram Panchayat*); the officers of the governmental institutions (Tribal Welfare Office and Social Welfare Office); and local non-governmental organizations (Coorg Organization for Rural Development-CORD and IBRA).

a. Dependent variable: Approach to evaluate Ecological Knowledge

The evaluation of the level of ecological knowledge was carried out through a set of questions about general knowledge of the selected natural resources. The questionnaire provides the individual level of EK of every sample informant. To capture variability in knowledge among informants, we designed the questionnaire with questions with different level of difficulty.

The structure of the questionnaire consists in a) one question about identification through a graphical material (recognition of the seven natural products showing pictures) and b) three questions about ecological or morphological attributes. For instance, we asked about seasonality: “*In which season soap nut flowers?*”; or morphological features: “*How are pepper leaves disposed? [Alternative or Opposite]*”. Thus, to approach the ecological knowledge of each product we have done 4 questions. Altogether the questionnaire on ecological knowledge includes 28 questions (see Appendix 2, ecological knowledge section).

The questions were design based on a previous literature review of the ecological characteristics of the area and specially focused on the selected natural products (see below summarized ecological characteristics on *Ecology of each product* on Results section). Also the direct field observations have complemented this information.

b. Explanatory variables: Approach to evaluate the use of the NR

Figure 12 represents the material flows and characteristics (see Introduction section) of the interaction between the informant and the nature fragment (proxied as one of the seven selected natural products). We detected that the informant has the following flows: 1) inputs such as collection or other actions (*e.g.*, bought from the market or exchanged with the neighbor); and 2) outputs such as commercialization or consumption. As all the considered flows are actively done by the informant, we call them indistinctly flows or actions.

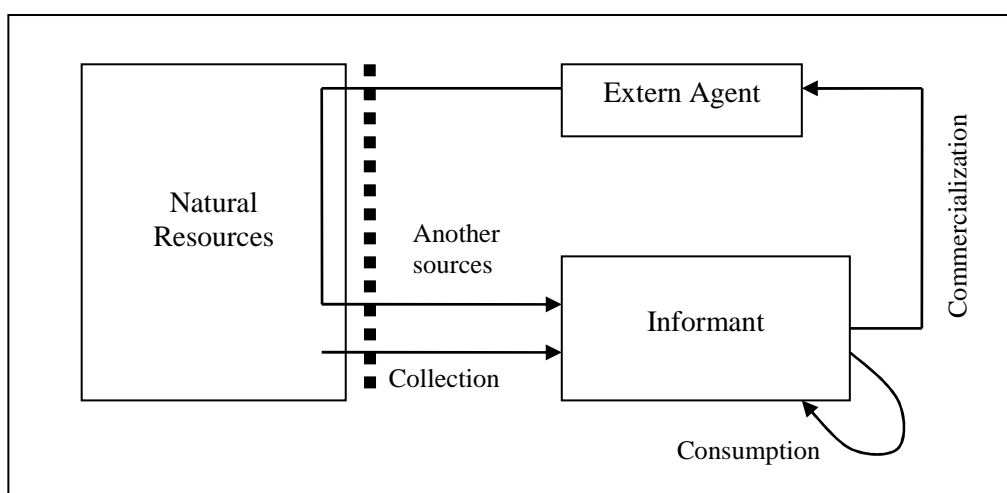


Figure 12. Diagram of material flows between the informant and the natural product.
 Note: The external agent should be understood as people (other than the informant), economical institutions (market) and other institutions (as government).

The use was captured through: i) quantitative parameters that approach the explanatory variables of the multivariate model; and ii) qualitative parameters to understand the interaction and describe the flows detected. Table xx summarizes the parameters captured to approach both quantitative and qualitative parameters.

First, to evaluate the use of a natural product, we considered only two key actions (consumption and collection). We did not consider quantitatively the other flows, because they are interdependent, *e.g.* to commercialize bamboo one would first need to collect bamboo; or the purchase of mangos in the market would be reflected on the posterior consumption. To modelize all these complex interactions we should carry out a list of questions (approaching all the actions quantitatively and separately) that would be so long for the questionnaire and uncomfortable for the respondent. Thus, finally we approached the use with two integrated

indexes of both actions, which indirectly contemplates the others. Consumption was proxied by the number of uses of each natural product; whereas collection was proxied by the frequency of collection (number of times a person goes to collect a given product).

Second, to characterize the “use” we did a description of the source and purpose of both actions (consumption and collection). For collection: 1) there were three possible collection places (forest, houseland or coffee estates); 2) the purpose of collection would have three possibilities: consumption, sale or wages. For consumption: 1) the source could be from buying the product or collecting it (the informant or other member of their household); 2) the purpose of consumption is equal to the consumptive uses that they do with the product.

Table 6. Variables to capture quantitatively and qualitatively the “use” of NR

Concept	Parameter used	Valor	Variable
Consumption	Number of different uses	0-33	Continuous
Collection	Frequency (T.T ⁻¹)	0-∞	Continuous
<hr/>			
Consumption			
Purpose	Types of use	txt	Categorical
Source	Collected by informant*	0/1	Categorical
	Collected by household’s member	0/1	Categorical
	Bought	0/1	Categorical
Collection			
Purpose	Self-consumption*	0/1	Categorical
	Commercialization	0/1	Categorical
	Work (wages)	0/1	Categorical
Source	Place of collection	-	Categorical

Note: highlight that both questions captures the same.

To capture information on all the parameters presented in Table 6, we asked 12 questions. The list of questions is the same for each natural product (see below Table 7, to see all use questionnaire section address to Appendix 2).

Table 7. Questions applied to capture the use variables. Where XX represents the name of each natural product asked about.

Action	Concept	Questions
Consumption	Purpose & Index	<i>What is XX used for in your house? (Do you use for anything else?)</i>
Consumption	Source	<i>In the last year, did you ever buy it?</i>
Consumption	Source	<i>In the last year, did you ever collect it?</i>
Collection	Source	<i>In the last year, where did you mainly collect XX from? (Options: from the forest, the plantation, houseland and/or other places)</i>
Collection	Purpose	<i>In the last year, what did you mainly do with the XX collected? (Options: consumption, to sale and/or to get wages)</i>
Collection	Index	<i>During the last year, when did you mainly collect XX it? (Options: All over the year, rainy, winter and/or summer season)</i>
Collection	Index	<i>During that mentioned period, how often did you go to collect it?</i>
Collection	Source	<i>In the last year, some other members of your household collect it?</i>

c. Control variables

We also administrated a set of questions to capture variables that can influence our dependent and explanatory variables.

First, we considered control variables referred to the natural resources perceived abundance and access. Because knowledge and use of natural products are conditioned for the possibility of accessing to these natural products and for their abundance, we collected information (presented below on Table 8) on those two variables. The access has been proxied as legal access to collect in the forest (the license to collect some of the forest products is managed by LAMPS Society and for this reason is also called LAMPS license) and the legal access to own land (they call *patta* of the land, when they have the papers, in other words, land rights).

Table 8. Control Variables: abundance and access to NR.

Concept	Parameter used	Valor	Unit	Variable	Contribution
Access					
Legal Antecedents	Land <i>patta</i>	0/1	-	Categorical	+
	LAMPS license	0/1	-	Categorical	+
Abundance					
Actual	Perceived scale	1- 4	-	Categorical	+

Also we have taken into account the following general control variables: **age, sex, caste, income, education** and **location**. To capture age, when the informant didn't know his/her exact age (often it happened with the old people, but also among youth) we asked for the age of their relatives. For instance, we asked "*How old is your eldest son/daughter?*", if they didn't know we asked for the age of other relatives (as the eldest grandchildren) and by this comparisons we calculate their approximate age. The caste group was captured through the classifications of the *jati* reported by the informants. For income we considered the household income as the amount of Rupees that the household got during the month prior to the interview. To evaluate the education we asked the maximum school grade completed and after that we have used an indicator only between schooled and unschooled people.

The location of the community in relation to the forest was other control variable. We difference three types of locations, classifying the communities as: those inside the forest, those in the border and those outside the forest. Although this variable is interesting because links with the environment of each informant, it does not capture the heterogeneity of cases inside each community.

3.4. Methods of data analysis

a. Construction of variables

Ecological knowledge

Each knowledge questions was punctuate as 1 (correct or true answer) or 0 (incorrect or false answer). Responses were found checking ecological literature (Sharma 2006, BIOTIK, 2010; Stephens 2009; Chan et al 2006; Bally et al 2006; and NMBA 2010). For each natural product, we then constructed an Index of Ecological Knowledge by adding responses to four questions (see eq.1). Finally we constructed an overall index of ecological knowledge by adding the total of each product (see below eq.2).

$$EK_{natprod,i} = I_{natprod,i} + Q1_{natprod,i} + Q2_{natprod,i} + Q3_{natprod,i} \text{ (eq.1)}$$

Where (and also for the next equations): *i* represents the informant; *natprod* the natural product (mango, mara genasu, coffee, coconut, pepper, bamboo or soap nut); *I* the identification question; and *Q* the questions on ecological or morphological attributes.

$$EK_{total,i} = \sum EK_{natprod,i} \text{ (eq.2)}$$

Thus, ecological knowledge of each product ($EK_{natprod,i}$) ranges between 0 and 4 and as there are seven natural products, the overall Index of Ecological Knowledge ($EK_{total,i}$) ranges from 0-28.

Consumption index

To configure the consumption index per each natural product we used eq.3. We have taken into account the maximum uses ($n^{\circ}uses_{max}$) that can have each natural product (according to the total uses said by all the informants). Each natural product would have different number of maximum uses: some products only have one use whereas other products have 10 different uses (uses are reported on Results section, Table 9). The individual Consumption Index is the proportion between the number of uses said by the informant in a given interview and the maximum number of uses that could be mentioned. We created the overall Consumption Index for each individual (eq.4) adding the indexes of the seven natural products. The indexes follow the expressions:

$$ConsumptionIndex_{natprod,i} = \frac{n^{\circ}uses_i}{n^{\circ}uses_{max}} \text{ (eq. 3)}$$

$$ConsumptionIndex_{total,i} = \sum ConsumptionIndex_{natprod,i} \text{ (eq. 4)}$$

The individual Consumption Index of each product ($ConsumptionIndex_{natprod,i}$) ranges between 0-1. The total Consumption Index is the result of the sum of all seven indexes, therefore it ranges from 0 to 7.

Collection index

As the number of collection days was usually much lower than the maximum or potential days, the proportion would show numbers very low and concentrate. For this reason we don't use finally the same procedure as the consumption index to capture the Collection Index. Our aim is to understand how the collection can be associated with the ecological knowledge, we need to understand the variability of these variables. Thus, the Collection Index created is based on a division (by quartiles) of the number of collected days. For each natural product were established five categories of collection and were punctuated: no collection (punctuated as 0), low collection (first quartile, punctuated as 1), medium-low collection (second quartile, punctuated as 2), medium-high collection (third quartile, punctuated as 3) and high collection (fourth quartile, punctuated as 4).

The Collection Index per each natural product ranges from 0-4. The overall Collection Index is calculated as the addition of the individual collection index of all natural products and ranges from 0 to 28.

b. Estimation strategy

We consider total ecological knowledge (EK) as dependent variable and the consumption and collection acts as explanatory variables. To analyze their relationships we ran a bivariate analysis (first between binary variables and second through Pearson correlation) between: EK-consumption and EK-collection.

Secondly, we ran multivariate regressions through an Ordinary Least Square (OLS) model. The multivariate analysis (eq.5) consists in a linear regression model that allows to estimate associations between i) the dependent variable, Ecological Knowledge, ii) the explanatory variables, Collection and Consumption, and iii) a set of control variables. In our case, we consider as a control variables: age, gender, household income, education and house material. Finally we create clusters depending on the caste of the people (Scheduled Caste, Scheduled Tribals and Other Backward Castes) due to produce estimates for unstratified cluster-sampled data.

Generally, our model fits the following mathematical expression:

$$EK_{total,i} = \alpha + \gamma CollectionI_{total,i} + \lambda ConsumptionI_{total,i} + \psi C_{total,i} + \varepsilon_i \text{ (eq.5)}$$

In the model, $EK_{total,i}$ captures the overall Ecological Knowledge Index of the individual i . $CollectionI_{total,i}$ refers to Collection Index of the individual i . $ConsumptionI_{total,i}$ captures the Index on Consumption of individual i . C_{ic} captures the set of control variables included in the

model. Last, ε_i refers to unexplained value or random error term. α , γ , λ , and ψ are the coefficients estimated with the regression model. We expect that people who collected and consume more would have a higher ecological knowledge.

Finally, we did a robustness analysis changing the control variables applied on the model and observing the coefficients of our explanatory variables.

