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ENGOV Working Paper No. 3, 2013

**Dynamic processes in the use of natural resources
and food systems by indigenous and mestizo
communities in Mexico and Brazil**

Authors: Esther Katz (IRD) and Mina Kleiche-Dray (IRD)

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Dynamic processes in the use of natural resources and food systems by indigenous and mestizo communities in Mexico and Brazil

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Abstract

This report is describing and analyzing indigenous "knowledge(s)" as practices and discourses of traditional actors related to their cultural context -including the symbolic and material uses ascribed to natural resources- and changes in order to understand how they take part in the environmental governance alignment. Several complementary and comparative studies were carried out focused on the evolution in the use of plants in farming practices, cooking, craft and diet in Mexico and Brazil. These studies are related to the environmental issue that we will analyze via the social networks of "traditional" actors involved, particularly, from a local knowledge anthropological perspective.

This report is focused specifically on indigenous ethnic groups of the Mexican Oaxaca region (Mixtec and Triqui people) and the Northern Brazilian Amazon region (Arawak and Tukanoan people of the Rio Negro, State of Amazonas, Patamona of the State of Roraima and Ka'apor of the border of the States of Pará and Maranhão). To understand how these actors are related to nature, we will follow them through: the history of the occupation of the lands; the evolution of the social organization related to agriculture practices, mainly subsistence agriculture; the evolution of culinary practices and diets. With an integrated and comparative perspective this report will contribute to give information on the perceptions, representations and practices of the use of natural resources in order to respond to environmental governance issues.

Keywords

Natural resources; food systems; indigenous and mestizo communities; Mexico; Brazil; indigenous knowledge; traditional knowledge; environmental governance alignment; local knowledge; Oaxaca; Mixtec and Triqui people; Brazilian Amazon region; Arawak people; Tukanoan people; Rio Negro, State of Amazonas, Patamona of the State of Roraima; Ka'apor people; Pará; Maranhão; agriculture practices; subsistence agriculture; culinary practices.

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1. Introduction

The general contribution of the WP5 (Kleiche-Dray, 2012) on how nature can be used in an equitable and sustainable manner in LAC is based on the main issue which consists in understanding the involvement of different knowledge holders in the production of nature by their use of natural resources. It will try to position the evolution of different 'knowledges' on natural resources in these relationships between development issues, environment and the evolution of these knowledges in LAC countries. The methodology is a multidisciplinary approach applied on a selection of critical case studies following the chain of knowledge(s) in order to clarify the building of knowledge process (process and representation and practice) on nature, encapsulated in the culture, values and institutions of the main actors, traditional and scientific actors as knowledge holders. And it will emphasize in each case study the interactions, the exchanges, the spread of knowledge(s) built in different ways (traditional, indigenous, popular, scientific, hybrid, political, economic) and the fluctuation of perceptions and practices on natural resources (formalism, objectivity, instrumentalization) with the aim to cross these issues. The report presents the first results of the WP5. The WP5 is constituted by several studies focused on the relationship between knowledge on natural resources and environment governance through its uses by two main groups of knowledge holders, who hold specific knowledge: traditional populations and scientists. WP5 methodology was previously presented in the Analytical Framework Report of this research theme.

The objective here is to follow the thread of knowledge among the two studied groups and analyze how they respond to the question of environment governance. The first group, traditional Indigenous and mestizo populations generally do not participate in decisions taken in the political sphere, they are in a subordinate position, because their knowledge is not considered as universal, normative, but rather located in a particular context that would not allow to diffuse. On the other side, the scientists are holders of a dominating knowledge which constructed the prevailing vision held in the modern world on natural resources and on the whole, on relationship to nature. Between these two poles, there is a wide range of knowledge holders (NGOs, political and economic stakeholders, activists, etc.), considered in the WP5 as intermediary actors. Therefore we led different case studies linked to the following questions that were elaborated during the seminars we held in France and Mexico: What is (are) this (ese) knowledge(s)? What is nature? What are the natural resources? What is the environment governance for each group of knowledge-holders? (see the Analytical Framework Report of this research theme).

In order to reach these objectives in the dynamics of the WP5, we will work in three steps, following three lines. Each line is dedicated to a category of stakeholders (traditional actors, scientists and intermediary stakeholders). Each one will be worked in three steps: 1) do fieldwork and a field report for each case study 2) present a synthetic report for each line, based on the field reports 3) scientific publications

All the case studies and the members of the Project are presented on the web page dedicated to the WP5 <http://bekonal.hypotheses.org/presentation>

The present report is the second step of the line on traditional knowledge(s). This research report does not deal directly with environment governance, that will be dealt with in the next report, dedicated to the interactions between different types of knowledge, the objectives of the line 3.

Therefore the present report delivers the first results of the line 1, analyzing the traditional knowledge(s), as the second step of this group of case studies. In a third step, we will discuss the reports in seminars that will be led in 2013, in order to produce scientific publications.

As mentioned, this report is focused on one group of actors, the “traditional actors”. Its aim is to identify and characterize the knowledge(s) mobilized and the 'nature(s)' generated, to understand how such knowledge(s) and nature(s) (nature epistemologies) connect.

Several complementary and comparative studies were carried out, centered on the dynamics in the use of plants in farming practices, cooking, craft and diet in Mexico and Brazil. The case study on the use of medicinal plants by traditional curers in Mexico, which is still in process, is therefore not included in this report in order to deliver it in time.

These studies are related to the environmental issue that we will analyze via the social networks of “traditional” actors involved, particularly, from a local knowledge anthropological perspective crossed with a historical approach.

2. Research context

The ideas about the backwardness of the traditional health system and the traditional agricultural system are internalized in Latin American societies, particularly among decision-makers of health and agrifood policies. In fact, the descriptions of the low access to the public health system and of the low agricultural production are not impartial or neutral. On the contrary, they assume values, goals and models through a language of representations that are connected under a structure of power and hegemony. However, indigenous and mestizo populations in Brazil and Mexico have therapeutic systems (Linares and Flores, 1999), family production systems (Alvarez-Buylla et al., 2011) and knowledge(s) of medicine and particular culinary production associated with knowledge about the environment. In many Latin American countries, the traditional knowledge of these populations is often ignored or despised. This frustrates a dialogue permitting to understand health and agrifood problems as well as environmental degradation and poverty in Latin America and the Caribbean.

In the Amazon -a bio-geographical region known as a precious ecosystem that hosts great diversity of flora and fauna often threatened of extinction-, environmentalists have valued certain indigenous knowledge on nature (Carneiro da Cunha and Almeida, 2000), as a way of protesting against the devastating impact of intensive farming, illegal deforestation for commercial purposes and, recently, against soybean crops, predatory practices which are responsible for the formation of the so-called Arch of Deforestation in the Brazilian Amazon. However, environmentalists have not publicized therapeutic, agricultural or culinary knowledge(s). In Brazil, research on medicinal plants has focused on their capability to deliver active ingredients to major international pharmaceutical companies that favor their integration into industrial pharmaceutical production. However, their use and handling within indigenous and mestizo communities has not been considered. In the same way, Agricultural production has focused on commercial agriculture and biotechnology, favoring productivity rather than agro biodiversity or sustainability. In Mexico, similarly, despite the

recognition of the historical importance of the use of endemic plants in the production of medicine (contraceptive pill obtained from barbasco) and of the cultural and food importance of maize for traditional farmers, their traditional therapeutic and agricultural systems are still regarded as backward and unproductive. The indigenous cuisine heritage, even if it is the origin of Mexican cuisine, has been recently recognized by the UNESCO but has not yet received the recognition it deserves (Boege, 2008). The same case occurs in Brazil, where the indigenous population represents a minority: indigenous cuisines are ignored by the majority of the population. Moreover, in a context of globalization, migration and urbanization in both countries, the agricultural and traditional culinary knowledge(s) are threatened. On the other hand, civil society movements and recent initiatives of heritage declaration taking place in both countries try to resist these threats (Ellen et al., 2000; Toledo, 2000).