The creation of database has been done on Microsoft © Office Access (2003). However, the results have been created through data analysis and statistics software: Intercooled STATA 9.0 for Windows (2005). We used STATA for data analysis, data management and graphics. The program works with data-management commands that allowed us to combine and reshape datasets, manage variables, and collect statistics. Thus, bivariate analysis and multivariate analysis has been done through this statistical software. The results also have been complemented with Microsoft © Office Excel (2003) due to draft the majority of the tables and some of the graphics.

3.5. Possible bias

Results from our study can be affected by plausible biases and caveats that could be related to a) translation process, b) participation of the people, c) specifically sight problems for ecological knowledge section, d) measurement error of dependent and explanatory variables, omitted variables and possible reverse causality.

a. Translation process

To data collection was based on self-report methods, therefore a clear communication with informants was essential. Every question on the survey was explained by the researcher (in English) and the translator was communicating the question to the informant (in Kannada). The same process was done for the answer, due to compile all the answers directly in English and the same format. To standardize and facilitate the translation process, before the starting of the data recompilation each question was analyzed and explained to the translators.

However, the translation process could restrict or bias the communication with informants. From translation we could have two different possible biases. First, possible divergences between the two translators in the answers given by informants (could capture differently what should be the same answer). Second, as a translation always appears the possibility to have a mistake during the process. We tried to minimize these biases through i) previous the data collection we did good training on the questionnaire in order to be understood by the translators the exact sense of the question and (possible) answer, ii) during the data collection, exchanging the translators between the research teams, and iii) carrying out processes of revision and

discussion about the data collection during the fieldwork. However errors generated during translations might still affect our data.

b. Participation of the people

Sample selection was conditioned by the possibility to find people inside the communities, as we discarded the possibility to carry out the questionnaire on work places (mainly, coffee plantations). Thus, we can establish two main factors that have determined the selection of our sample on the communities: availability and acceptance of the respondents. Availability was mostly affected by the working activities and our field timetable. As the interviews were carried out on the peak of the harvesting season of coffee and after pepper (February to April), and many workers were on the coffee plantations during all day (approximately from 8 to 18hr). Thus, on the communities during that time we could find mostly non-employed people (women taking care of their children and old people) or just this day they had problems for working.

To minimize bias on the selection of participants, we tried to expand our timetable to cover all the possible stratus of population. Also we tried to visit the communities on their holidays days, were more people could be there. However, interviewing in afternoons and on holidays, presented problems: some people were not available because they have house care (cooking, washing clothes...), some people had serious problems with alcoholism (mainly men) and some people were not at home because they went for shopping to the market town (mainly during holiday). The other possibility was to change the period of data collection avoiding the peak of harvesting coffee. However, during the rainy season (the monsoon) the fieldwork becomes more dangerous and the communities can be inaccessible. After, during the winter season the workers are also harvesting (in paddy fields) or working on the coffee plantations (*e.g.*, cutting herbs).

About the acceptance, this was mainly related to each particular situation. Some people didn't accept to be interviewed, generally, when they were shy or scared people (mostly young women) and in situations of drunk persons going around.

c. Biases related to graphic materials

To evaluate individual ecological knowledge, we have carried out a set of questions using graphic material. In general, the problem with photographs lies with the ability of the participants to link abstract images to reality. Photographs are strictly visual, without other characteristics such as roughness or odors. We detected that responses to EK questions could suffer from two possible biases First, the people could have some sight problems and be more difficult the recognition process. Second, some of the people are not used to see and to interpret the graphic materials such as pictures or diagrams.

An ethnobotany study in Bolivian Yuracaré and Trinitario communities (Thomas et al, 2007) showed that more plants were recognized through color photographs than through voucher

specimens, therefore demonstrating the usefulness of photographs. However, other studies (Reyes-Garcia et al, 2003) have argued that in the case of Bolivian Tsimane' people had difficulties identifying objects through pictures.

To minimize this bias, we print good quality and color photographs of fresh material, plasticized to be durable. Also we codify in the answers questionnaire those people with sight problems.

d. Other possible biases

First, our indexes might suffer from random measurement error. For instance, it is possible that some people may not have understood some of the questions used to construct the Ecological Knowledge Index, or gave responses at random. Random measurement error in the explanatory variables would produce an attenuation bias and make the estimates more conservative.

Second, our estimations may be biased by the role of omitted variables. For example, previous research has pointed at the association between EK and distance from cities (Begossi 1996). It is possible that EK are influenced by this relation, but unfortunately we did not collect data on the topic. Failure to control for this or other variables that influence EK and use might bias our estimations in an unknown magnitude and direction.

Third, we do not have convincing instrumental variables to control the model. For this reason, we limit our discussion to the association between EK and use, without speak about causality.

4. RESULTS

4.1. Descriptive analysis

a. Sample description

The main characteristics of the sample are summarized below in Table 9. We have taken into account the standard variables to describe a human group such as age, gender and income, but also we have incorporated socio-cultural, educational and environmental aspects. The sample has a representation of individuals of different ages and gender. The average age is 39.65 ± 16.14 years old, ranging from 16 until 85 years old. The sample is more concentrated on the first thirty years (at 46 years, the accumulated frequency is 70%) than the next forty years (thereby from 46 years until 85 years only represents the 30% of the sample). The explanation about this stratification also requires considering the local life expectancy at birth¹⁵. We should point out that the share of females (58.29%) is larger than the share of males (41.71%), but as the percentage difference is less than 20% we consider our sample representative in gender aspect. Monthly household income ranged from 0 to 150.000Rs/household, with an average of 7,807 Rs/household¹⁶. We can identify predominance of two *jatis*: jenukuruba and yerava. People from those two *jatis* (both are scheduled tribes) together represent more than 75% of the sample. For this reason the descriptions given previously (see Context section) of these social-cultural groups would be noticeable to interpret the results. About 53% of our sample had never gone to school, a notable percentage. The 62% of our sample lived in solid houses, whereas the remaining 38% lived in huts or mixed houses.

Finally, due to the importance of understanding the links between humans and nature for the purpose of this work, we also collected data on the provision of livelihoods from nature. We understand that –in the study area- this supplying is through farming and harvesting. For this reason, here we describe the agricultural land surface, the livestock activities and the location of the communities related to the forest. About half (51.6%) of our sample lived inside the forest, 23.7% in the border and 24.7% far from the forest¹⁷. The average of agricultural land is almost 1 acre/household¹⁸ (0.978 acre) and the 61.5% of the sample owned one or more livestock. Thus, forest presence, agriculture and farming activities would have an important role. However, only the 6.04% of the sample had license to collect forest products and only the 11.60% had *patta* of

¹⁵ The life expectancy on 2001 in Kodagu was 63,3 years old (Census, 2001). However, this data (the only available) is from nine years ago and about all Kodagu, therefore doesn't capture the case study reality.

¹⁶ The average ratio of exchange on February 2010 was 1 Euro : 63,4291 Rs. www.x-rates.com

¹⁷ These data would provide the control variable of Location (related to the forest).

¹⁸ One acre is equitable to 4047m².

their land (land rights). We suppose that more people is collecting or cultivating, therefore the legal access not always would be the excluding factor for these activities.

Table 9. Sample description: basic characteristics (demographical, socio-cultural and environmental).

Variable	Qualitative description	Average or %
<i>Age</i>	In years	39.65 ± 16.14
<i>Household income</i>	Average of salary per household the last month (Rs)	7,806.91 ± 12,008.79
<i>Schooling</i>	Maximum educational level finished at the school (standard course)	2.72 ± 3.58
<i>Agriculture</i>	Average of agricultural land surface (acres)	0.978 ± 1.382
<i>Gender</i>	Sex of the person	Male 41.71 % Female 58.29 %
<i>Jati</i>	Scheduled Tribals (S. T.):	jenukuruba 47.59 % yerava 30.48 % bettakuruba 4.28 % girijsana 0.53 %
	Scheduled Caste (S. C.):	harijsana 3.74 % nayakaru 2.14 % parivara 2.14 % Others SC 2.14 % panika 1.07 %
	Other Backward Castes (O. B. C.):	malayalis 4.28 % barber 0.53 % gowda 0.53 % tulujana 0.53 %
<i>Educational levels</i>		None (unschooled) 53.01 % Primary school (1st - 4th) 17.49 % Medium school (5th - 7th) 15.85 % High school (8th - 10th) 10.93 % Pre-university studies (11th - 12th) 2.73 %
<i>Illiteracy</i>	People unable to read a simple sentence in <i>kannada</i>	72.28 %
<i>House type</i>	Households by type of structure:	Solid houses 62.01 % Mixed materials 10.61 % Huts 27.37 %
<i>Location</i>	Closeness to the forest:	% of informants living inside the forest 32.80 % % of informants living in the border of the forest 42.47 % % of informants living outside the forest 24.73 %
<i>Legal access</i>	Access to the forest (% of informants that have LAMPS license)	6.04 %
	<i>Patta</i> of the land (% of informants that have rights for their cultivated land)	11.60 %
<i>Livestock farming</i>	Livestock (% of informants that own one or more animals)	61.50 %

b. Relationships between sample variables

The analysis by pairs of some of the main variables control variables that describe the sample provides useful information to better understand the context and the possible linkages. In this sense, we can observe that income variable varies considerably across the different socio-cultural stratification between different groups (*jati*). For instance, has been reported a medium household income of 7607 Rs for Jenukurubas, 9286 Rs for Yeravas and 5343 for Bettakurubas. The cause of this fact might be more conditioned by the social distribution of the employment (each kind of employment with different income) between *jatis*, than a different income. But this question should be revised with a deeper analysis.

About educational aspects, when we analyze the level of scholarization by gender, a remarkable difference appears: whereas the 44% of the men are unschooled, the percentage increases up to 60% when we refer to women. Also the distribution between educational levels (here divided into primary, medium school, high school and pre-university studies) shows differences socio-culturally. For example, nobody from the most common caste (jenukuruba) was reported with pre-university studies, whereas we reported some cases in jerava, but also in minority's *jatis* such as parivara and harijana.

Finally, we observe that as more close are from the forest, larger is the land surface and the livestock (Table 10, note that in both cases are statistically significant). Thus, contrary to what we would expect people living inside the forest have more land surface than people living far from the forest, respectively 1.4 and 0.3 acres on average. The same happens with livestock, where we can see that the proportion of people that has livestock (at least one animal) is: 77.1% inside the forest, 53.2% in the border and 54.4% far from the forest. Also an interesting relation is found between the kind of houses and the closeness to the forest: as far is the house from the forest, more permanent (with solid materials) is the house (note on Table xx that the relation is significant and have a noticeable coefficient of 0.58). At the same time, as close to the forest more temporal are the houses.

Table 10. Statistical relationships among control variables. (Tested with Pearson correlation)

Variables		Statistics
Schooling	Gender	0,16**
Land surface	Closeness forest	-0,44***
Livestock	Closeness forest	-0,30***
House material	Closeness forest	0,58***

Note: * $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$.

c. Product description

c.i) Ecology of each product

Table 11 summarizes the main ecological features of the natural resources considered on the sample: mango (*Mangifera indica*), mara genasu (*Manihot* sp.), coffee (*Coffea robusta*), coconut (*Cocos nucifera*), pepper (*Piper nigrum*), bamboo (*Bambusa bamboos*) and soap nut (*Sapindus laurifolius*). Graphical information about all of them on their local environment is provided in Annex 3.

Table 11. Description of the natural products characteristics.

Scientific name	Description
<i>Mangifera indica</i>	Large spreading and evergreen tree attaining a height of 10-25m. The leaves are dark green, elliptic or lanceolate and somewhat leathery. The small pinkish-white flowers are borne in large panicles. The fruit is a large ovoid-oblong drupe, yellowish green to red in colour when ripe. The seed is large, ovoid-oblong, compressed and non-endospermic.
<i>Manihot</i> sp.	Shrubby perennial that grows to a height of 6-8 feet. It has smooth erect stems that contain a soft white pith and have nodes from which new plants are obtained. The large compound, dark green, reddish veined leaves are palmately divided into about seven leaflets. The roots, which are the most valuable portions of the plant, grow in clusters of 4-8 at the stem base.
<i>Coffea robusta</i>	Perennial shrub or a small tree. The leaves are opposite, ovate and with undulate margins. The white flowers are borne in dense axillary clusters. The fruit (called cherries) grows in clusters tightly bunched on a very short stem in the axil of the leaves on the youngest branches.
<i>Cocos nucifera</i>	Trunk of 40 to 60 ft. high with a crown of large feather-like fronds. The leaves (fronds) are from 6 to 15 ft. long or somewhat more, leaflets 2 to 3 ft. long, linear-lanceolate, leathery, widest at the base with a sacking like tissue attached to the margins. The flowers arise between the leaves, protected by a boat-shaped sheath (spathe) when in bud; male and female flowers are mixed in the same inflorescence. The fruit is a drupe is egg-shaped or rounded. The seed or nut is surrounded by a dense protecting layer of coir and an external waterproof skin.
<i>Piper nigrum</i>	Weak trailing shrub, attaining a length of 9 meters. The swollen nodes produce adventitious roots, leaves and axillary buds. The roots enable the plants to cling to the support. The leaves are simple, alternate, ovate and dark green. The minute white flowers are borne on dense spikes. The fruit is a one-seede spherical drupe.
<i>Bambusa bamboos</i>	Gregarious. Flowers at long intervals 40-60 years and the clump/plant dies after flowering. The culm is up to 30 metres tall, cylindrical, dark green, erect, strong and hollow. Typical from moist deciduous forests up to an altitude of 1000 metres.
<i>Sapindus laurifolius</i>	A moderate-sized semi-deciduous tree. The leaves are compound paripinnate. Flowers are small in terminal panicles covered with a rust-coloured down. Fruit composed of a 2 to 3 lobed fleshy drupe clothed with a rust-coloured down when young, and much wrinkled when dry.

References: Sharma 2006; BIOTIK, 2010; Stephens 2009; Chan et al 2006; Bally et al 2006; NMBA 2010.

c.ii) Uses

The consumption uses of the natural products are exposed below (Table 12). We observe that some products are reportedly consumed by all the people in the sample (mango and coconut) (see below Table 12, the first row of each product); some others are consumed for more than 90% of the people (mara genasu, coffee, pepper and bamboo); and finally, one product is consumed by less than 20% of the people in the sample (soap nut).

Otherwise, when we ask specifically for the uses of each product we could find more diversity on the answers. In Table 12 we can see the frequency of use (times that is mentioned each use) and a brief description of each one. Through the frequencies we can observe that the most mentioned uses are related to food and religious uses. Although specific uses of each natural product are also outstanding. For example, for pepper the predominant use is medicinal leaving on second position the food function; for bamboo is construction (also followed by food use); and for the soap nut, washing is the first use.

For further information on the uses description (graphic material captured during fieldwork) see Appendix 3.

Table 12. Consumption and uses of selected natural product: percentage of consumption, frequency of use and description of the uses.

Concept	Valor	Unit	Use description
Mango consumed	100	%	
Uses of mango mentioned*			
Use 1 Food	187	#	As a fruit, jam, pickle and to prepare <i>samber</i> or curry.
Use 2 Religious	93	#	Mango leaves are used for good auspices during events such as marriages, festivals, <i>pooja</i> and funerals.
Use 3 Juice	5	#	Mango juice.
Use 4 Firewood	5	#	Mango branches are used as firewood.
Use 5 Medicinal	2	#	Medicinal for teeth.
Use 6 Vinegar	2	#	Mango juice is fermented and used to flavor special food such as pork.
Use 7 Agriculture	1	#	Covering coffee roots.
Total's mentions	295		
Mara genasu consumed	97,8	%	
Uses of Mara genasu mentioned*			
Use 1 Food	178	#	Fresh or cook as a chips, boiled, with sugar, <i>samber</i> ...
Total's mentions	178		
Coffee consumed	97,86	%	
Uses of coffee mentioned*			
Use 1 Drink	183	#	To drink.
Total's mentions	183		
Coconut consumed	100	%	
Uses of coconut mentioned*			
Use 1 Food	187	#	To prepare chutney, curry, <i>samber</i> , <i>paisa</i> and other meals.
Use 2 Religious	159	#	Worship god offering coconuts (this ceremony is called <i>pooja</i>).
Use 3 Drink	10	#	'Coconut water' (inside the shell).
Use 4 Broomstick	8	#	With the central nerve of the dried leaves.
Use 5 Firewood	7	#	Mainly using the dried leaves.
Use 6 Oil	7	#	Coconut oil extracted and applied on the hair.
Use 7 Ornaments	5	#	Leaves used as ornaments on marriages, festivals and funerals.
Use 8 Construction	2	#	Covering the roof directly with dried leaves, handmade walls, doors, ...
Use 9 Protection	2	#	Protecting from the sun plants and as a shelter for animals.
Use 10 Fertilizer	1	#	Fertilizer.
Total's mentions	388		

Pepper consumed		96,26	%	
Uses of pepper mentioned*				
Use 1	Medicinal	160	#	For cough, cold and fever. Also ointments and hair fall.
Use 2	Food	140	#	To prepare curry, <i>samber</i> , special food (such as pork) and others.
Total's mentions		300		
Bamboo consumed		95,19	%	
Uses of bamboo mentioned*				
Use 1	Construction	172	#	To build houses (walls, roof and beams), fences, and stairs.
Use 2	Food	152	#	Young branches that grow on rainy season. Bamboo rice in flowering periods.
Use 3	Firewood	25	#	Bamboo branches as firewood.
Use 4	Religious	23	#	To build objects used on funerals, festivals and marriages.
Use 5	Handicrafts	6	#	Handicrafts, boxes, furniture, baskets...
Use 6	Artistic	2	#	Different kinds of artistic objects.
Use 7	Tools	1	#	Adding rollers down a bamboo branch and driving it.
Total's mentions		381		
Soap nut consumed		17,11	%	
Uses of soap nut mentioned*				
Use 1	Wash clothes	19	#	Preparing soap from the fruit to do the washing.
Use 2	Wash jewellery	9	#	Cleaning the gold, silver and other ornamental objects with Soap nut fruit.
Use 3	Medicine	7	#	Fruit applied for skin diseases (ointment), for cold and also as a medicine for animals.
Use 4	Wash dishes	7	#	Preparing soap from the fruit to wash vessels and dishes.
Use 5	Hygiene (bath)	4	#	Preparing shampoo and soap with the fruit.
Total's mentions		46		

* Note that the sample is composed by 187 persons, but each informant could say more than one use for each product. For this reason the uses are presented in frequencies (noted as #) instead of percentages.

We refer natural product "consumed" as the percentage of people that were consuming this NR (at least, one use reported).

c.iii) Sources of natural resources

There are two factors: agent (collector) and source. The collector could be the informant or some other member of his family; the source could be the market or the nature. From this basis, we consider three different sources from which a person could obtain any of the products before: 1) through commercial exchange (buying the product); 2) through collection carried by the informant itself; and 3) through collection done by some other member from the household. Table 13 shows the frequencies of the sources for each product, through tables that combine collection (by the informant) with the two other sources. For instance, mango was not collected and bought either by 21 informants; was not collected and bought by 25 informants; was not bought but yes collected by 122 informants and was both collected and bought by 19 informants; etc. There are various combinations and usually the main source of each natural product varies across them (see bold numbers in Table 13).

Table 13. Sources of each natural product: bought, collected by the informant or collected by some other member of the household. Combinations of frequencies.

Natural Product	Collected (informant)	Bought		Collected (household)	
		<i>no buy</i>	<i>buy</i>	<i>not collected</i>	<i>collected</i>
Mango	<i>no collect</i>	21	25	17	29
	<i>collect</i>	122	19	30	111
Mara genasu	<i>no collect</i>	16	115	120	11
	<i>collect</i>	36	15	13	38
Coffee	<i>no collect</i>	6	44	23	27
	<i>collect</i>	44	93	20	117
Coconut	<i>no collect</i>	12	149	126	35
	<i>collect</i>	8	18	16	10
Pepper	<i>no collect</i>	49	36	25	60
	<i>collect</i>	85	17	37	65
Bamboo	<i>no collect</i>	70	10	31	49
	<i>collect</i>	104	3	41	66
Soap nut	<i>no collect</i>	169	0	160	9
	<i>collect</i>	17	1	10	8

c.iv) Place of collection

A detailed analysis of the places of collection (when the collection is carried out by the informant itself) is exposed graphically on Figure 13 (to see the data to build Fig.13, see Appendix 4, Table. App.i). We categorized the sources of collection as forest, coffee estate (equally of coffee plantation), houseland and others to compare the differences of origin between products. We can group natural products into four categories according to their different origins: 1) products that are collected form the agricultural land (a combination of coffee plantations and houseland) such as coffee and pepper; 2) products that are mostly collected from the own houseland (coconut and mara genasu); 3) products mainly from the forest (bamboo); and finally, 4) products from diversity of origins (as mango and soap nut).

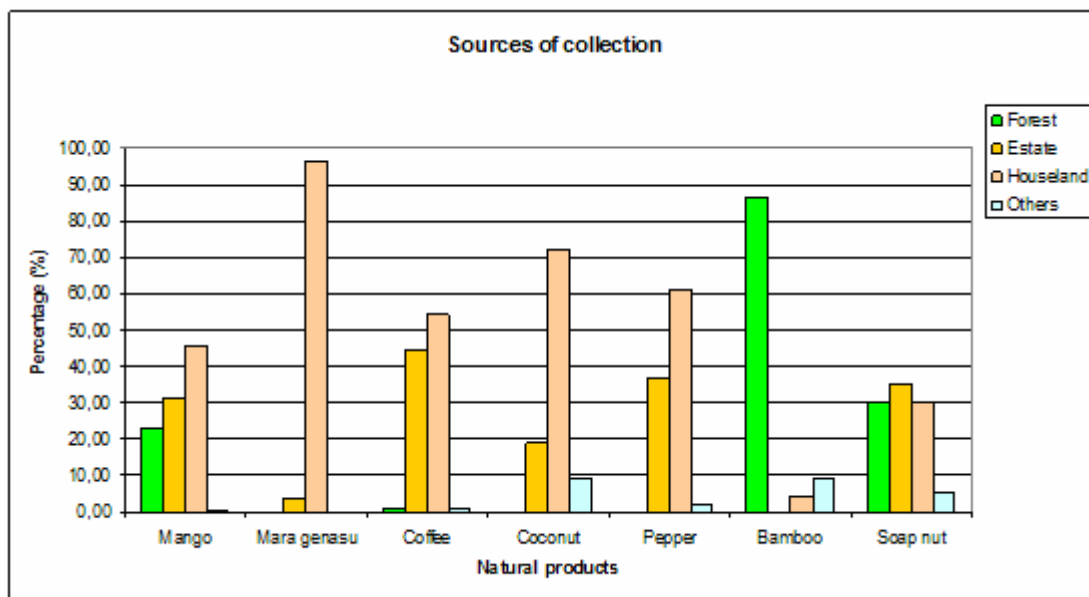


Figure 13. Places of collection of each natural product (expressed in %).

c.v) Purposes of collection

In case of natural products collected from the person, the purpose of the collection was categorized as 1) to consume, 2) to sell and 3) to get wages (Table 14). We observe products that are collected with combined purposes, such as coffee and pepper that have great frequencies on the three categories. The remainder products are mostly used for household consumption. This analysis allows grouping the products into mainly consumption products (mango, mara genasu, coconut, bamboo and soap nut) and commercial-consumption products (coffee and pepper). While the first group is basically either wild products or from local agriculture, the second group is composed by products related to the extensive of Kodagu.

Table 14. Purposes of collection per each natural product (frequencies).

Natural product	Purpose			Total
	Consume <i>(freq)</i>	Sell <i>(freq)</i>	Wages <i>(freq)</i>	
Mango	142	4	0	142
Mara genasu	52	9	0	52
Coffee	76	73	94	138
Coconut	24	1	2	25
Pepper	88	55	51	104
Bamboo	107	0	0	107
Soap nut	18	5	1	20

Note that the sample is composed by 187 persons, but each informant could say more than one purpose for each product. For this reason the purposes are presented in frequencies instead of percentages.

The cases of pepper and coffee are all emphasized as the purposes are distributed and have not a clear main purpose.

Also should be pointed out that is usual to have a combination of purposes of use. For example, the four cases where mango was reportedly collected “to sell”, people also said it was “for consumption”. In the case of commercial products, a diversity of combinations appears (see below Table xx). The 32.6% of the people who collected coffee did so only as a source of wage income; but the 21.0% collected coffee for the three reasons (own consumption, sale and wages); and 19.6% for own consumption and sale. In general, the 55.1% of the people collected coffee for several purposes. Something similar happened with the pepper, although in that case, commercial activities were less frequent and own consumption more frequent. As coffee, a majority of people (the 64.4%) who collected pepper was for multi-purpose aims. This diversity of outputs proves that there is not an only way to be related with these resources.

Table 15. Specific analysis of outputs (combined and separately) for commercial products (coffee and pepper).

Natural product	Purpose of use						
	Mono-purpose			Multi-purpose			
	Consume	Sell	Wages	Consume & sell	Consume & wages	Sell & wages	Consume & sell & wages
	%	%	%	%	%	%	%
Coffee	7,25	5,1	32,61	19,57	7,25	7,25	21,01
Pepper	21,15	1,9	12,5	27,88	13,46	0,96	22,12

c.vi) Grouping natural resources

The analysis of the sources and the purposes provides wide information to classify the natural products. As is explained on the theoretical framework (see above Introduction section) the modes of nature appropriation could be understood through the conception of a rural metabolism between human societies and nature. As we commented, Toledo (2008) differentiated among five different metabolic acts: appropriation, transformation, circulation, consumption and excretion. Whereas some of these acts are inside the social organism (through economical exchange) and therefore being an exchange between humans; some others are outside this social organism and therefore are ecological (or material) exchange between human society and nature.