3. State of the art and research gaps/report contribution

The study deals with two areas of Latin America: the Mixtec region in Southern Mexico and the Northern Brazilian Amazon, on the themes of knowledge on natural resources, subsistence agriculture, food plants and food practices. For several decades, anthropological research in Mexico has mainly dealt with indigenous people. Numerous monographs of indigenous communities were published from the 1930's to the 1980's. Anthropologists have also been and still are very attracted by rituals and their continuity since the prehispanic period. Anthropologists rarely dealt with knowledge on natural resources. Corn cultivation was usually quickly described in a monograph chapter and very little attention was paid to the use of other natural resources (fruit trees, wild plants, game, insects). Anthropologists were also more attracted by some regions than others. Until the 1980's, there were few anthropology works published on the Mixtec region: Ravicz (1965), Romney and Romney (1966), Pépin-Lehalleur (1976). There were also few archeology (Spores, 1967) and ethnohistory publications (Dahlgren, 1954), it has slightly increased since then, but still leaves many blanks (Jansen, 1982; Spores, 1984; Pastor, 1987; Monaghan, 1990; Terraciano, 2001). It has increased in anthropology, by most publications have been oriented on emigration, except for Monaghan's book (1995) on rituals and symbolism. In the 1980's, biologists recently trained in ethnobiology started exploring the knowledge and use of the environment by different indigenous and mestizo populations all over Mexico. In the Mixtec region, J.L. Viveros and A. Casas, directed by J. Caballero (UNAM), studied the use of plants by the Mixtecs of Alcozauca, Guerrero (Casas et al., 1994). They instructed E. Katz in ethnobiology. A. de Ávila studied the use of plants by the Mixtecs of Coicoyan de las Flores, Oaxaca (close to Guerrero). But they all have had different approaches. Ávila focused more on plant classifications and ethno linguistics (see Ávila, 2004). Viveros and Casas worked more on the management of plants, Casas went on with research on plant domestication. Katz has had a more anthropological approach, an interest in symbolism as well as in the historical continuity of agricultural and culinary techniques. Casas, Viveros, Caballero and Katz (1987) compared the use of food plants and the food consumption patterns in the two areas where they worked. Most researches on the knowledge and use of resources in Mexico, usually led by biologists, have occasionally dealt with the historical continuity in the use and management of resources, but have more rarely crossed this type of data with social organization, exchange networks, history of land occupation, mobility and migration, relationships to institutions, what brings out the long-term roots and the circulation of knowledge on natural resources.

On the studied areas in the Northern Amazon, the Northwestern region (Brazilian Rio Negro and neighboring regions in Colombia and Venezuela) has been fairly well studied (Reichel-Dolmatoff, 1968, 1995; Hugh-Jones, 1979; Chernela, 1996; Ribeiro, 1995), but probably not enough in relationship to its diversity. The middle Rio Negro had not attracted anthropologists, as, for a long time, local people did not show off their Amerindian identity. There are very few studies of the Patamona (Whitehead, 2003), but sometimes included with other ethnic groups, such as Akawaio. The main research on the Ka'apor were led by Ribeiro (1996) and Balée (1994). Anthropologists who have dealt with the Amazon have also been fascinated by rituals, but also by mythology, social organization and relationship to nature. Nature has been a central theme of study in Amazonian anthropology. It already appears in Levi-Strauss's *Pensée sauvage* (1962) and *Mythologiques* (1964-1971) and is the main focus of study of famous anthropologists (Descola, Reichel-Dolmatoff, Viveiros de Castro). On the other hand, in spite of ethnoecological research led by Posey (1990), Balée (1994) and Ribeiro (1995) in the 1980-90's, studies in ethnobiology are far less numerous than in Mexico. Few works, except Ribeiro (1995), cross the ethnobiological approach with the study of the culinary techniques. On the whole, Amazonian agricultural and food systems have not been much studied yet (see Hugh-Jones, 1979; Ribeiro, 1995; Van Velthem, 1996), but may raise interest in the future (see Empeaire, 2010, Robert & López, 2012). Part of these studies are linked to material culture and agriculture and culinary utensils as arts and crafts (Ribeiro, 1995, Van Velthem, 2003). Studies in ethnohistory and archaeology of the Amazon are not numerous yet (see Neves, 2001, Carneiro da Cunha, 1992), and oral history has been so far more explored than archives. For a long time, the Amazon has been seen as an area of wilderness with a static history, populated by small isolated communities. Since the 1980's-90's, it has been shown that the Amazon had a much bigger population before the colonizers' arrival, that the forest has been transformed by humans for centuries (Balée, 1994), that there used to be long-distance exchange networks that were affected by colonization (Dreyfus, 1992), but complex exchange networks still remain at regional levels (Gallois, 2005). Empeaire (2008, 2010) has set up an innovative approach on the circulation of cultivated plants, crossing cultivators' histories of life with the history of their plants, which she applied on her research in the Rio Negro¹: she asked the cultivators how and who from they obtained their plants, which ones they took along when they moved from one place to the other, and designed the exchange networks through the Pajek computer program. We will refer to her results. Inspired from this method, we also started asking about the plant circulation in the Mixtec highlands. In the Northern Amazon, the team members linked, like in the Mixtec region, subsistence agriculture with culinary techniques and food consumption, and links with social organization, myths, and circulation of knowledge, mobility and migration, relationships with institutions.

4. Methodology

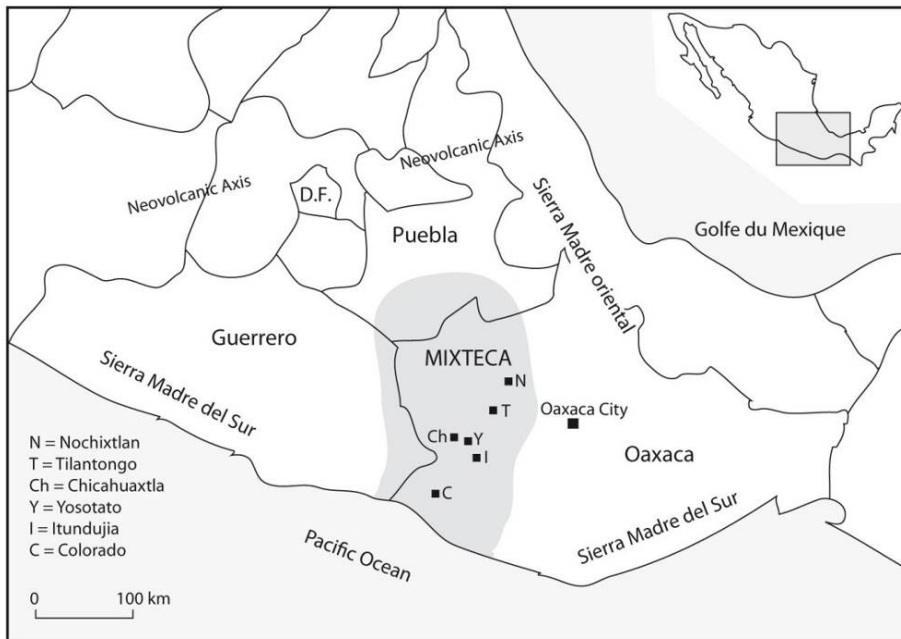
The present report was written by E. Katz in collaboration with Mina Kleiche-Dray, the Work Package leader. It is the synthesis of previous reports based on the field results of WP5 team: the anthropologists E. Katz, F. Jankowski, E. Lazos (with two students), and C. López, and two Brazilian Master students directed by E. Katz, Z. Oliveira and F. Silva, of the interdisciplinary program in "Sustainable Development in Indigenous Lands" of the Centro de Desenvolvimento Sustentável of the University of Brasilia. Both of them are Amerindians and have been working on their own community and region. E. Lazos and her students applied questionnaires on food and agricultural

¹ She is co-leading the IRD/CNPq PACTA project in which E. Katz is participating (Populations, Agrobiodiversity and Associated Traditional Knowledge).

production in the Mixtec villages they studied in 2011. In July and October 2011, F. Jankowski, as a post-doctorate, worked in another Mixtec village, San Juan Colorado, observing the interactions between farmers and agronomists in the framework of a participative development project. E. Katz has been working in the Mixtec highlands since 1983. She went back in 2011 to San Pedro Yosotato, the main community she studied, as well as neighbouring Mixtec and Triqui villages, in particular San Andrés Chicahuaxtla, a Triqui community. She has started working in the middle Rio Negro in 2007. C. López started working with the Ka'apor a few years ago, and went back there in 2011. The present report is the result of fieldwork led in 2011, but includes as well several decades of fieldwork experience and bibliographical research. The descriptions and analysis presented in this report are focused on specific case studies, therefore cannot lead to a generalization. Yet they all respond to a common research question on the construction of knowledge through the relationship between Nature and Society, providing detailed information on the use of resources in the different studied communities. All the researchers used the classical anthropological method of the participant observation, with open and semi-open interviews. Several of them also used methods of ethnobotany. They also made an effort to present the historical background of the studied areas. The intention is to go beyond the classical case studies by integrating a dynamic perspective and taking traditional communities as open systems. Therefore the presented results have to be considered as a first trial of this innovative approach. We hope that they become significant elements in a brainstorming on the role of traditional knowledge in the construction of a model of fair and sustainable use of natural resources.

5. The case studies presentation

The case studies have been led so far in Mexico and in Brazil with indigenous people, on the theme of agriculture and food systems. In Mexico, the research was conducted in three areas of the Mixtec region, in the State of Oaxaca: San Miguel Huautla (Nochixtlan district) and Santiago Tilantongo (Tlaxiaco district), in the semi-arid plateaux of the highlands (E. Lazos), Santa Cruz Itundujía (Putla district) (E. Lazos), San Pedro Yototato (Tlaxiaco district) and San Andrés Chicahuaxtla (Putla district) (E. Katz), in the subhumid area of transition between the highlands and the lowlands, and San Juan Colorado (Jamiltepec district), in the subhumid lowlands, called “the Mixtec Coast” (F. Jankowski). All villages are Mixtec communities, except for Chicahuaxtla, a Triqui community. Both Mixtec and Triqui people speak Otomanguan Mixtecan languages.