We grouped the natural resources according to the results of the main sources and purposes of use. The first group is composed by mango, mara genasu, coconut, bamboo and soap nut. All of them are collected mainly for consumption (see above Table 10) and their sources are from the houseland, the forest or the plantations (see above Graphic 1). The second group is composed by coffee and pepper, products that have a multiple and complex destinations but with an important weight on commercial uses (for sale or as a source of wage, see above Table 10). The source of the second group is also variable and combined: mostly are collected for consumption and commercial purposes on the house land, and to get wages are collected on the estate (coffee plantations), but never are collected in the forest. On the one hand, the first group basically considers the acts of appropriation (so the first and the last of the chain) and consumption, what Toledo (2008) defined as the first kind of appropriation (only affected by the self-consumption but without influences of economical exchanges). On the other hand, the second group considers the acts of transformation, production, circulation and consumption and therefore appropriation (material and cognitive) might be affected by both ecological and economical exchanges.

From here to the next sections, the division would be codified as Group A and Group B, where the consumption natural products are called as “Group A” (mango, mara genasu, coconut, bamboo and soap nut), and the marketable or for wages natural products as “Group B” (coffee and pepper).

c.vii) *Reflections from the informants*

We compile some of the comments captured during the developing of the questionnaires (Table 16). These answers or comments that came up from the informants help to understand the context and some of the trends previously explained with quantitative data.

Table 16. Comments that came up during the questionnaire about the natural products asked.

Topic	Comment
Sources	Why we should buy? We are in the forest. (1311006)
Management	We don't use our houseland (KFD doesn't allow), we need to go to another community to cultivate. (1311002) If you collect soap nut or bamboo Forest Department doesn't allow and will arrest you (0812005)
Soap nut	(About soapnut) Earlier, we sold by LAMPS, but now the prize is so low. (1212006) (<i>now they collect only to wash clothes at home, they go to the forest once an year to collect it</i>). We work, we can buy the soap. (0111008) I collect soap nut when I go to collect lichens, gooseberry, <i>sigeekay</i> and other forest products. (1212004) We don't use soap nut, now we have chemicals for everything. (0611002)
Coconut	The abundance of coconut is low, because of the elephant problem (1212005, 0912003) We need the coconut for any kind of food. (1011005)
Bamboo	The bamboo is not allowed to sell (1212005) Only this year we have collected (bamboo) rice. As now all bamboo will die, they will bring it to Kerala for textile. (1212001) (About bamboo). We will collect when is not moon light. It's so dark. If you collect in moon light, the bamboo will break easily. (1212004) After bamboo dies, gives poverty (0812003) (About bamboo). Forest Department doesn't allow the selling. (0912004)
Mara genasu	The abundance of mara genasu is low, because of the elephant problem (1212005) Rats not allow to grow the mara genasu (1211011, 1212001)
Pepper	(About uses of pepper) For hair fall we use a wild plant, lemon and pepper. Also we use pepper in skin diseases, mixing garlic, lemon juice, roots and pepper powder. With all this ointment, we cover the hunt, then will burn and after 10 minutes you can remove it. After that apply coconut oil. Two days and everything fine! (1211011) We have pepper in our houseland, but we need rain to grow it. (1112003) Only men can collect pepper. (1311012) We make a powder with garlic, cumin seeds and pepper. Then we put the powder in boiling water. Filter it. And drink two times per day. We collect it during the summer, but we use in Rainy season as medicine. (0311001)
Coffee	First, we dry the coffee. Second, we bring it to the meal and we get the powder. (1011017) To make powder in the meal they charge us 10 Rs/kg. (1112002)
Mango	I put all the mangos in a bag, and then I collect the liquid from the drops that fall down. (1212003)

d. Description of variables

d.i) Ecological knowledge

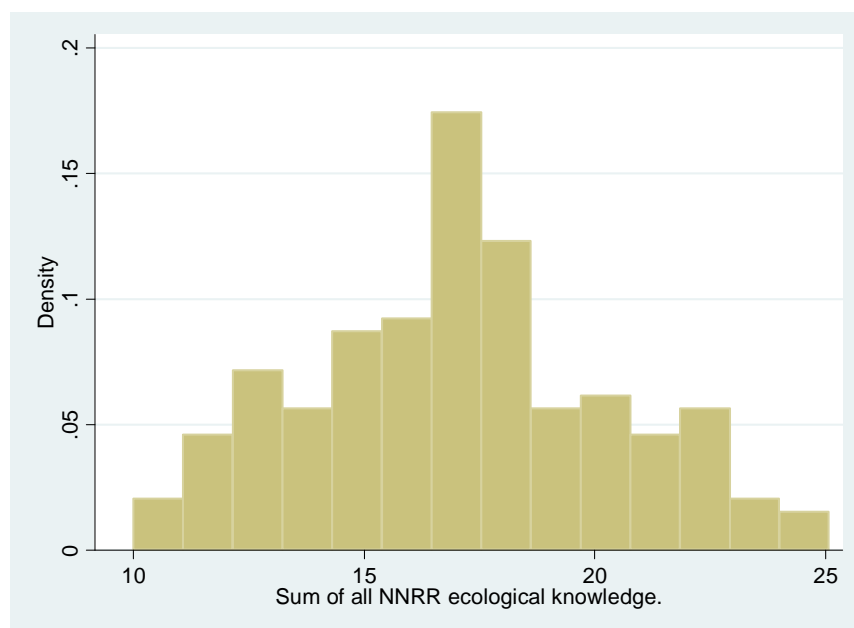
To understand the variation of the ecological knowledge variable (see below, Table 17) we present the mean, the standard deviation and the range of each portion of knowledge tested and the total result. The higher mean is on coconut, whereas the lower mean on ecological knowledge is for soap nut. However on both cases we can observe a high range of variation (see on Table 17, column of standard deviation).

Table 17. Description of ecological knowledge variables.

Natural product	Ecological knowledge Index			
	Mean	Std. Dev.	Min	Max
Mango	2,27	0,75	0,00	4,00
Mara genasu	2,87	0,69	1,00	4,00
Coffee	2,08	0,89	0,00	4,00
Coconut	3,03	0,82	0,00	4,00
Pepper	2,67	0,88	0,00	4,00
Bamboo	2,40	0,84	0,00	4,00
Soap nut	1,68	1,00	0,00	4,00
All	17,04	3,05	10,00	24,00
Group A	2,45*	0,47	1,20	3,60
Group B	2,38*	0,66	0,50	4,00

Note: * Both indexes would be ranging from 0-4, to be comparable between them.

The average individual has an ecological knowledge of 17 points from a potential maximum of 28 points (four questions of each of the seven products). The total ecological knowledge shows a normal distribution (see below, graphic 2) tested by through the Shapiro-Wilk W test.



Graphic 1. Histogram of ecological knowledge total variable

d.ii) *Collection index*

Table 18 shows the seasonality of each natural product, the maximum collection days (potential days), the collected days said by the informant and the resultant index (that ranges from 0 to 4). By product we can get the medium of number of collected days (see fourth column on Table 18). Mango is the most collected product: 13.9 days per month, therefore almost two weeks per month its being collected in medium ratio. Mango is followed by bamboo, collected 6 days per month, on average. The lower rate of collection is for Soap nut, which is collected on average less than one day per month. To remark that Group B is on average more collected than Group A.

Table 18. Description of collection variable and collection indexes

Natural Product	Season when the product can be collected	Potential days	Number of days when it was collected*		Collection Index	
			Mean	Std. Dev.	Mean	Std. Dev.
Mango tree	Rainy	120	13,93	11,57	2,15	1,47
Mara genasu	All the year	365	2,30	4,51	0,70	1,30
Coffee	Summer	120	2,78	6,69	1,27	1,50
Coconut tree	All the year	365	1,57	2,17	0,34	1,01
Pepper	Summer	120	2,19	6,24	1,39	1,60
Bamboo	Depending on the use**		6,17	7,72	1,56	1,58
Soap nut	Summer	120	0,79	1,81	0,32	0,98
All NR					7,82	5,14
Group A					1,01^	0,69
Group B					1,33^	1,32

Note: * The unit would be collected days per month . ** Collected for food (young branches) during the summer season; and for construction (old branches) all over the year, but more predominantly during summer season. ^ Both indexes would be ranging from 0-4, to be comparable between them.

d.iii) Consumption index

As is commented before the consumption index is created as a proportion (see above *Construction of variables* on Methods section). The number of uses (see column of average of number of uses on Table 19) shows that coconut tree is the product with more uses cited on average, followed by bamboo, pepper and mango tree. The other products have on average less than one use cited. However, when we consider the index the order change radically (see mean Index column on Table 19), because the consumption index is created taken into account the potential uses.

Table 19. Consumption variable description.

Natural Product	Potential uses	Number of uses		Index	
		<i>Average</i>	<i>Std. Dev.</i>	<i>Mean</i>	<i>Std. Dev.</i>
Mango tree	7	1,58	0,60	0,225	0,086
Mara genasu	1	0,98	0,15	0,989	0,105
Coffee	1	0,98	0,15	0,979	0,145
Coconut tree	10	2,07	0,61	0,207	0,061
Pepper	2	1,61	0,55	0,805	0,276
Bamboo	7	2,04	0,79	0,291	0,112
Soap nut	5	0,25	0,59	0,049	0,118
All NR	33			3,55	0,47
Group A	30			0,35*	0,05
Group B	3			0,89*	0,17

Note: * Both indexes would be ranging from 0-1, to be comparable between them.

d.iv) Control variables

All control variables used in the model would be the same for all NR, except the abundance. In *Sample description* section are shown the mean results of these variables (see on Table xx, variables of age, gender, household income, level of education and location related to the forest). We present on Table xx, the abundance control variable and the results from every natural resource reported. As we commented, abundance has been collected through a perceived scale, thus would not be the synonymous of the local abundance, in terms of ecology. Bamboo was reported as the most abundant product, followed by coffee and pepper. Soap nut was reported to have lower values on abundance. Group B (extensive agriculture of Kodagu) have an average abundance much greater than the Group A.

Table 20. Abundance Index description.

Natural product	Abundance Index	
	<i>Mean</i>	<i>Std. Dev.</i>
Mango tree	3,12	0,92
Mara genasu	2,36	0,99
Coffee	3,48	0,83
Coconut tree	2,79	0,92
Pepper	3,26	0,91
Bamboo	3,55	0,84
Soap nut	2,17	0,96
All	20,73	3,87
Group A	2,79*	0,58
Group B	3,37*	0,78

Note: * Both indexes would be ranging from 0-4, to be comparable between them.

4.2. Bivariate analysis

a. Mann-Whitney statistic

To carry out the bivariate analysis we discard the T-test, because is required a variable with normal distribution. Whereas the variable of total knowledge (the sum of each product's knowledge) is normally distributed, the variables of partial knowledge are not. Thus, we used the Wilcoxon rank-sum test (which is also known as the Mann-Whitney two-sample statistic) that tests the hypothesis that two independent samples (i.e., unmatched data) are from populations with the same distribution using STATA (2005).

Table 21 (see below) shows the bivariate analysis between knowledge and **collection** separately by each product. Overall and for all the products, the group of collectors have higher average ecological knowledge than the group of no-collectors. However, the difference in means is only significant at the 90% confidence level of above in two cases: coffee and bamboo. Even so, this analysis confirm that collection variable have a non worthless role modifying knowledge, finding higher knowledge on people that collects and less on people that doesn't collect (see also columns of mean and z on Table 21).

Table 21. Bivariate analysis using Man-Withney statistic: knowledge-collection (1/0).

	Collection (1)				Collection (0)				^
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.	z
Mango	2,29	0,74	0,00	4,00	2,20	0,78	1,00	4,00	-0,724
Mara genasu	2,98	0,71	2,00	4,00	2,82	0,68	1,00	4,00	-1,284
Coffee	2,15	0,91	0,00	4,00	1,88	0,80	0,00	3,00	-1,641 *
Coconut	3,16	1,03	0,00	4,00	3,02	0,78	1,00	4,00	-0,972
Pepper	2,70	0,85	1,00	4,00	2,65	0,92	0,00	4,00	-0,172
Bamboo	2,51	0,78	1,00	4,00	2,25	0,89	0,00	4,00	-1,963 **
Soap nut	1,94	1,11	0,00	4,00	1,65	0,98	0,00	4,00	-0,977

^ Man - Withney statistic

* $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$.