Map 1 : Localization of the studied areas in the Mixtec region



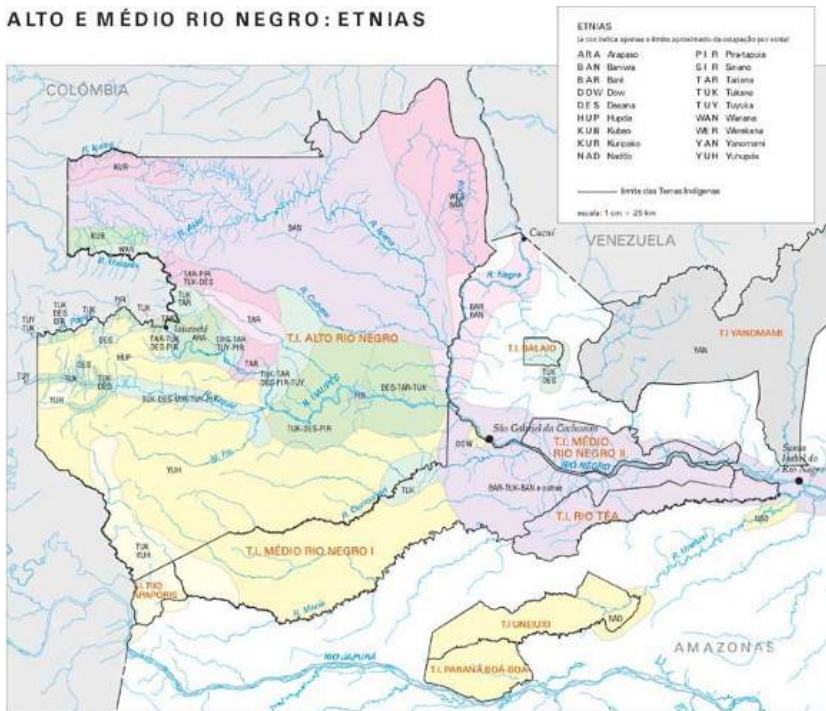
San Miguel Huautla (Nochixtlan), Santa Cruz Itundujía (E. Lazos), San Pedro Yosotato (E. Katz)

In Brazil, the research was conducted in three regions of the Northern Amazon: first, in two areas of the Rio Negro basin, in the State of Amazonas, a well preserved forest area of the Northwestern Amazon, in the middle Rio Negro, in the small multi-ethnic town of Santa Isabel do Rio Negro (7000 inhabitants) and surrounding communities in the middle Rio Negro, with Tukanoan, Baré and Baniwa (Arawak) people (E. Katz), and in the upper Rio Negro, with Baniwa and Curipaco people (who speak almost the same language) in the Aiary and Içana rivers and in the town of San Gabriel da Cachoeira (F. Silva, CDS student, Baniwa Indian); second, with Patamona (Carib) people, in the community of Urinduk, Terra Indígena Raposa Serra do Sol, in the savanna highlands of the State of Roraima (a corridor of savanna in the middle of the Amazonian forest) (Z. Oliveira, CDS student, Patamona Indian); and third, in the area of transition between forest and tree savanna, at the limit of the States of Pará and Maranhão, in the Northeastern part of the Amazon (called “pre-Amazon”), on the Turiacu river, in the Terra Indígena Alto Turiacu, with the Ka’apor, speakers of a Tupi language (C. López).



Map 2: Localization of the 3 areas of study in the Northern Amazon: Rio Negro (Santa Isabel, São Gabriel and communities of the Alto Içana and Aiary rivers) (Amazonas), Terra Indígena Raposa Serra do Sol (community of Urinduk) (Roraima), Terra Indígena Alto Turiaçu (Maranhão/Pará)

ALTO E MÉDIO RIO NEGRO: ETNIAS

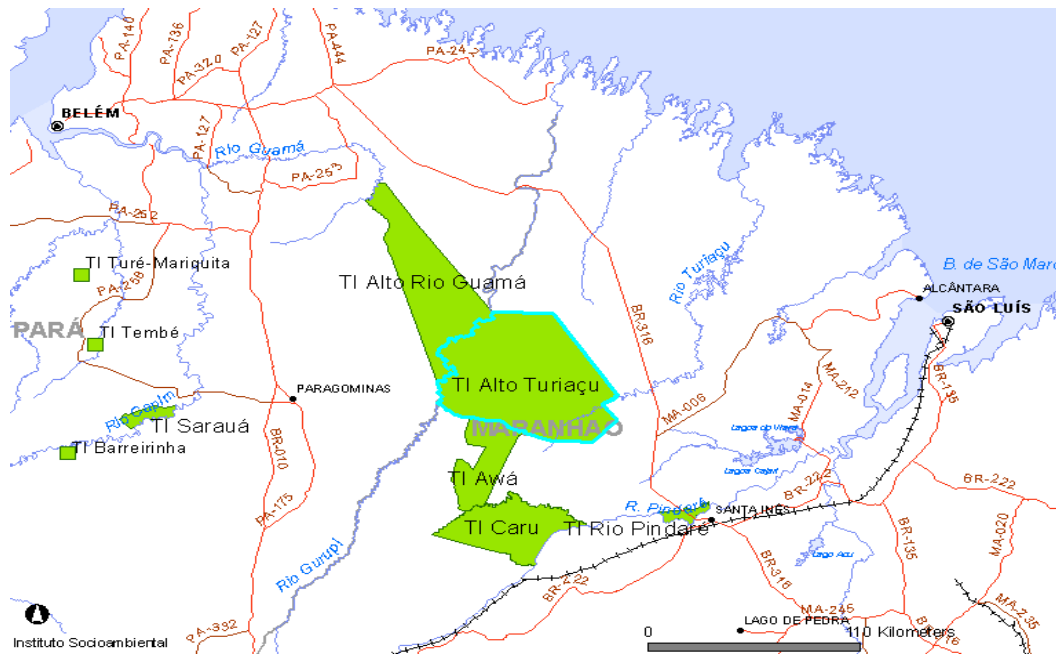


Map 3: Ethnic groups and Indigenous Lands of the Rio Negro. Source: Instituto Socioambiental.



Map 4

Localization of the community of Urinduk, Município of Uiramutã, Terra Indígena Raposa Serra do Sol (TIRSS), State of Roraima



Map 5: Localization of the TI Alto Turiaçu

6. Research results

Synthesis

In order to understand the relationship between the studied people and nature, we will present first, as an introduction, their localization, the particularities of their ethnic groups(s), their social and spatial organization and their mode of subsistence. Then we will describe their agricultural and culinary practices and the recent evolution of their diet. With an integrated and comparative perspective, this report will contribute to give information on the perceptions, representations and practices of the use of natural resources in order to respond to environmental governance issues.

The Mixtec and Triqui people have always occupied the Mixtec region. They were deprived of part of their lands under Spanish colonization, then again at the time of independence; they gained back some lands after the Mexican Revolution but have constantly gone through land conflicts, particularly harsh in this region. The Mixtec and Triqui people are primarily corn cultivators practicing the milpa system. Their knowledge of nature is very much focused on agriculture. The milpa is the name for the corn field, where corn, beans and squash are planted together. Moreover the farmers collect in this space edible weeds and insects and occasionally hunt animals attracted by the crops. In each micro-environment, they cultivate different species or varieties of the three plants. Introduced “beans” (African beans in the lowlands, fava beans in the high altitudes) are cultivated the same way as local beans, while wheat, introduced by the Spaniards in the highlands, is cultivated separately. Corn varieties are classified according to the criteria of altitude, use of water, agriculture technique, origin of the seeds, grown duration, color of the seeds, and size of the cob. Agriculture work is traditionally performed through mutual help (the *guetza*), less practiced today because of migration, above all to the US. It seems that the varieties cultivated on slopes or on the highest altitudes are the first ones that the farmers give up, because they require more work, have a longer growing cycle, sometimes are farther from the village. On the other hand, new species or varieties of plants and new techniques have been introduced recently: passion fruit, for instance, is now cultivated in lowlands gardens; tomatoes are now grown on larger scale in greenhouses. In the cosmovision of the Mixtecs and the Triquis, agriculture is a central point; the corn cycle and the rain cycle are crucial. There is a long-term continuity in the performance of agrarian rituals, even though they took a catholic appearance.

Likewise we have to take into account the historical background of the population living in the Northern Amazon. The Rio Negro has a complex multi-ethnic setting. Arawak, Eastern Tukanoan and Maku people have been interacting together for centuries. Yanomami people, who were isolated for a long time, are on the margin of these interactions. Arawak and Tukanoan people, who are the object of this study, live along rivers, practice agriculture, fishing and hunting and share the same agricultural and culinary techniques, focused on bitter cassava. Maku people used to be hunters-gatherers, now practice agriculture, but still have a hunters’ reputation. Carib people of the savannas of Roraima, such as the Patamona, have many agricultural and culinary techniques in common with the Rio Negro people. The Ka’apor, a Tupi-speaking people, who call themselves “the forest dwellers”, fled from the colonizers who settled on the coast and went inland. They do not live on riversides, and are more hunters than fishermen. They also practice an elaborate agriculture.