Secondly, the same analysis is carried out for **consumption** variable (Table 22). In mara genasu, coffee and soap nut, the group of consumers have higher average ecological knowledge than the group of no-consumers. But not in pepper and bamboo cases, where the group of no-consumers might have higher average ecological knowledge than the group of consumers. In two cases (mango and coconut) the test has not been done, all the informants were consumers of mango and coconut and was not possible to realize the comparison. However, we should point out that the difference in means is not significant at the 90% confidence level of above for any case. The group of no-consumers was minority (less than 10 persons, see variable *Obs.* in Table 22) in all the cases, except soap nut, fact that might explain this preliminary results (in next section we would do the same analysis but not with a binary variable and would allow to review it).

Table 22. Bivariate analysis using Man-Whitney statistic: knowledge-consumption (1/0).

	Consumption (1)					Consumption (0)					^
	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min.</i>	<i>Max.</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min.</i>	<i>Max.</i>	<i>z</i>
Mango	187	2,27	0,75	0,00	4,00	0	♦				-
Mara genasu	177	2,88	0,68	1,00	4,00	4	2,50	1,00	2,00	4,00	-1,233
Coffee	183	2,08	0,89	0,00	4,00	4	2,00	0,82	1,00	3,00	-0,163
Coconut	187	3,03	0,82	0,00	4,00	0	♦				-
Pepper	181	2,67	0,89	0,00	4,00	6	2,83	0,75	2,00	4,00	0,375
Bamboo	178	2,39	0,85	0,00	4,00	9	2,56	0,73	1,00	3,00	0,710
Soap nut	32	1,91	1,09	0,00	4,00	155	1,63	0,97	0,00	4,00	-1,171

♦ The variable consumption (0) doesn't exist, because all the sample is consuming the product (note that *Obs*=0)

^ Man - Withney statistic

* $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$.

b. Pearson correlation

The principal difference with the previous analysis is that in this case we analyze the variable collection or consumption with different values, rather than simply binary (1 or 0). Whereas the first analysis (Wilcoxon rank-sum test) showed us the effect to consume or to collect into the knowledge level, the Pearson correlation links the level collection and consumption with the knowledge level.

b.i) All natural resources pooled

The second bivariate analysis (see Table 23, below) is between the level of ecological knowledge and the level of **collection**, both captured through indexes (see *Construction of variables* in Methods section to know how are created). The correlation is significant at the 90% confidence level only on *mara genasu* ($p=.04$) and coffee cases ($p=.02$). The rest of natural products were statistically insignificant, but bore the expected sign. In overall, when we consider all seven natural products the level of knowledge and the level of collection are positive and statistically significant ($p=.003$).

Table 23. Relation between: 1) EK level and collection level; 2) EK level and consumption level. Pearson correlation.

Natural products	Variables	Pearson correlation	
		Collection index	Consumption index
		<i>Coef.</i>	<i>Coef.</i>
Mango	Knowledge	0,09	0,05
Mara genasu	Knowledge	0,15**	0,13*
Coffee	Knowledge	0,17**	0,01
Coconut	Knowledge	0,08	0,00
Pepper	Knowledge	0,02	-0,01
Bamboo	Knowledge	0,09	0,14*
Soap nut	Knowledge	0,10	0,10
All	Knowledge	0,25***	0,16**

* $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$.

Table 23 also describes the Pearson correlation between ecological knowledge level and **consumption** level (second column). We observe that only in the case of *mara genasu* ($p=.07$) and bamboo ($p=.06$) this correlation was statistically significant. If we focus on the sign of the relation we confirm that is positive for the majority of the cases, with the exception of pepper that has a light 0.01 negative coefficient (but $p= .90$). However, if we consider the overall relation (so, all seven resources) the level of knowledge and consumption are correlated positively and significantly ($p= 0.03$).

b.ii) Bivariate analysis grouping the natural resources

The same analysis of Pearson correlation is done but separating the NR between Group A and Group B (Table 24), therefore each group would have different level of knowledge, collection and consumption. The correlations by Group A were statistically significant in both cases, with collection index ($p=.002$) and with consumption index ($p=.0007$). Also in both cases, the coefficients bore the expected sign (positive). However, knowledge of Group B was correlated statistically insignificant with consumption and with collection. But they bore a positive sign.

Table 24. Separating by groups of NR, relation between: 1) EK and Collection; 2) EK and consumption.

Natural products	Variables	Pearson correlation	
		Collection index <i>Coef.</i>	Consumption index <i>Coef.</i>
Group A	Knowledge	0,23***	0,25***
Group B	Knowledge	0,11	0,02
All	Knowledge	0,25***	0,16**

* $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$.

Thus, the consideration of divide the natural resources between two differentiate groups can provide new clues to understand the aims of the present study.

4.3. Multivariate analysis

a. Multivariate regressions

The multivariate regressions (Table 25) are done considering three possibilities: 1) pooling all seven natural resources; 2) considering only the Group A (consumption resources); and 3) considering only the Group B (marketable).

First, we examine the relation between ecological knowledge and the two forms of use of NR: consumption and collection (Table 25, first column), considering all seven natural resources. We use ordinary least squares (OLS) regression with robust standard errors. We ran the regressions clustering by *panchayat*. Conditioning for age, gender, income, education, location and abundance, ecological knowledge was associated with greater consumption of NR and with greater collection of NR. A 1% increase in consumption index was associated with a 0.64% ($p=.08$) increase in the score of ecological knowledge; a 1% increase in collection index was associated with 0.08% increase of EK level ($p=.04$). As predicted in our arguments, we found that EK and use of NR are associated, although the increase in collection is low.

Table 25. OLS regression explaining ecological knowledge (dependent variable) through a multivariate model clustering by *panchayat* variable, robust analysis

	Dependent Variable		
	Ecological Knowledge of		
	<i>All NR pooled</i>	<i>Group A</i>	<i>Group B</i>
Explanatory variables			
<i>Consumption index</i>	0,636*	1,702*	0,005
<i>Collection index</i>	0,077**	0,098**	0,027
Control Variables			
<i>Age</i>	-0,066***	-0,041***	-0,027***
<i>Gender</i>	-0,073	-0,025	-0,018
<i>Income</i>	0,000**	0,000*	0,000
<i>Education</i>	0,302	0,135	0,067
<i>Location-forest</i>	-0,622*	-0,335	-0,164
<i>Abundance</i>	0,105**	0,047	-0,057
R²	0,25	0,20	0,14
n	173	175	180

Note: * $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$. Group A: NR for consumption. Group B: NR for commercial purposes or wages (marketable).

We move on to examine the same variables but taking into account the products of consumption (Group A). We ran the same OLS regression (Table 25, second column) and we found that controlling by the same variables (age, gender, income, education, location and abundance) both associations are also positive and significant. Surprisingly, an increase of 1% in consumption index was associated with a 1.7% increase of EK level ($p=.10$), a greater rate than considering all NR. Also the collection coefficient of 0.10% ($p=0.02$) is greater, but still low.

Contrary to these results, knowledge of marketable products (Group B) and use of them bore no strong association with each other. We ran the OLS regression (Table 25, third column) with same control variables as the other regressions, we found that the coefficient for consumption was only 0.005 ($p=.98$) and the coefficient for collection was 0.03 ($p=.38$).

b. Robustness analysis

To test how sensitive our results are to the assumptions made, we regressed the values reported in Table 25 against values found under three different assumptions. We found that the coefficients were positive and statistically significant (Table 26). So we conclude that the model is robust to data collected.

Table 26. Multivariate OLS regressions to explain ecological knowledge variable, robustness analysis, clustering by *panchayat*, robust analysis

	Dependent Variable			
	<i>Ecological Knowledge (All NR pooled)</i>			
Explanatory variables				
<i>Consumption index</i>	0,636*	0,804**	0,667*	0,606**
<i>Collection index</i>	0,077**	0,063*	0,062*	0,074*
Control variables				
<i>Age</i>	-0,066***	-0,077***	-0,064***	-0,067***
<i>Gender</i>	-0,073	-0,036	-0,059	-0,032
<i>Income</i>	0,000**	0,000**		0,000
<i>Education</i>	0,302		0,324	0,360
<i>Location-forest</i>	-0,622*	-0,543	-0,620*	
<i>Abundance</i>	0,105**	0,097**	-0,104**	0,112**
<i>Land surface</i>		0,064		
<i>Livestock</i>			-0,021	
<i>House material</i>				-0,596**
R²	0,25	0,24	0,24	0,25
n	173	170	175	173

Note: * $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$.

5. DISCUSSION

This research advances our understanding of the ways to be related with nature in two different aspects. First, as we expected, **people who collected and consume more had a higher ecological knowledge**. Thus, we corroborate empirically the positive and statistically significant association and, therefore we give one step more to the possible applications on other ethnoecological studies. The studies of erosion of EK could be an application through the creation of indexes of knowledge proxied by the actual uses.

However, when we analyzed the relations use-knowledge by products we did not find this association, might be because our variables of knowledge per each product (only ranging from 0-4) were not capturing enough variability to bore the association. Future research could improve the measures of individual ecological knowledge by creating indexes that capture more variability per every natural resource and then checking how the product itself influences the kind of relation of the resource user.

About the control variables used, we should notice that age was always significant, but with the unexpected sign. This fact, could be explained for the kind of ecological knowledge test applied. As we used ecological knowledge and not other local knowledge indicator (as traditional knowledge and practices or skills over the management of NR), our results differs with the usual expected trend where older people stores higher levels of EK. Might be could be interesting to run the association again with those kind of indexes. When we move to abundance almost in all the regressions that we ran we found a positive sign and in some cases was significant. Thus, the potentiality of access might be key when we want to model variables as EK or use.

Second, at the group level, we could find significant association for those products that we called the generic name of “Group A” and mean those products that were not collected for direct economical purposes (as commercial or for wages). Thus, **who collected and consume more those consumable products had a higher ecological knowledge**. We might deduct that these kind of products play a role in thoughts different than those for marketable purposes.

Both groups of resources had similar levels of EK. **But the people who collected and consumed more Group B products had not necessarily a higher level of EK**. Thus, other factors may be involved on knowledge and on use, different than those that influenced the consumable products. As we divided by purposes, we could speculate that economical purposes are playing a role modifying the relation between both ways to relate with nature: cognitive and

material. However, is necessary an intensive analysis with data from more resources to establish these advances.

As Toledo and González de Molina (2007) pointed out the cognitive and tangible dimensions are reciprocally conditioned during the metabolic process. We might specify that when we take into account the first acts of this process (collection and consumption) we could find a positive association between both dimensions, in other words, are walking in parallel. Nevertheless, when the process advances (so, in case of products marketable or for labour) they are not related. We suppose, as we commented, that between this gap might be we miss some control variable and that other models should be created to explain better this process.

Finally, this study helps to understand some of the relations between **local** communities of Kodagu and their local environment. We found that all high proportions of our sample were collecting these natural products and we identified the places of collection and their purposes. All descriptive analysis might be useful to identify clear patterns on these products. As coffee is the main competitor for land use and we found a multi-purpose pattern to use it we recommend to the conservator biologist to analyze in detail the possibilities of these communities to become one element more on the conservation of the landscape mosaic by providing their local knowledge and their historically recognized favorable attitude towards the nature. But not only the changes on land use could model their provision of livelihoods, the application of the Forest Rights Act (see Appendix 1) would change radically the analysis of use of NR, providing new land and being an interesting process to be reported. This study, provides a first “*state of affairs*” in tribal communities in Kodagu actual, the evolution and posterior analysis of trends would provide important clues about both aims: provision of livelihoods and biodiversity conservation.

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7. BUDGET

The budget for this project is detailed below on Table 27. Is divided chronologically into the three main phases of the project (on next section is explained the principal goals of each phase) that are basically pre-fieldwork, fieldwork and post-fieldwork.

Table 27. Detailed accounts

Phase	Unit	Nº of units required	Prize (€/unit)	Total prize (€)
Phase 1				
<i>Theoretical construct/ Review of secondary data/ Preparation</i>				
Desktop work	hours	100	10	1.000 €
Materials	photocopies	100	0,04	4 €
Office (rent, ADSL,water and electricity)	month	1	100	100 €
Transport	train ticket (T-10)	5	15,5	77,5 €
Food expenses	meals	25	4	100 €
Total phase 1				1.281,5 €
Phase 2				
<i>Travel expenses</i>				
Travel	airplane tickets	2	550	1.100 €
Insurance				112 €
VISA costs				105 €
Transport (airport-field)				20 €
<i>Fieldwork</i>				
Field work	hours	450	12,5	5.625 €
Field food expenses	lunch	70	0,5	35 €
Translator (salary and expenses)	month	2,5	155	387,5 €
Transport (petrol for the motorbike)	month	3	35	105 €
Accomodation (rent)	month	3	40	120 €
Other food expenses	days	90	1	90 €
<i>Entering data</i>				
Desktop work	hours	150	10	1.500 €
Materials	photocopies	200	0,04	8 €
Office (mobilephone, internet, water, electricity)	month	3	20	60 €
Total phase 2				9.267,5 €
Phase 3				
<i>Statistical analysis and writing</i>				
Desktop work	hours	150	10	1.500 €
Materials	photocopies	500	0,04	20 €
Office (rent, ADSL,water and electricity)	month	1	100	100 €
Transport	train ticket (T-10)	4	15,5	60 €
Food expenses	meals	20	4	80 €
Total phase 3				1.760 €
Total				
Phase 1			1.281,5 €	
Phase 2			9.267,5 €	
Phase 3			1.760,0 €	
Total without IVA			12.309,0 €	
IVA (16%)			1.969,4 €	
TOTAL			14.278,4 €	

8. CALENDAR

Due to accomplish the previous explained aims, was scheduled the following calendar (see below Table 28). This calendar incorporates three main phases on concept and location. First phase provided the conceptual framework and the fieldwork preparation and it was carried in Spain. Second phase comprised the field data collection and the construction and understanding of the case study context. Finally, the third phase comprised the data analysis, results discussion and compilation of all information due to carry out the writing and the final submission.

Table 28. Project planning

	Year 2009				Year 2010							
	Months	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Phases	1st				2nd				3rd			
Theoretical construct	■	■	■	■								
Review of secondary data		■	■	■	■							
Preparation of ethnographic interviews		■	■	■	■							
Preparation of field work		■	■	■	■							
Ethnographic interviews						■	■	■	■			
Entering data							■	■	■			
Statistical analysis										■	■	
Writing			■	■				■	■	■	■	
Final submission												■

APPENDIX

Appendix 1: Forest Rights Act

Appendix 2: Survey

Appendix 3: Graphic materials

Appendix 4: Complementary data

1. Appendix 1: Forest Rights Act

THE SCHEDULED TRIBES AND OTHER TRADITIONAL FOREST DWELLERS RECOGNITION OF FOREST RIGHTS) ACT, 2006

NO. 2 OF 2007

[29th December, 2006]

An Act to recognise and vest the forest rights and occupation in forest land in forest dwelling Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded; to provide for a framework for recording the forest rights so vested and the nature of evidence required for such recognition and vesting in respect of forest land.

WHEREAS the recognised rights of the forest dwelling Scheduled Tribes and other traditional forest dwellers include the responsibilities and authority for sustainable use, conservation of biodiversity and maintenance of ecological balance and thereby strengthening the conservation regime of the forests while ensuring livelihood and food security of the forest dwelling Scheduled Tribes and other traditional forest dwellers; AND WHEREAS the forest rights on ancestral lands and their habitat were not adequately recognised in the consolidation of State forests during the colonial period as well as in independent India resulting in historical injustice to the forest dwelling Scheduled Tribes and other traditional forest dwellers who are integral to the very survival and sustainability of the forest ecosystem; AND WHEREAS it has become necessary to address the long standing insecurity of tenurial and access rights of forest dwelling Scheduled Tribes and other traditional forest dwellers including those who were forced to relocate their dwelling due to State development interventions.

BE it enacted by Parliament in the Fifty-seventh Year of the Republic of India as follows:

CHAPTER PRELIMINARY 1

1. Short title and commencement. - (1) This Act may be called the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.
(2) It extends to the whole of India except the State of Jammu and Kashmir.
(3) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint.

2. Definitions.- In this Act, unless the context otherwise requires,-
(a) "community forest resource" means customary common forest land within the traditional or customary boundaries of the village or seasonal use of landscape in the case of pastoral communities, including reserved forests, protected forests and protected areas such as Sanctuaries and National Parks to which the community had traditional access;
(b) "critical wildlife habitat" means such areas of National Parks and Sanctuaries where it has been specifically and clearly established, case by case, on the basis of scientific and objective criteria, that such areas are required to be kept as inviolate for the purposes of wildlife conservation as may be determined and notified by the Central Government in the Ministry of Environment and Forests after open process of consultation by an Expert Committee, which includes experts from the locality appointed by that Government wherein a representative of the Ministry of Tribal Affairs shall also be included, in determining such areas according to the procedural requirements arising from sub-sections (1) and (2) of section 4;
(c) "forest dwelling Scheduled Tribes" means the members or community of the Scheduled

Tribes who primarily reside in and who depend on the forests or forest lands for bona fide livelihood needs and includes the Scheduled Tribe pastoralist communities;

(d) "forest land" means land of any description falling within any forest area and includes unclassified forests, undemarcated forests, existing or deemed forests, protected forests, reserved forests, Sanctuaries and National Parks;

(e) "forest rights" means the forest rights referred to in section 3;

(f) "forest villages" means the settlements which have been established inside the forests by the forest department of any State Government for forestry operations or which were converted into forest villages through the forest reservation process and includes forest settlement villages, fixed demand holdings, all types of taungya settlements, by whatever name called, for such villages and includes lands for cultivation and other uses permitted by the Government;

(g) "Gram Sabha" means a village assembly which shall consist of all adult members of a village and in case of States having no Panchayats, Padas, Tolas and other traditional village institutions and elected village committees, with full and unrestricted participation of women;

(h) "habitat" includes the area comprising the customary habitat and such other habitats in reserved forests and protected forests of primitive tribal groups and pre-agricultural communities and other forest dwelling Scheduled Tribes;

(i) "minor forest produce" includes all non-timber forest produce of plant origin including bamboo, brush wood, stumps, cane, tussar, cocoons, honey, wax, lac, tendu or kendu leaves, medicinal plants and herbs, roots, tubers and the like;

(j) "nodal agency" means the nodal agency specified in section 11;

(k) "notification" means a notification published in the Official Gazette;

(l) "prescribed" means prescribed by rules made under this Act;

(m) "Scheduled Areas" means the Scheduled Areas referred to in clause (1) of article 244 of the Constitution;

(n) "sustainable use" shall have the same meaning as assigned to it in clause (o) of section 2 of the Biological Diversity Act, 2002;

(o) "other traditional forest dweller" means any member or community who has for at least three generations prior to the 13th day of December, 2005 primarily resided in and who depend on the forest or forests land for bona fide livelihood needs.
Explanation.-For the purpose of this clause, "generation" means a period comprising of twenty-five years;

(p) "village" means:

(i) a village referred to in clause (b) of section 4 of the Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996; or

(ii) any area referred to as a village in any State law relating to Panchayats other than the Scheduled Areas; or

(iii) forest villages, old habitation or settlements and unsurveyed villages, whether notified as village or not; or

(iv) in the case of States where there are no Panchayats, the traditional village, by whatever name called;

(q) "wild animal" means any species of animal specified in Schedules I to IV of the Wild Life (Protection) Act, 1972 and found wild in nature.

CHAPTER II FOREST RIGHTS

3. Forest rights of Forest dwelling Scheduled Tribes and other traditional forest dwellers.

(1) For the purposes of this Act, the following rights, which secure individual or community tenure or both, shall be the forest rights of forest dwelling Scheduled Tribes and other traditional forest dwellers on all forest lands, namely:

(a) right to hold and live in the forest land under the individual or common occupation for habitation or for self-cultivation for livelihood by a member or members of a forest dwelling Scheduled Tribe or other traditional forest dwellers;

- (b) community rights such as nistar, by whatever name called, including those used in erstwhile Princely States, Zamindari or such intermediary regimes;
 - (c) right of ownership, access to collect, use, and dispose of minor forest produce which has been traditionally collected within or outside village boundaries;
 - (d) other community rights of uses or entitlements such as fish and other products of water bodies, grazing (both settled or transhumant) and traditional seasonal resource access of nomadic or pastoralist communities;
 - (e) rights including community tenures of habitat and habitation for primitive tribal groups and pre-agricultural communities;
 - (f) rights in or over disputed lands under any nomenclature in any State where claims are disputed;
 - (g) rights for conversion of Pattas or leases or grants issued by any local authority or any State Government on forest lands to titles;
 - (h) rights of settlement and conversion of all forest villages, old habitation, unsurveyed villages and other villages in forests, whether recorded, notified or not into revenue villages;
 - (i) right to protect, regenerate or conserve or manage any community forest resource which they have been traditionally protecting and conserving for sustainable use;
 - (j) rights which are recognised under any State law or laws of any Autonomous District Council or Autonomous Regional Council or which are accepted as rights of tribals under any traditional or customary law of the concerned tribes of any State;
 - (k) right of access to biodiversity and community right to intellectual property and traditional knowledge related to biodiversity and cultural diversity;
 - (l) any other traditional right customarily enjoyed by the forest dwelling Scheduled Tribes or other traditional forest dwellers, as the case may be, which are not mentioned in clauses (a) to (k) but excluding the traditional right of hunting or trapping or extracting a part of the body of any species of wild animal;
 - (m) right to in situ rehabilitation including alternative land in cases where the Scheduled Tribes and other traditional forest dwellers have been illegally evicted or displaced from forest land of any description without receiving their legal entitlement to rehabilitation prior to the 13th day of December, 2005.
- (2) Notwithstanding anything contained in the Forest (Conservation) Act, 1980, the Central Government shall provide for diversion of forest land for the following facilities managed by the Government which involve felling of trees not exceeding seventy-five trees per hectare, namely:
- (a) schools;
 - (b) dispensary or hospital;
 - (c) anganwadis;
 - (d) fair price shops;
 - (e) electric and telecommunication lines;
 - (f) tanks and other minor water bodies;
 - (g) drinking water supply and water pipelines;
 - (h) water or rain water harvesting structures;
 - (i) minor irrigation canals;
 - (j) non-conventional source of energy;
 - (k) skill upgradation or vocational training centres;
 - (l) roads; and
 - (m) community centres:
- Provided that such diversion of forest land shall be allowed only if,
- (i) the forest land to be diverted for the purposes mentioned in this sub-section is less than one hectare in each case; and
 - (ii) the clearance of such developmental projects shall be subject to the condition that the same is recommended by the Gram Sabha.

CHAPTER III
RECOGNITION, RESTORATION AND VESTING OF FOREST RIGHTS AND RELATED
MATTERS

4. Recognition of, and vesting of, forest rights in forest dwelling Scheduled Tribes and other traditional forest dwellers. - (1) Notwithstanding anything contained in any other law for the time being in force, and subject to the provisions of this Act, the Central Government hereby recognises and vests forest rights in

(a) the forest dwelling Scheduled Tribes in States or areas in States where they are declared as Scheduled Tribes in respect of all forest rights mentioned in section 3;
(b) the other traditional forest dwellers in respect of all forest rights mentioned in section 3.

(2) The forest rights recognised under this Act in critical wildlife habitats of National Parks and Sanctuaries may subsequently be modified or resettled, provided that no forest rights holders shall be resettled or have their rights in any manner affected for the purposes of creating inviolate areas for wildlife conservation except in case all the following conditions are satisfied, namely:

(a) the process of recognition and vesting of rights as specified in section 6 is complete in all the areas under consideration;

(b) it has been established by the concerned agencies of the State Government, in exercise of their powers under the Wild Life (Protection) Act, 1972 that the activities or impact of the presence of holders of rights upon wild animals is sufficient to cause irreversible damage and threaten the existence of said species and their habitat;

(c) the State Government has concluded that other reasonable options, such as, co-existence are not available;

(d) a resettlement or alternatives package has been prepared and communicated that provides a secure livelihood for the affected individuals and communities and fulfils the requirements of such affected individuals and communities given in the relevant laws and the policy of the Central Government;

(e) the free informed consent of the Gram Sabhas in the areas concerned to the proposed resettlement and to the package has been obtained in writing;

(f) no resettlement shall take place until facilities and land allocation at the resettlement location are complete as per the promised package:

Provided that the critical wildlife habitats from which rights holders are thus relocated for purposes of wildlife conservation shall not be subsequently diverted by the State Government or the Central Government or any other entity for other uses.

(3) The recognition and vesting of forest rights under this Act to the forest dwelling Scheduled Tribes and to other traditional forest dwellers in relation to any State or Union territory in respect of forest land and their habitat shall be subject to the condition that such Scheduled Tribes or tribal communities or other traditional forest dwellers had occupied forest land before the 13th day of December, 2005.

(4) A right conferred by sub-section (1) shall be heritable but not alienable or transferable and shall be registered jointly in the name of both the spouses in case of married persons and in the name of the single head in the case of a household headed by a single person and in the absence of a direct heir, the heritable right shall pass on to the next-of-kin.

(5) Save as otherwise provided, no member of a forest dwelling Scheduled Tribe or other traditional forest dweller shall be evicted or removed from forest land under his occupation till the recognition and verification procedure is complete.

(6) Where the forest rights recognised and vested by sub-section (1) are in respect of land mentioned in clause (a) of sub-section (1) of section 3 such land shall be under the occupation of an individual or family or community on the date of commencement of this Act and shall be restricted to the area under actual occupation and shall in no case exceed an area of four hectares.

(7) The forest rights shall be conferred free of all encumbrances and procedural requirements, including clearance under the Forest (Conservation) Act, 1980, requirement of paying the #net

present value# and #compensatory afforestation# for diversion of forest land, except those specified in this Act.