The traditional Amazonian slash-and-burn agriculture systems are based on bitter cassava for the people of the Rio Negro and Roraima, both on sweet and bitter cassava for the Ka’apor. Fishing,

hunting and gathering are also important activities. They also extract material from their natural resources for their arts-and-crafts. Patamona and Rio Negro people build canoes. Basketry is the way of making most culinary utensils in all these ethnic groups. Moreover the Ka'apor are very well renowned for their feather work. All of these ethnic groups have a very fine knowledge of their natural resources.

More generally the integrated perspective report will also focus on the links between social organization, mobility and the use of natural resources as a key role in the construction of knowledge related to the nature. Markets have been an important Mesoamerican institution since prehispanic times and are crucial places for exchanging knowledge on plants or obtaining new species. Many plants were introduced during the Spanish colonization. For the last decades, State institutions have to be taken into account in this circulation. In the studied Amazon regions, mobility is also part of the structure of the societies. Complex exchange networks link different ethnic groups in the Rio Negro and Roraima areas; moreover in the Rio Negro, because of exogamy and patrilocality, women circulate from their home community to their husband's community. Trade, market, mobility and migration within the region and out of the region or of the country allow people to carry food or seeds along with them. This exchanging includes their adaptation, re-appropriation by other people in another context, which favored the construction of knowledge.

The analysis of the culinary knowledge will show how food processing and consuming are associated to material and symbolical practices. If in the Mixtecs and Triquis communities, many dishes are still boiled and steamed in pots and earth oven, cooking on a gas stove and frying food have now become common techniques. The complexity of the culinary processing of corn to make tortillas requires a long training, especially to master the grinding techniques; the young women are likely to lose them soon, as they now use motor grinders. Young people are also losing knowledge on wild greens (quelites), which were commonly consumed, together with tortillas, beans and chili pepper. Since the late 1990's, with the massive emigration to the US, more money has been circulating in most communities, so people consume less greens, more meat and more industrial food and drinks.

Like corn for the Mixtec and Triqui people, one plant, cassava, plays a central role in the Northern Amazonian people's food. Cassava processing techniques also require years of training. A wide range of products are issued from this tuber, in particular cassava bread, "flour" and beer. In each studied area of the Amazon, food habits are dynamic. Besides traditional food, based on cassava and fish or game, new items have been introduced. The middle Rio Negro people, who were involved in the trade linked to extractivism since the end of the 19th century, are the most exposed to changes. They have had access to outside food for a long time, but only consumed it occasionally. Since the late 1990's, many of them, as well as people of the upper Rio Negro, have migrated to towns on the river and receive State allowances, therefore have been consuming outside food on a more daily basis. Upper Içana Baniwa, Patamona and Ka'apor people, located in more remote areas, retain more their traditional diet but have also had access to industrial food for the last 10-15 years.

The description and analysis of these case studies showed us that "Traditional knowledge" covers a wide range of perceptions, representations and practices. Contrarily to what is generally shown, indigenous or traditional perceptions, representations and practices are not backward, but alive and dynamic. They have been adapted not only to their biophysical environment but have also been following the evolution of the society. As structural criteria of the studied societies (matrimonial exchanges; goods exchanges) or as specific/occasional events (migration, colonization, welfare State

actions), the circulation will show that even when living in remote communities, people are mobile and their knowledge of natural resources is always connected to other social actors. Historical analysis helped us to see how new plants and agriculture techniques are constantly experimented, selected, adopted, while others are left aside, when their efficiency is not proved at a technical or social level.

If the analysis of a long historical period allowed us to observe the dynamics of the use of natural resources in all case studies, the analysis of some present practices reinforce this observation and allowed us to identify and characterize it.

All the case studies presented in this report highlighted the close relationships of these populations with the environment through agriculture and culinary practices, which are expressed in various ways. The interest of these studies is given by the deep roots of plant knowledge through their use in agriculture and food processing techniques, which tangled up varied social links. The historical analysis comparing different social spaces shows how the use of natural resources has always been dynamic and helps understanding how knowledge has been built

Details of research results

Ethnic groups, social and spatial organization and use of resources

Table 1: Ethnic groups of the Mixtec region (studied groups are in bold)

All ethnic groups are speakers of Otomanguean languages. Linguistic sub-groups are indicated.

Main ethnic group	Mixtec (Mixtecan)
Minor ethnic groups (enclaves within the Mixtec territory)	Chocho (Popolocan) (highlands) Popoloca (Popolocan) (highlands) Triqui (Mixtecan) (limit between highlands and lowlands) Amuzgo (Amuzgo) (lowlands)

The Mixtecs are presently the third main ethnic group in Mexico, with about 475 000 native speakers. Moreover there are numerous Mixtecs who do not speak their language anymore. The Triquis, who speak an Otomanguean Mixtecan language, like the Mixtecs, are about 25 000 speakers (INEGI, 2010, INALI, 2008). The Mixtec region, in Mixtec Ñu Savi, the Land of the Rain, is located in the Southeast of Mexico, in the Western half of the State of Oaxaca and on a fringe of the States of Puebla and Guerrero. In the late prehispanic period, the region was divided into political entities, which the Spaniards called kingdoms or “lordships” (señorios), held by Mixtec rulers. The Triquis, as well as other small Otomanguean ethnic groups, were included in Mixtec señorios. The Aztecs conquered most of the Mixtec kingdoms in the 15th century, and called the region Mixtecapan, the Land of Clouds. Then the Spaniards conquered the Aztec Empire in 1521 and colonized the Mixtec region (Spores, 1984). They divided the Mixtec political entities into smaller communities, reorganized the society, destroyed indigenous temples, built churches, converted the population to Catholicism, took hold of the best lands and introduced plants, animals, agricultural and food processing techniques from Spain (ibid.). By 1580, as shown in the Relaciones Geográficas, reports sent to the Spanish Crown (Acuña, 1984), many introduced plants were cultivated by the Mixtec farmers (Katz, 1994). The inhabitants of the Mixtec region were primarily cultivators of corn (*Zea mays*), associated to beans (*Phaseolus* spp.) and squash (*Cucurbita* spp.). They went on practicing

this agricultural system, but also integrated new plants, as we will see below. They also kept on practicing agrarian rituals, turned into catholic Saints festivals (Katz, 2002a). After the Independence of the country, in 1821, the new government authorized the privatization of the lands of the indigenous communities, which had been under the protection of the Spanish Crown during the colonial period. The Mixteca Baja (Northwestern part of the region), in particular, was quite affected by this process, called *desamortización* of the lands (Pastor, 1987). The Mixtecs participated actively in the Mexican Revolution, which started in 1910. Some villages were supporters of Zapata and others of his rival, Carranza. As a result of the Revolution, an agrarian reform was applied in the 1930's. The lands of the haciendas were distributed as *ejidos* (lands that belong to the State but are used by a community) between several communities. In the 1990's, a new law authorized the privatization of the *ejidos*. In 1998, when an inventory of the lands was performed in the perspective of potential privatization, one of the studied communities, Yosotato, entered into a severe dispute with a neighboring village and lost its *ejido* lands. This violent conflict has not been solved yet. Oaxaca indigenous communities have gone through land conflicts all through their history, with peak periods. In 2003, Oaxaca was the State with the highest number of land disputes (about 300) and there were 15 violent land conflicts, including Yosotato case (López Barcenas, 2003). When there are conflicts between neighboring communities, people do not marry together, do not have exchanges, what accentuates the linguistic separation. Presently, Mixtec is divided into about 80 different languages and Triqui into 3 languages (INALI, 2008). When there are no specific conflicts, there are many exchanges between communities, especially through religious festivals or pilgrimages and markets (markets always take place where there is a religious festival). People establish *compadrazgo* (ritual kinship) relationships in the places where they go to buy or sell in the market and on the way to the trading place. There have always been trading routes linking the Mixtec highlands to the lowlands and the Mixtec region to the rest of the country (Terraciano, 2001). Some regional routes were replaced by road transportation since the 1960-70's, but some traditional traders (*chirinos*) still travelled with mules until the 1980's. Markets have always been an important Mesoamerican institution (Long & Attolini, 2009). They are crucial in the exchange of plants and knowledge. Mixtec people have also been migrating within the region (they used to work temporarily in the haciendas) and, for at least several decades, out of the region or of the country, carrying food or seeds along with them. Migration to the United States has tremendously increased in the late 1990's, but with strong restrictions to cross the border. Massive emigration has had an impact on agriculture practices and food habits. Further consequences may appear in the future.