(8) The forest rights recognised and vested under this Act shall include the right of land to forest dwelling Scheduled Tribes and other traditional forest dwellers who can establish that they were displaced from their dwelling and cultivation without land compensation due to State development interventions, and where the land has not been used for the purpose for which it was acquired within five years of the said acquisition.

5. Duties of holders of forest rights.- The holders of any forest right, Gram Sabha and village level institutions in areas where there are holders of any forest right under this Act are empowered to:

(a) protect the wild life, forest and biodiversity;

(b) ensure that adjoining catchments area, water sources and other ecological sensitive areas are adequately protected;

(c) ensure that the habitat of forest dwelling Scheduled Tribes and other traditional forest dwellers is preserved from any form of destructive practices affecting their cultural and natural heritage;

(d) ensure that the decisions taken in the Gram Sabha to regulate access to community forest resources and stop any activity which adversely affects the wild animals, forest and the biodiversity are complied with.

CHAPTER IV

AUTHORITIES AND PROCEDURE FOR VESTING OF FOREST RIGHTS

6. Authorities to vest forest rights in forest dwelling Scheduled Tribes and other traditional forest dwellers and procedure thereof. - (1) The Gram Sabha shall be the authority to initiate the process for determining the nature and extent of individual or community forest rights or both that may be given to the forest dwelling Scheduled Tribes and other traditional forest dwellers within the local limits of its jurisdiction under this Act by receiving claims, consolidating and verifying them and preparing a map delineating the area of each recommended claim in such manner as may be prescribed for exercise of such rights and the Gram Sabha shall, then, pass a resolution to that effect and thereafter forward a copy of the same to the Sub-Divisional Level Committee.

(2) Any person aggrieved by the resolution of the Gram Sabha may prefer a petition to the Sub-Divisional Level Committee constituted under sub-section (3) and the Sub-Divisional Level Committee shall consider and dispose of such petition: Provided that every such petition shall be preferred within sixty days from the date of passing of the resolution by the Gram Sabha:

Provided further that no such petition shall be disposed of against the aggrieved person, unless he has been given a reasonable opportunity to present his case.

(3) The State Government shall constitute a Sub-Divisional Level Committee to examine the resolution passed by the Gram Sabha and prepare the record of forest rights and forward it through the Sub-Divisional Officer to the District Level Committee for a final decision.

(4) Any person aggrieved by the decision of the Sub-Divisional Level Committee may prefer a petition to the District Level Committee within sixty days from the date of decision of the Sub-Divisional Level Committee and the District Level Committee shall consider and dispose of such petition:

Provided that no petition shall be preferred directly before the District Level Committee against the resolution of the Gram Sabha unless the same has been preferred before and considered by the Sub-Divisional Level Committee:

Provided further that no such petition shall be disposed of against the aggrieved person, unless he has been given a reasonable opportunity to present his case.

(5) The State Government shall constitute a District Level Committee to consider and finally approve the record of forest rights prepared by the Sub-Divisional Level Committee.

(6) The decision of the District Level Committee on the record of forest rights shall be final and binding.

(7) The State Government shall constitute a State Level Monitoring Committee to monitor the process of recognition and vesting of forest rights and to submit to the nodal agency such returns and reports as may be called for by that agency.

(8) The Sub-Divisional Level Committee, the District Level Committee and the State Level Monitoring Committee shall consist of officers of the departments of Revenue, Forest and Tribal Affairs of the State Government and three members of the Panchayati Raj Institutions at the appropriate level, appointed by the respective Panchayati Raj Institutions, of whom two shall be the Scheduled Tribe members and at least one shall be a woman, as may be prescribed.

(9) The composition and functions of the Sub-Divisional Level Committee, the District Level Committee and the State Level Monitoring Committee and the procedure to be followed by them in the discharge of their functions shall be such as may be prescribed.

CHAPTER V

OFFENCES AND PENALTIES

7. Offences by members or officers of authorities and Committees under this Act.- Where any authority or Committee or officer or member of such authority or Committee contravenes any provision of this Act or any rule made thereunder concerning recognition of forest rights, it, or they, shall be deemed to be guilty of an offence under this Act and shall be liable to be proceeded against and punished with fine which may extend to one thousand rupees:

Provided that nothing contained in this sub-section shall render any member of the authority or Committee or head of the department or any person referred to in this section liable to any punishment if he proves that the offence was committed without his knowledge or that he had exercised all due diligence to prevent the commission of such offence.

8. Cognizance of offences.- No court shall take cognizance of any offence under section 7 unless any forest dwelling Scheduled Tribe in case of a dispute relating to a resolution of a Gram Sabha or the Gram Sabha through a resolution against any higher authority gives a notice of not less than sixty days to the State Level Monitoring Committee and the State Level Monitoring Committee has not proceeded against such authority.

CHAPTER VI

MISCELLANEOUS

9. Members of authorities, etc., to be public servants.- Every member of the authorities referred to in Chapter IV and every other officer exercising any of the powers conferred by or under this Act shall be deemed to be a public servant within the meaning of section 21 of the Indian Penal Code.

10. Protection of action taken in good faith. - (1) No suit, prosecution or other legal proceeding shall lie against any officer or other employee of the Central Government or the State Government for anything which is in good faith done or intended to be done by or under this Act.

(2) No suit or other legal proceeding shall lie against the Central Government or the State Government or any of its officers or other employees for any damage caused or likely to be caused by anything which is in good faith done or intended to be done under this Act.

(3) No suit or other legal proceeding shall lie against any authority as referred to in Chapter IV including its Chairperson, members, member-secretary, officers and other employees for anything which is in good faith done or intended to be done under this Act.

11. Nodal agency.- The Ministry of the Central Government dealing with Tribal Affairs or any officer or authority authorised by the Central Government in this behalf shall be the nodal agency for the implementation of the provisions of this Act.

12. Power of Central Government to issue directions.- In the performance of its duties and exercise of its powers by or under this Act, every authority referred to in Chapter IV shall be subject to such general or special directions, as the Central Government may, from time to time, give in writing.

13. Act not in derogation of any other law.- Save as otherwise provided in this Act and the Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996, the provisions of this Act shall be in addition to and not in derogation of the provisions of any other law for the time being in force.

14. Power to make rules. - (1) The Central Government may, by notification, and subject to the condition of previous publication, make rules for carrying out the provisions of this Act.

(2) In particular, and without prejudice to the generality of the foregoing powers, such rules may provide for all or any of the following matters, namely:-

(a) procedural details for implementation of the procedure specified in section 6;

(b) the procedure for receiving claims, consolidating and verifying them and preparing a map delineating the area of each recommended claim for exercise of forest rights under sub-section

(1) of section 6 and the manner of preferring a petition to the Sub-Divisional Committee under sub-section (2) of that section;

(c) the level of officers of the departments of Revenue, Forest and Tribal Affairs of the State Government to be appointed as members of the Sub-Divisional Level Committee, the District Level Committee and the State Level Monitoring Committee under sub-section (8) of section 6;

(d) the composition and functions of the Sub-Divisional Level Committee, the District Level Committee and the State Level Monitoring Committee and the procedure to be followed by them in the discharge of their functions under sub-section (9) of section 6;

(e) any other matter which is required to be, or may be, prescribed.

(3) Every rule made by the Central Government under this Act shall be laid, as soon as may be after it is made, before each House of Parliament, while it is in session, for a total period of thirty days which may be comprised in one session or in two or more successive sessions, and if, before the expiry of the session immediately following the session or the successive sessions aforesaid, both Houses agree in making any modification in the rule or both Houses agree that the rule should not be made, the rule shall thereafter have effect only in such modified form or be of no effect, as the case may be; so, however, that any such modification or annulment shall be without prejudice to the validity of anything previously done under that rule.

K. N. CHATURVEDI,
Secy. to the Govt. of India

2. Appendix 2. Survey

Questionnaire: “Quality of Life of tribal people from Kodagu”

The questionnaire should be administrated only to one adult (>16 years old) per household. Informants should be selected randomly among all adults present in the house at the moment of the visit.

Gramma Panchayat		Community name:	
Individual name:		Individual Code	
Researcher code: (1=M Grau; 2= F Zorondo)		Translator Code (1=Jenu; 2= Anil)	

Section I: Socio-demographic questions. The questions will be administrated to each individual.

Code	Instructions	Answer's format	Answer
<i>age</i>	How old are you? If unsure, add 900 to the age (ex, aprox 30=930)	Years	
<i>Male</i>	Write the informant's sex	1=male; 0=female	
<i>hhhead</i>	Are you the household head?	1=yes; 0=not	
<i>residence</i>	How many years have you continuously lived in this community? If all his/her life, write down age	Years	
<i>residprevious</i>	Where did you live before? 1=village/town in the same area; 2= village/town some Virajpet taluk, 3= Outside Kodagu.	Code	
<i>jati</i>	What is your <i>jati</i> ?	Text	

Natural Capital

"I will show you some pictures of different plant's parts. Please, could you tell me from which plant are they?"

Code	Instructions	Answer's format	Answer
<i>EKman0</i>	From which plant are these leaves?	In words:	
<i>EKcof0</i>	From which plant is this flower?	In words:	
<i>EKmar0</i>	From which plant is this stem?	In words:	
<i>EKpep0</i>	From which plant is this stem?	In words:	
<i>EKcoc0</i>	From which plant is this trunk?	In words:	
<i>EKbam0</i>	From which plant is this trunk?	In words:	
<i>EKnut0</i>	From which plant is this fruit?	In words:	

Use Questions:

"I am going to ask some questions about the use of some natural products by you and your household." *

CODE (XX)	1 Mango	2 Mara genasu	3 Coffee	4 Coconut	5 Pepper	6 Bamboo	7 Soap nut
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Code	Instructions	Answer's format	Answer
<i>(If they know the product, then follow the next questions. If they don't know ask for the next product.)</i>			
<i>U1cons</i>	What is it used for in your house?	In words:	
<i>U2cons</i>	Do you use for anything else?	In words:	
<i>U3cons</i>	Do you use for anything else?	In words:	
<i>The next questions refer to the informant and NOT to all the household.</i>			
<i>Ubuy</i>	In the last year, did you ever buy it?	1: buy, 0: no	
<i>Ucol0</i>	In the last year, did you ever collect it?	1: collect, 0: no	
<i>If he/she didn't collect it, go to question Uhh. If he/she collected, ask all the following questions:</i>			
<i>Ucol1</i>	In the last year, where did you mainly collect XX from? 1: Forest; 2: Coffee estates; 3: House land; 4: Other: _____ . (Could be combined)	Value:	
<i>Ucomm</i>	In the last year, what did you mainly do with the XX collected: 1: To use; 2: To sell; 3: Wage labour. (Could be combined.)	Value:	
<i>Next questions refer to the collection to use or to sell.</i>			
<i>Ucol2</i>	During the last year, when did you mainly collect XX it? 1: Rainy season; 2: Winter season; 3: Summer season; 4: all year round. (Could be combined)	Value:	
<i>Ucol3</i>	During that mentioned period, how often did you go to collected it?	In words:	
<i>Uacc1</i>	Last time you collected XX, how much time did it take to arrive from your house to the place where you collect it?	Minutes:	
Uhh	In the last year, some other members of your household collect it?	1: yes, 0: not	
<i>Uabund</i>	How is the abundance of XX around your community? 1= "Very low"; 2= "Low"; 3= "Moderately abundant"; 4= "Very abundant"	Value:	

Ecological Knowledge Questions:

Code	Instructions	Answer's format	Answer
	<i>Now I'm going to ask you some questions about Mango.</i>		
EKman1	How are the Mango leaves disposed? (show drawing)	1: Alternate; 2: Opposite; 99= Both.	
EKman2	Do the Mango leaves always have the same colour?	1: yes, 0: not	
EKman3	In which season does the mango tree flowers? 1: Rainy season; 2: Winter season; 3: Summer season; 4: all year round. (Could be combined)	1, 2, 3, 4	
<i>"Now I' will ask you some questions about the use of Mara genasu (wood potato) in your household" (↑ go to page xx, *).</i>			
	<i>I'm going to ask you some questions about Mara genasu (Wood potato).</i>		
EKmar1	How are the <i>Mara genasu</i> leaves disposed?	1: Alternate; 2: Opposite; 99= Both.	
EKmar2	How can you easily plant it? 1. Through seeds 2. Through the stem (nodes) 3. Through roots	1,2,3	
EKmar3	Which one is the <i>Mara genasu</i> leaf? (show drawing)	1, 2, 3	
<i>"Now I' will ask you some questions about the use of Coffee in your household" (↑ go to page xx, *).</i>			
	<i>I'm going to ask you some questions about Coffee plant.</i>		
EKcof1	How are the Coffee leaves disposed? (show drawing)	1: Alternate; 2: Opposite; 99= Both.	
EKcof2	Where do the coffee fruits grow? 1. On all the branches 2. On young branches 3. On old branches	1, 2, 3; 99: Others	
EKcof3	Which one is the Coffee leaf? (show drawing)	1, 2, 3	
<i>"Now I' will ask you some questions about the use of Coconut in your household" (↑ go to page xx, *).</i>			

	<i>I'm going to ask you some questions about the Coconut.</i>	
<i>EKcoc1</i>	In which season does the Coconut tree produce more fruit? 1: Rainy season; 2: Winter season; 3: Summer season; 4: all year round. (Could be combined)	Value:
<i>EKcoc2</i>	Which of these trunks is from Coconut tree? (<i>show drawing</i>)	1, 2, 3
<i>EKcoc3</i>	Where are the coconut flowers born? (<i>show figure</i>) 1. On the trunk 2. Between the leaves, in a different structure 3. At the end of the leaves	1, 2, 3; 99: Others
<i>"Now I' will ask you some questions about the use of Pepper in your household" (↑ go to page xx, *).</i>		
	<i>I'm going to ask you some questions about Pepper plant.</i>	
<i>EKpep1</i>	Which is the pepper leaf? (<i>show drawing</i>)	1, 2, 3
<i>EKpep2</i>	In one stick of pepper you can find: 1. One big flower alone 2. A lot of small flowers together 3. Pepper has no flowers	1, 2, 3; 99: Others
<i>EKpep3</i>	How are the Pepper leaves disposed?	1: Alternate; 2: Opposite; 99: Both.
<i>"Now I' will ask you some questions about the use of Bamboo in your household" (↑ go to page xx, *).</i>		
	<i>"I'm going to ask you some questions about Bamboo plant."</i>	
<i>EKbam1</i>	After how many years can you find bamboo rice in bamboo plants? 1. After 1 year 2. After 10 years 3. After 40-60 years	1, 2, 3; 99: Others
<i>EKbam2</i>	Which is the bamboo leaf? (<i>show drawing</i>)	1, 2, 3
<i>EKbam3</i>	After giving rice, what does it happen to the Bamboo plant?	1: dye; 0: Others.
<i>"Now I' will ask you some questions about the use of Soap nut in your household" (↑ go to page xx, *).</i>		
	<i>I'm going to ask you some questions about Soap nut.</i>	
<i>EKnut1</i>	Which is the Soap nut leaf? (<i>show drawing</i>)	1, 2, 3
<i>EKnut2</i>	Are the flowers smaller or bigger than this? (<i>Show a coin</i>)	1: Smaller; 2: Bigger; 99:Others

<i>EKnut3</i>	In which season does it flowers? 1: Rainy season; 2: Winter season; 3: Summer season; 4: all year round. (Could be combined)	1, 2, 3, 4	
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“ If you think about all these products that we spoke about: bamboo, *mara genasu*, mango, coffee, soap nut, pepper and coconut (show pictures of everyone), which one is the more important? “Please, could your rank these products in order of importance for you and your family?”

Through the pictures of every natural product they will create graphically the order preferred.

Code	Instructions	Answer’s format	Answer
<i>Urank1</i>	Which one is the most important?	In words:	
<i>Urank2</i>	And next?	In words:	
<i>Urank3</i>	And next?	In words:	
<i>Urank4</i>	And next?	In words:	
<i>Urank5</i>	And next?	In words:	
<i>Urank6</i>	And next?	In words:	
<i>Urank7</i>	And next?	In words:	

Code	Instructions	format	Answer
<i>Nland</i>	How many acres are you using to cultivate?	Number	
<i>Ncrop</i>	How many crops are you cultivating in your agricultural land?	Number	
<i>Elandown</i>	Who is the legal owner of the land you cultivate?	Text	
<i>Epattaland</i>	Does the owner have <i>patta</i> of this land?	1=yes; 0=not	
<i>PAsellland</i>	Can the owner sell this land?	1=Yes, 0=not	
<i>Nvegeta</i>	How many vegetables and fruit plants do you have in your land?	Number	
<i>Nsellprod</i>	The last year, how many rupees did you get for selling natural products (honey, sikekay, soapnut, tree mass...)?	Rupees	
<i>Elamps</i>	Do you have LAMPS licence to collect natural products?	1=Yes, 0=not	
<i>Nnatprod01</i>	What natural products did you collect for the household use the last week from outside your land?	Text	
<i>Nnatprod02</i>	What natural products did you collect for the household use the last week from outside your land?	Text	
<i>Nnatprod03</i>	What natural products did you collect for the household use the last week from outside your land?	Text	

<i>Nnatprod04</i>	What natural products did you collect for the household use the last week from outside your land?	Text	
<i>Nchicken</i>	How many chickens does your household have?	number:	
<i>Npig</i>	How many pigs does your household have?	number:	
<i>Ncow</i>	How many cows does your household have?	number:	
<i>Ngoat</i>	How many goats does your household have?	number:	
	<p>Show and say:</p> <ul style="list-style-type: none"> - These ten pieces represent the food and fruits that your household eat during the year, and - This draw contains different sources of food and fruits, which are the “nature/cultivate lands”, “shop/market”, “friends or family” and “ration cards”. <p>If you think about all the food and fruits that your household eat during the last year, how much of them you get from the different sources?.</p>		
<i>Nfoodnat</i>	(Don't ask.) How much do you get from the nature and cultivate lands?	Number of pieces	
<i>Nfoodshop</i>	(Don't ask.) How much do you get from the shop and market?	Number of pieces	
<i>Nfoodfriend</i>	(Don't ask.) How much do you receive from friends or family?	Number of pieces	
<i>Nfoodration</i>	(Don't ask.) How much do you get from the ration card?	Number of pieces	
<i>Qolnat01</i>	<p>If you think about all the good and bad aspects of “<i>nature surrounding your community</i>”, how satisfied are you with “<i>nature surrounding your community</i>”?</p> <p>1=“Very dissatisfied”; 2=“dissatisfied”; 3=“Not satisfied”; 4=“Not so satisfied”; 5=“Satisfied”; 6=“Very satisfied”.</p>	Value:	
<i>Naccind</i>	During the last 12 months, how many times have you gone to the Forest?	number	

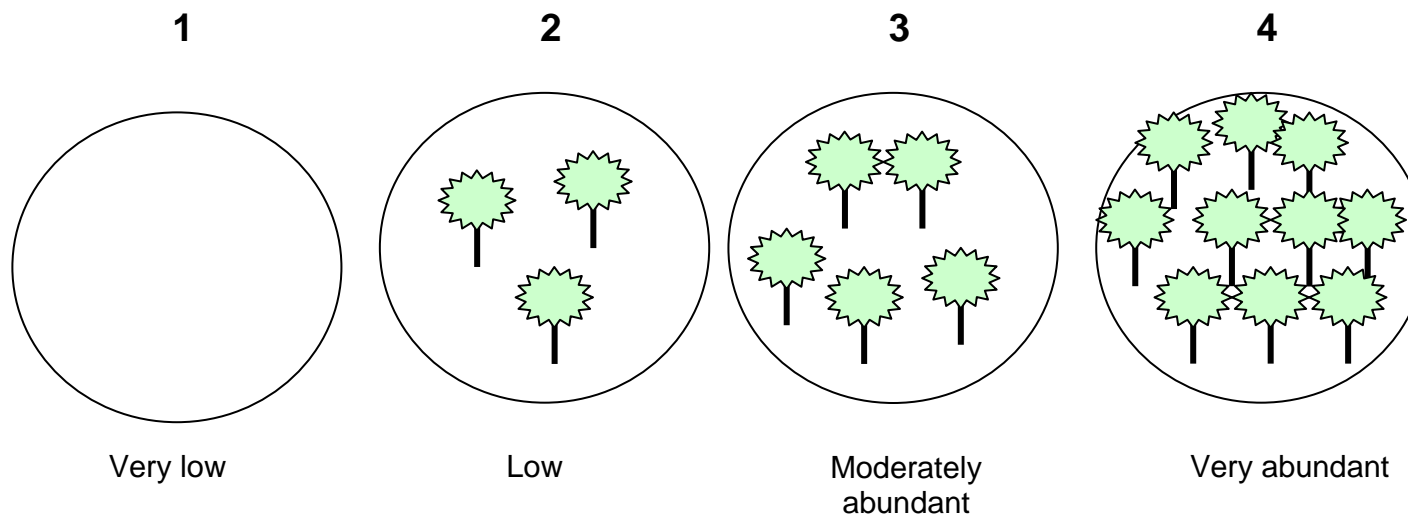
Next questions were part of a shared questionnaire with Francisco Zorondo, we compile here only what we used for the analysis:

<i>hkannada</i>	Please, Can you read the following text written in Kannada? In Kannada ["The Puttari festival. Puttari means new rice, and is the rice harvest festival in Kodagu. On the Puttari day, the house is decorated with flowers and green mango and banana leaves. Traditional foods are prepared."]	2=easily 1=with difficulty 0=unable	
<i>hliteracy</i>	What is the maximum school grade you have completed?	Text	
<i>Einctypes01</i>	Can you tell me all the sources of income in your household during the last month?	Text:	
<i>Einctypes02</i>	Can you tell me all the sources of income in your household during the last month?	Text:	
<i>Einctypes03</i>	Can you tell me all the sources of income in your household during the last month?	Text:	
<i>Einctypes04</i>	Can you tell me all the sources of income in your household during the last month?	Text:	
<i>Ehhincr</i>	How many rupees was your household income the last month? (considering all household member who are working)	In Rupees	
<i>Eindinc</i>	What was your personal income the last month?	In Rupees	
<i>Ehhmat</i>	(don't ask to the people) How is the house of the informant? 1=Hut, 2=mixed between hut and solid house, 3=solid house	Code	

Section V: Observations

Code	Instructions	Answer's format	Answer
<i>indcomment</i>	To ask: Do you have any comments about the questions?	Text:	
<i>Envobs</i>	How was the environment of the questionnaire? 0=bad; 1=not so bad, not so good; 2=good	Value	
<i>Biasobs</i>	Would be there some bias in any question?	1=yes, 0=not	
If the answer is YES:			
<i>Biasobs1</i>	Which are/what is the question with plausible bias?	Code of answer	
<i>Biasobs2</i>	Which kind of bias would be there?	Text	
<i>Inflobs</i>	Was the informant influence by somebody?	1=yes, 0=not	
If the answer is YES:			
<i>Inflobs1</i>	Is he/she some relative of the informant?	1=yes, 0=not	
<i>Inflobs2</i>	in which questions the informant received help?	Code of answer	
<i>Inflobs3</i>	Which kind of help her/his received?	Text	
<i>generalcomments</i>	Please, note general comments if any problem would be there in the survey.	Text	

Perceived Abundance scale (material used during the interviews):



Material used for the Ecological Knowledge Test
TRUNKS - COCONUT



LEAVES 1 – MARA GENASU



LEAVES 2 – COFFEE



LEAVES 3 – SOAP NUT



LEAVES 4 - PEPPER



LEAVES 5 – BAMBOO

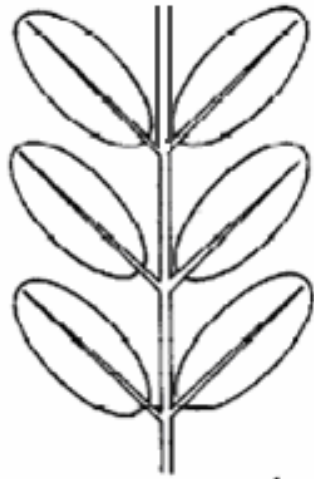


Material for Recognition used in Ecological Knowledge Test

(Note: during the fieldwork we printed pictures bigger than in the present document, to facilitate the recognition)



OPPOSITE



ALTERNATE



3. Appendix 2. Graphic material.

All pictures were taken during the fieldwork (January-April 2010).
Authors: Francisco Zorondo-Rodríguez and Mar Grau

Land-uses

Agro-forestral system:



Bamboo (left) and teak plantation (right):



Paddy fields:



Uses of NR

Bamboo as a tool:



Bamboo for construction (hut):



Coconut leaves as ornament:



Coffee, pepper, tamarind and others drying:



Mango leaves (ornaments for Festivals and other celebrations):



4. Appendix 3. Complementary data.

Natural product	Sources of collection			
	Forest	Estate	Houseland	Others
	(%)	(%)	(%)	(%)
Mango	22,87	30,85	45,74	0,53
Mara genasu	0,00	3,70	96,30	0,00
Coffee	0,56	44,69	54,19	0,56
Coconut	0,00	18,75	71,88	9,38
Pepper	0,00	36,57	61,19	2,24
Bamboo	86,73	0,00	4,42	8,85
Soap nut	30,00	35,00	30,00	5,00

Table. App. i. Sources of the collected products by percentages. Data that is represented graphically on Figure 1 (Results section).