Market in Chichahuaxtla (E. Katz)

Land occupation in the Northern Amazon

Table 2: Studied Amazonian ethnic groups and their neighbors, by linguistic family (Source: Ricardo, 2012) (The studied groups are in bold)

Table 2.1: Ethnic groups of the Rio Negro

Arawak	Eastern Tukanoan	Maku	Yanomami
Baniwa, Curipaco (Aiary, Içana) (+Venezuela) Werekena (Xié) Tariano (Vaupés) Baré (middle and upper Rio Negro)	Tukano, Desana, Piratapuia, Tuyuka, Arapasso, Wanano, Karapanã, Miriti-Tapuya Bará, Barasana, Cubeo, Makuna, Tatuyo (Colombia)	Daw, Hupdah, Yuhup (upper Rio Negro) Nadöb (middle Rio Negro) Kakwa, Nukak (Colombia)	Yanomami (rio Marauia, Venezuela) Sanuma, Ninam, Yanomae,... (Roraima, Venezuela)

See Map 3.

Table 2.2: Indigenous people of Northern Roraima

Carib	Arawak
Kapon (people of the highlands): Ingarikó, Patamona , Akawaio – NE Makushi, Taurepang – N, NE Yekua’na (Terra Indígena Yanomami) – NW	Wapishana – N, NE

Table 2.3: The Ka’apor and their neighbors

Tupi	Timbira (Macro-Gê)
Ka’apor , Tembê, Guajajara, Guajá	Canela

The Rio Negro

The Northwestern Amazon, which includes the Rio Negro region in Brazil, the Vaupés region in Colombia and part of the Amazonas State in Venezuela, is considered by most anthropologists as a whole cultural area, where Arawak and Eastern Tukanoan people, and, in part, Maku people, share many cultural features (Calbazar & Ricardo, 2002). Yanomami people live on the



margins of this region, but were isolated for a long time and do not share the same cultural system (Milliken et al.).

The upper Rio Negro area is a complex mosaic of the people mentioned above (see Map 3). In the middle Rio Negro, the original inhabitants were Maku and Arawak people, including the Baré, but the area was highly depopulated in the 18th century, because of epidemics and slave raiding. The Arawak inhabitants lost their languages in favour of Nheengatu (or *lingua geral*, common Tupi language). Since the end of the 19th century, people have been migrating from the upper to the middle Rio Negro. Most early migrations were linked to extractivism (Calbazar & Ricardo, 2002). In Santa Isabel, most ethnic groups of the region are represented (Dias, 2008). Salesian missions were created in the middle and upper Rio Negro at the beginning of the 20th century and had a strong influence on the local cultures.



Salesian church and mission, Santa Isabel do Rio Negro (E. Katz)

Maku people usually live in between rivers; they used to be hunters-gatherers, but they adopted agriculture from their neighbors (Epps, forthcoming). Arawak and Eastern Tukanoan always live close to rivers and practice agriculture, as well as fishing, hunting and gathering. Arawak people, who are distributed over a large portion of the Amazon, are usually associated with riverside occupation, fishing and agriculture. They also practice exchanges and alliances rather than war (Santos Granero, 2002). Emperaire (2010) confirms that in the Rio Negro, the agricultural and food systems are common to Arawak and Eastern Tukanoan people. These people also have in common a patrilineal, patrilocal social organization based on clan exogamy (combined with linguistic exogamy in the case of the Tukanoans). Circulation of knowledge and of goods occurs through ritualized and non-ritualized exchanges with allies (Reichel Dolmatoff, 1968, Jackson, 1983, Chernela, 1996, Calbazar & Ricardo, 2002). Plants, in particular cassava varieties, circulate through marriage exchange. Women get cassava varieties from their mother, and when they get to their husband's community, they receive another stock from their mother-in-law (Emperaire, 2010). People can circulate to very far away distances on the rivers, and transport new plants back home. They also move their residence often, and when they do so, bring along plants. Missionaries, extractivism traders, and more recently government institutions have played a part as well in the introduction of new plants to the region (ibid.).

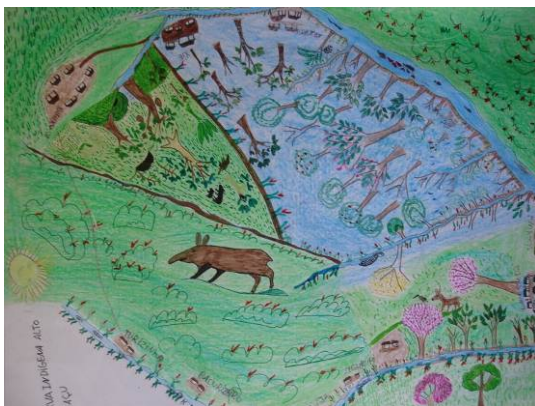
The Patamona of Roraima

The Patamona are a Carib ethnic group of the savanna highlands of the State of Roraima. Together with the Ingarikó and the Akawaio, they are called Kapon, "People of highlands". For a long time, they had little contact with the Brazilian society, unlike their lowlands neighbors, such as the Makushi (Jovita, 1948), but they were involved in indigenous exchange networks, such as the ones described for other Carib people by Gallois (2005). Until a few decades ago, they used to travel to Southern Venezuela to exchange ceramics against cassava graters made by the (Carib) Yekuana. The

Patamona were recognized in Brazil as a specific ethnic group only in 2005. They live in two multi-ethnic communities (Patamona/Akawaio/Taurepang/Makushi/Wapishana), Urinduk and Saraó, along the Mau river, at the Guyana border. They are only 120 people in Brazil (FUNASA, 2010) and were 5500 in Guyana in 1990 (Ricardo, 2012). They intermarry with other Carib groups of the region, Ingarikó, Akawaio, Taurepang, Makushi. Like other Carib ethnic groups, they have a matrilineal, matrilocal social organization. The Patamona practice agriculture and fishing and live close to the rivers. All the men know how to fish, but not all of them are hunters. They are also well-known canoe builders, which they exchange with other ethnic groups. They usually cultivate in the forested areas of their territory.

The Ka'apor of Pará/Maranhão

The Ka'apor speak a Tupi language. They are likely to be the descendants of the Tupinamba people who occupied the coast of Maranhão and Pará at least until the 17th century, when they were described by French explorers (Thévet, d'Evreux), and escaped from the Portuguese colonizers by fleeing to the inland forests (Ribeiro, 1996). According to their oral history, the Ka'apor used to live in the area of the present city of Belém and fled through the Guama river, until reaching the Gurupi and Turiaçu rivers where they presently reside. The Ka'apor do not live on main riversides, but inland, on terra firme. As other Tupi groups, they occupy forest areas, while the Macro-Gê, such as their Timbira neighbors, the Canela, live in the cerrado (tree savanna). Precisely, "Ka'apor" means "people who live in the forest". They are mainly cultivators, hunters and gatherers. They also fish in small tributary rivers. The close relationship of Ka'apor with the environment is expressed in various ways: the names of the people are mainly related to plants; time management is based on knowledge of flowering and fruiting cycles of plants and animal species abundance. Although Balée and Aguiar (1988) describe the Ka'apor as patrilineal and uxorilocal, according to present observations done by C. López, they have a patrilineal and patrilocal social organization, but deeper studies on this subject would be necessary. Women receive seeds and cassava stakes from their mother and their mother-in-law.



Ka'apor drawing of the use of resources (C. López)

The common feature of the presented ethnic groups is the practice of subsistence agriculture and the strong relationship to the environment. The Mixtecs and Triquis are mountain people. They are not turned towards the coast or the rivers. For them, agriculture is a way to transform the wilderness into a humanized environment. The plant world is very significant for them, while hunting

and fishing are very minor activities. On the other hand, for Amazonian people, hunting or fishing are as important as agriculture. People of the riversides, such as the Patamona and the Arawak and Tukanoans of the Rio Negro are more inclined to fishing, while inland people such as the Ka'apor are more hunters, but both activities are complementary in space and seasons. Traditional slash-and-burn Amazonian agriculture in areas of low demographic density, such as the ones studied, have a low impact on the environment (Emperaire, 2010), what made Westerners believe for a long time that the Amazon was a "virgin forest" (Balée, 1994). The forest provides part of their subsistence, as well as the material for their arts-and-crafts.

Colonization, welfare and coercive State and impact on agriculture relationships: landscape transformation processes and agriculture practices

Mixtec/Triqui agriculture and corn cultivation

Agriculture has always been the central focus of Mesoamerican cultures. The agricultural fields are also places where people collect "wild" plants, such as edible weeds (quelites), and insects, and occasionally hunt animals. Today, in the Mixtec region, the main economic activity is still subsistence agriculture, based on the milpa system, the association of corn (*Zea mays*), beans (*Phaseolus* spp.) and squash (*Cucurbita* spp.). Different species or varieties of the three plants are cultivated according to the altitude and climate. *Cucurbita ficifolia* and *Phaseolus coccineus* only grow in the highlands, *Cucurbita argyrosperma* only in the lowlands, while *Phaseolus vulgaris* is found over a wider range of altitude. Mixtecs and Triquis have the same practices, which may vary from one community to the other according to the micro-environments. In the Mixtec highlands, some other cereals and legumes, introduced from Europe by the Spaniards, are also cultivated. The Mixtecs of the valley of Nochixtlan cultivate wheat and fava beans (*Vicia fava*). Wheat is also cultivated in several mestizo and indigenous communities in valleys around the town of Tlaxiaco. Fava beans are cultivated in gardens or in milpas, while wheat is cultivated in separate fields. The Triquis of Chichahuaxtla cultivate fava beans, but no wheat. The Mixtec farmers of Yosotato used to cultivate *Vigna unguiculata* (frijol china), originally from Africa, in their lowland ejido, before they lost the access to this land. When weeding the corn and coffee fields, they collect the edible greens, quelites. Sometimes, husk tomato (*Physalis* spp.) is also sown or favored in the milpa. The people cultivate around the houses fruit trees, herbs, chili pepper (*Capsicum annuum* in the lowlands, *Capsicum pubescens*, an Andean species, in some highland communities). In the subhumid mountain areas of Yosotato, Chichahuaxtla, Itundujía and San Juan Colorado, the farmers also cultivate coffee as a cash crop, and grow fruit trees in the coffee fields. In the lowlands of San Juan Colorado, there is a wider variety of tropical plants: pineapple (*Ananas comosus*), cocoa (*Theobroma cacao*), sugar cane (*Saccharum officinarum*), roselle (jamaica, *Hibiscus sabdariffa*), inga (guajinicuile, *Inga* sp.), mamey (*Pouteria sapota*).



Sowing corn with a digging stick in Yosotato; Weeding the “young milpa” and collecting quelites, Cuquila (E. Katz)

Table 3: Plant species and varieties cultivated in Yosotato milpas (Katz, 1993)

Altitude	CORN (Zea mays)	Corn races ^o	BEAN (frijol...)	Bean species (Phaseolus/Vigna)	Harvest //corn	SQUASH	Cucurbita
TIERRA FRIA							
2300 - 2500 m	"tata viko"	Cónico	de burro de nema de hueso	<i>Ph. Coccineus</i> <i>Ph. Coccineus</i> <i>Ph. Vulgaris</i>	simultaneous	chilacayote calabaza	<i>C. ficifolia</i>
1700 - 2300 m	"tata kawa"	<i>nal-tel+cónico</i> <i>nal-tel+bolita</i>	de burro de nema de hueso de cascara blanda Tempranero arrancador*	<i>Ph. Coccineus</i> <i>Ph. Coccineus</i> <i>Ph. Vulgaris</i> <i>Ph. Vulgaris</i> <i>Ph. Vulgaris</i> <i>Ph. Vulgaris</i>	simultaneous previous	de huiche	<i>C. pepo</i>
TIERRA CALIENTE							
800 - 1200 m	Amarillo olotón# olotillo# híbrido#	<i>tuxpeño+cónico</i> <i>tuxpeño+nal-tel</i> <i>tuxpeño+bolita</i> <i>tuxpeño H503</i>	Tempranero arrancador* san juanero Amarillo de año China	<i>Ph. Vulgaris</i> <i>Ph. Vulgaris</i> <i>Ph. Vulgaris</i> <i>Ph. Vulgaris</i> <i>V. unguiculata</i>	previous simultaneous posterior	calabaza	<i>C. argyrosperma</i>

Two cultivation cycles (rain cycle and irrigation cycle). They are white varieties.

* Sown after the corn. The other bean varieties are sown simultaneously.

Squash is sown and harvested together with corn.

^o The corn races were identified in 1986 by E. Hernández Xolocotzi from samples collected by E. Katz



Tata Kawa corn, Yosotato (E. Katz)

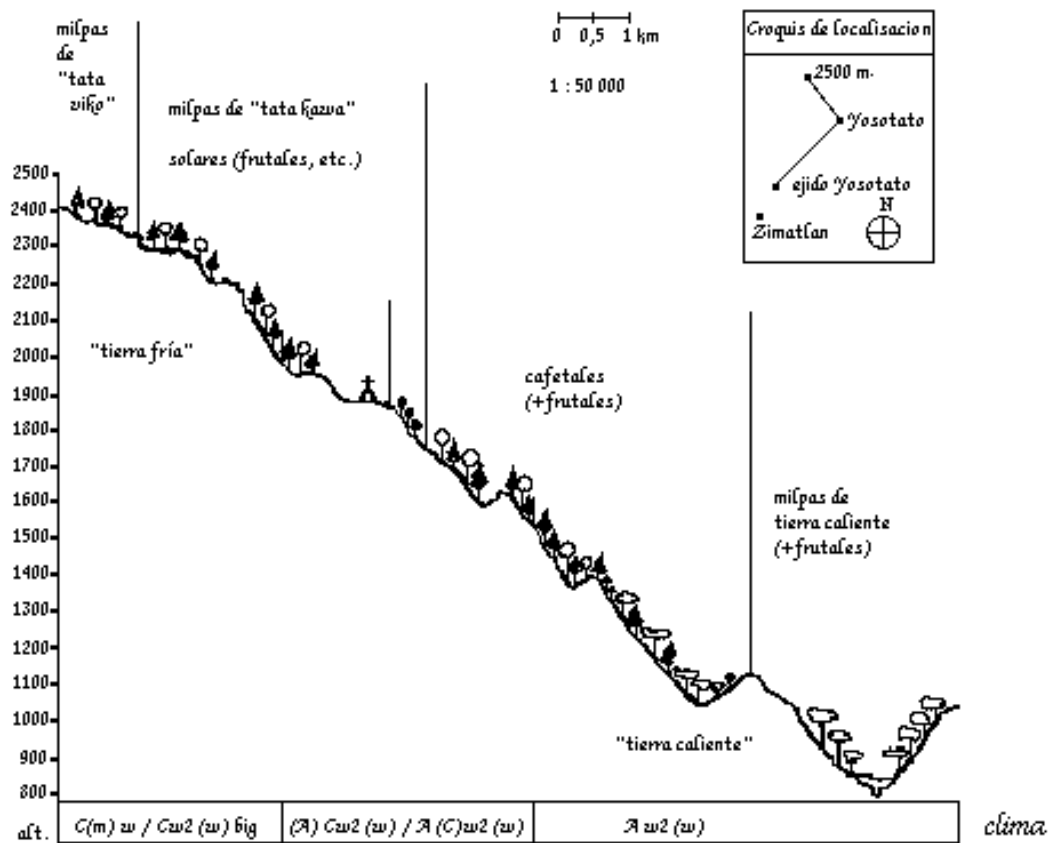


Figure 1. Topographic repartition of cultivated plants on the lands of San Pedro Yosototo

Source: Modified from Romero Peñaloza *et al.* (1986)

Yosotato farmers classify and give names to their traditional corn varieties according to the criteria presented in Table 4.

Table 4: Exemple of “Traditional” Clasification of corn varieties : Yosotato farmers classification

Altitude	« Cold lands » <i>Tierra fría</i> <i>Ñu’u vixi</i>		« hot lands » <i>Tierra caliente</i> <i>Nu ‘i’ni</i>	
Use of water	Irrigation <i>Chagüe (riego)</i> <i>Ñumi/Nute (irrigation/water)</i>		Rain <i>Temporal</i> <i>Savi (rain)</i>	Humidity <i>Viko (cloud)</i>
Agricultural technique	Plow <i>Barbecho</i> <i>Yunaxi</i>	Digging stick <i>Espeque</i> <i>Tundaxi</i>	Slash-and-burn <i>Roza</i> <i>Xii</i>	
Origin of the seeds	Local seeds <i>Semillas criollas</i> <i>Tata ñu savi</i>		Hybrid seeds <i>S. híbridas (mejoradas)</i> <i>Tata stila</i>	
Growth duration	3 months <i>3 meses</i> <i>uni yoo</i>	4 months <i>4 meses</i> <i>kumi yoo</i>	5 months <i>5 meses</i> <i>’u’’u’’ yoo</i>	Etc.
Color of the seeds	White <i>Blanco</i> <i>Kwixi</i>	Yellow <i>Amarillo</i> <i>kwa’d’</i>	Red <i>Colorado</i> <i>Kwe’e</i>	Blue <i>Azul</i> <i>Lee</i>
Size of the cob	Big <i>Olotón</i> <i>Na’nu</i>		Small <i>Olotillo</i> <i>Kwachi</i>	

Farmers of Chichahuaxtla cultivate five varieties: ta’n nin nguchrúu, that grows with humidity, equivalent of the tata viko – cloud seed - of Yosotato, ta’n nin nga’an (maíz de temporal), equivalent of the tata kawa of Yosotato, ta’n nin akuju, that grows on slopes, ta’n nin yukuaa (“ant corn”), that grows on slopes too, and ta’n nin gitsi, that grows on flat lands in the lowlands.

Farmers of Huautla studied by E. Lazos distinguish the maíz de temporal (rain corn) (sown at the beginning of the rainy season) from the maíz de cajete (corn planted in a little hole, like a bowl, cajete), planted in February in cold humid areas. These varieties correspond respectively with the tata kawa and tata viko of Yosotato.



Farmer in Huautla (E. Lazos)

In San Juan Colorado, according to F. Jankowski, there are two main varieties, a large white one that grows in three months and a half, and a smaller yellow one that grows in two months. The white one

is described as “male” and the yellow one as “female”. Three more varieties (brown, red, black) are less common.

Knowledge on plants and agriculture varies according to gender. In Mexico, the milpa is in the hands of the men. Women and children also participate in the agricultural tasks, but sowing is a male task. Children start going to the milpa at a very early age, to help in the weeding and the harvest. Teenage boys start helping their father around the age of 12, and start being able to plant corn by the age of 15, when they are sexually mature and able to get married.

As observed in Yosotato, the milpa is charged with deep symbolism, but today not everybody is totally conscious of it. Sowing has well recognized sexual connotations. People often refer to it through jokes and double-meaning language. The man opens the earth with a (phallic) digging stick and fecundates the earth with his seeds. A fermented drink of the century plant (*Agave* sp.), compared to rain and semen, is poured on the earth as an offering before starting to sow. People sow the milpa “in cross”, following the “path of the sun”, from East to West. Many cultivators do it, but not everybody can explain the relationship with the sun. The growing cycle of the corn follows the rain cycle and is compared to a human life cycle. The corn is sown just before the rains come, or when they have just started, when the earth heated by the sun of the dry season receives the first rains. The mixture of heat and humidity is propitious to fecundation, as in the human body. The corn is harvested just before or right after the end of the rainy season, according to the altitudes. Only the high altitude corn varieties, called in Mixtec “cloud seeds” (*tata viko*), are sown in February, are kept in humidity by the clouds of the mountain tops, and are harvested after a year. The corn plant is called *biyu* when little and *’itu* (milpa) when fully grown. It is compared to a little girl who grows in a woman who carries her baby (the cob) in her back (Katz, 2005). This is probably obvious to Mixtec speakers, but not so much to people who only speak Spanish.

Women may sow beans between two corn plants, weed and harvest the milpa. Women are in charge of the home garden, which is a place of innovation and experimentation. They plant fruit trees, herbs, medicinal and ornamental plants, keep seedlings there, bring plants from the forest.

Circulation of plants

When a young man gets married, he may go on cultivate a milpa with his father or open his own field, with seeds that he receives from his father. Wheat seeds also circulate from father to son.

When farmers stop to cultivate a variety of corn in a specific micro-environment and want to cultivate it again, they ask seeds from relatives or *compadres* who still have them. For instance, Yosotato farmers rarely cultivate the higher altitudes of their territory, but occasionally, a few farmers opened a field there. They asked *tata viko* seeds from inhabitants of a high altitude hamlet of Yucuiti neighboring community. They also say that if they recover their lowlands valley ejido plots, they will ask for the local seeds from a lowlands ejido related to Yucuiti.

On the whole, plants, agricultural and culinary knowledge circulate a lot within the same community, and tend to vary from one community to the other. For instance, in Chichahuaxtla, a specific variety of pear tree was planted by an American protestant missionary of the Summer Institute of Linguistics. It is now found in many gardens of the village center.

Plants also circulate from communities to communities or from outside of the region through the markets. Agricultural innovations often occur from plants found in the market. For instance, an old man from Yosotato told how, when he was a teenager, he found on the market of Tlaxiaco, the main regional town, a highland species of chili pepper, *Capsicum pubescens*, originally from the Andes, and brought it to his village, where it diffused among all the inhabitants. Very recently, a Triqui man found a passion fruit species (probably *Passiflora edulis* from Brazil) on the market in the city of Oaxaca, brought it to his village, Chicahuaxtla, at 2300 m of altitude, where it did not grow, and gave it to a relative who lives in Putla, a close-by lowland town at 800 m of altitude. She was very successful in growing it. She gave it to all of her neighbors and now sells it on Chicahuaxtla market.

Institutions and NGOs also play a part in the circulation of plants. In Yosotato, some fruit trees were introduced about 30 years ago by the National Indigenist Institute (ex: loquat, níspero, *Eryobotrya japonica*). Hybrid varieties of corn or commercial varieties of coffee were introduced by agents of the Ministry of Agriculture (SARH) or the Mexican Institute of Coffee (Inmecafé). The cultivation of new varieties of tomatoes (*Lycopersicon lycopersicon*) is probably linked to projects that helped introducing greenhouses in Tlaxiaco district (see below).

Migration and agricultural changes

Migration has had a strong impact on agriculture, especially since the late nineties, with massive migration to the United States. Thirty years ago, almost all the people who lived in villages were engaged in agriculture. In the studied highlands communities, it was estimated that 30 to 40% of the population has migrated, of which many are young people (cf. Lazos report). This situation has weakened local institutions, social networks and social and political organization. In the early 1990's, only young men were migrating, then young women started migrating too, older people and whole families as well. Over the last years, young people have had access to universities. On the whole, people study for a longer time. So there are less people in the villages. Many of them receive remittances from their emigrated relatives. When women remain in the village by themselves with the children, they tend to give up agriculture. Young people who have migrated usually do not want to go back to agriculture when returning to the village. Shops and taxis have proliferated in the villages. People often keep a small milpa near the house to have fresh corn for the Day of the Dead and maintain a symbolic tie with the earth. It does not seem that people who keep cultivating have lost plant species or varieties², but some of them are now less cultivated than before. It is the case of the highland humidity varieties of corn. Most of Yosotato farmers already dropped its cultivation several decades ago, as the village center had moved to a lower altitude and activities were more focused on coffee fields, located below the village. Huautla farmers comment that cultivating this variety requires more work than the other ones, that it is difficult to cultivate it without mutual help (guetza), less performed than before because of migration, and that in the last years, humidity was not sufficient enough to plant it. In Cuquila (Tlaxiaco district), a Mixtec village close to Yosotato and Chicahuaxtla, it was mentioned that people tend to give up cultivating *Phaseolus coccineus* (high altitude bean), because it takes much space and its yield is lower than *Phaseolus vulgaris*. There farmers cultivate less the steep lands, so the varieties cultivated there may diminish as well. There may be a general tendency to abandon higher altitude and steep lands, what should be checked out again on the field.

² One of the next steps of the study will be checking lists of plants collected in the 1980's.

New species or varieties have been observed, such as passion fruit and new varieties of tomatoes, as mentioned above. Since the last few years, some people have been cultivating tomatoes in gardens and greenhouses for sale. This fragile species was rarely cultivated in the past, because it needs water but rots easily under the rain.



Mixtec people queuing at the post office in Tlaxiaco to receive remittances from their migrated relatives (E. Katz)

Northern Amazon: cassava cultivation and complementarity with fishing and hunting

In the Northern Amazonian regions here studied, the slash-and-burn agricultural system is based on cassava (*Manihot esculenta*), in particular bitter cassava, and is subsistence agriculture. Traditionally men fish and hunt, cut the trees and burn the plot, but swidden agriculture remains in the hands of the women. Men also make different arts-and-crafts: canoes, basketry, in particular basketry cooking utensils. Ka'apor men make feather work, very valued among them, and women make collars.



Ka'apor arts and crafts (C. López)



Cassava swidden fields in Santa Isabel do Rio Negro: swidden field in the forest seen from the plane, cassava plant with sugar cane, and recently burnt field with banana trees (E. Katz)



Fishing in Santa Isabel do Rio Negro (E. Katz)

In the case of the Arawak/Tukanoans, where a detailed study was led by Emperaire (2010), the agricultural system is very complex, involving several varieties of bitter cassava, a fine knowledge of the soil. People also associate other plants with the cassava: different species and varieties of yam (inhame and cará, *Dioscorea* spp.), sweet potatoes (batata doce, *Ipomoea batatas*), chili pepper (*Capsicum chinense* and *Capsicum* spp.), cubiu (*Solanum sessiliflorum*) pineapple (abacaxi, *Ananas comosus*), cashew apple (cajú, *Anacardium occidentale*), sugar cane (*Saccharum officinarum*), sometimes other tubers such as sweet cassava (macaxeira, *Manihot esculenta*), corn (milho, *Zea mays*), which has been reported to be more common near the Colombian border. A long list of fruit trees are also cultivated, in or around the swidden field, as well as around the houses (banana, peach palm, ingá,...). Men plant fish-poison plants, corn and some fruit trees. In traditional Tukanoan communities of Colombia, men also cultivate tobacco and hallucinogenic plants (Hugh-Jones, 1993). Emperaire (2010) has found about a hundred cultivated food plants in the studied areas of the middle Rio Negro. Wild fruit trees, especially palm trees, are preserved when found on a swidden field. Some species are both wild and cultivated, such as palm trees (*Astrocaryum*, *Oenocarpus*, *Attalea*, *Euterpe*), ingá (*Inga* spp.), umari (*Poraqueiba sericea*) and cucura (*Pourouma cecropiaefolia*). According to F. Silva, this group of plants appears in Baniwa myths. Baniwa elders say that in the past these were the only plants they cultivated in swidden fields taken on deep forest. When the land was left fallow, game was attracted by the fruit, and they hunted there. The fruit trees which were introduced later, like guava (*Psidium guajava*), cupuaçu (*Theobroma grandifolium*), orange (*Citrus sinensis*), lemon (*Citrus aurantiifolia*),... have to be constantly maintained by humans in a cleared environment. If the forest takes over, they die, while the previously described trees, originally from the forest, survive.



Cucura, cubiu, ingá/umari, pineapple (E. Katz)

The Patamona cultivate bitter cassava, yam, sweet potato, sugarcane, chili pepper, squash (*Cucurbita* sp.), taioba (*Araceae* tuber?). In these savanna highlands, much fewer fruit trees are cultivated than in the Rio Negro and than in the savanna lowlands: banana (*Musa acuminata* x *balbisiana*), orange (*Citrus sinensis*), tangerine (*Citrus reticulata*), coconut (*Cocos nucifera*), mango (*Mangifera indica*), guava (*Psidium guajava*), soursop (*Annona muricata*),... Most were introduced relatively recently. Some wild fruit are consumed: buriti palm (*Mauritia flexuosa*), bacaba palm (*Oenocarpus bacaba*), cashew apple (*Anacardium* sp.), ingá (*Inga* spp.), araçá (*Myrtaceae*), murici (*Byrsonima crassifolia*),...



Landscape of the savanna highlands in the Patamona communities (Z. Oliveira)

In their swidden fields, the Ka'apor cultivate both bitter and sweet cassava, yam, sweet potato, corn, squash, rice, pineapple, watermelon (*Citrullus lanatus*), cashew (*Anacardium occidentale*), banana (*Musa acuminata* x *balbisiana*),, and less commonly bean and sesame (*Sesamum indicum*). They also cultivate fish-poisons and plants used in arts and crafts. Around the houses, they cultivate many fruit trees: the cashew tree is particularly important for them. Coconut (*Cocos nucifera*), banana (*Musa acuminata* x *balbisiana*), mango (*Mangifera indica*), soursop (*Annona muricata*), guava (*Psidium guajava*), ingá (*Inga* spp.), Malay apple (jambo) (*Syzygium malaccense*), papaya (*Carica papaya*), acerola (*Malpighia glabra*), avocado (abacate) (*Persea americana*), pitanga (*Eugenia uniflora*), peach palm (pupunha) (*Bactris gasipaes*), lemon, orange and tangerine (*Citrus* spp.).



Cashew apples in a Ka'apor house (C. López)



Cassava stems ready to be planted, cassava tubers just harvested and peeled, Santa Isabel (E. Katz)

The diversification of cultivated plant species seems to be more important in the Amazon than in Mexico, at least in the case of plant like cassava. The Northwestern Amazonian region, in particular, has been reported to have the world highest diversity in bitter cassava, probably hundreds of varieties, as 80 varieties were found among 35 cultivators; Middle Rio Negro women plant between 6 and 20 varieties of bitter cassava each. Yam, chili pepper and pineapple also have a high diversity in this region (Emperaire, 2010). The Ka'apor cultivate 6 varieties of bitter cassava and 3 of sweet cassava. Patamona women also use several varieties of bitter cassava, but we do not have yet a precise account. As a comparison, Mixtec/Triqui farmers plant usually one corn variety in each micro-climate: 2 varieties in Nochixtlan (highlands), 2 varieties in San Juan Colorado (lowlands) and 5 varieties of corn in Chicahuaxtla, 5 in Yosotato (transition between the highlands and the lowlands). Farmers in Yosotato plant 3 species of squash and 3 species of "beans", with 2 varieties for *Phaseolus coccineus* and 7 for *Ph. Vulgaris*, only one for the African bean (*Vigna unguiculata*).

According to a Brazilian geneticist, Roraima is the region of Brazil where there is the highest diversity of corn (Fabio Freitas, pers. com.), but the Patamona do not cultivate much corn. The Patamona do not cultivate sweet cassava; in the Rio Negro, it was introduced about a century ago by the missionaries and its use is minor (Emperaire, *ibid.*), while its use has been traditional among the Tupi people. The Ka'apor cultivate a specific very sweet variety, of an enormous size, the manjukaba. Compared to Mexico, the number of cultivated tuber species is higher, the number of species of fruit trees is very high. In Mexico, few fruit species grow in the highlands, they are more numerous in the lowlands. In the Amazon, there are many species of native fruit trees also found in the wild, such as umari and cucura in the Rio Negro, cashew apple and araçá in Roraima, cupuaçu in Maranhão, palm trees, inga, etc. Many tropical species from other continents were successfully introduced, such as mango, coconut, Malay apple,... On the other hand, very few greens are consumed in the Amazon (Katz et al., submitted), while it was important until recently in the Mexican indigenous diet.

In the Mixtec region, as an impact of migration to the United States, the number of farmers is reducing. It seems that the slopes and the higher altitudes are the first lands to be abandoned, therefore the corn and beans varieties cultivated in these areas are threatened to disappear in the future.

In the Mixtec region and the Rio Negro, school is taking over the agriculture knowledge transmitted by the parents to the children. In Chicahuaxtla, presently, children who live in the center of the village and whose parents are school teachers or shopkeepers do not go much more to the fields or the woods, and do not know so many plants as children with whom E. Katz worked in the 1980's in Yosotato. In the Rio Negro, F. Silva interviewed Baniwa teenagers about their participation in agricultural activities. Teenagers in small communities (less than 10 families) still help their mother

in the fields, in the moments when they do not go to school. They help their mother less often in bigger communities. In both cases, girls go more to the fields than boys, since agriculture is a feminine task. The boys probably go fishing and hunting with their father. In the town of São Gabriel da Cachoeira, teenagers only go to the fields on week-ends, and boys help more their mother than girls, who mainly help at home. In town, the fields are located at a further distance from the houses than in communities. The boys probably help in harder works, such as carrying the harvest. This situation endangers the transmission of knowledge between mother and daughter.

We see that contrarily to what is generally thought, indigenous agricultures are not backward, but adapted to their environment, and that cultivators try to make the most of it. Indigenous agricultures are dynamic. New plants and agricultural techniques are constantly experimented, selected, adopted, while others are left aside. When their efficiency is not proved, they are rejected.

We are going to see now how the diversity of agriculture is found in the kitchen, the complexity of the processing techniques of the staple foods, as well as food changes.

Culinary knowledge: variety and complexity of natural resources processing in the global world

Mixtec and Triqui cooking knowledge: food processing, human body and environment

Mixtecs and Triquis also share the same cooking knowledge, which, as agriculture, may slightly vary from one community to the other. Cooking is a feminine task, except for cooking in earth oven, which is performed by men, often for feasts. Usually whole animals (deer, goat, sheep) are cooked that way, a prehistoric pre-ceramic technique (Katz, 2006a). The main traditional utensils are the grinding stone (metate) for corn, the mortar (molcajete) for chili pepper, and the cooking pots. The grinding stone, a very ancient utensil, is symbolically linked to the woman and the hearth. A girl can get married when she masters the grinding technique, she receives a grinding stone when founding a new hearth, and it lasts along her whole life (Katz, 2003). Cutting techniques are not very elaborate. The meat is cut in big pieces with a machete, and so are vegetables such as squash. Meat is then cooked long enough to fall into pieces, other foods, such as corn and chili pepper are ground. Fifty years ago, food was mainly boiled, sometimes grilled, steamed or cooked in earth oven. Thirty years ago, few people fried food in oil or lard, and fewer owned a gas stove. Nowadays, many people own gas stoves. Although many dishes are still boiled, frying has become a common technique.

Food processing and consuming are symbolically associated to the human body and the environment. Steaming or boiling food in pots or earth oven refers to caves in the mountain, the earth womb, similar to the human womb, the mythic origin of clouds, seeds and humans. Hot and cold, dry and wet refer to the climate and the ideal states for human and earth fertility (Katz, 2006b).

The culinary processing of corn is very complex. It requires also several years of training. First the dry grains are taken out of the cob (they first take out two lines of grains in the shape of a “path”, then the others grains come out easily), then they are boiled with lime. Later they are rinsed, and are ground three successive times with water to directly make a dough (this is the most difficult technique), then turned into tortillas (what requires a long training too), cooked on a ceramic grill (comal). Motor grinders partly replaced the grinding processing, but in Yosotato, until the late 1990’s, the women always did the last grinding on the stone. As men emigrated, forcing women to do women’s and men’s work, and as new finer motor grinders came in, fewer women still grind corn

dough on the stone or do it only occasionally. Nevertheless, stone grinders are still present in most houses, close to the firewood hearth; women keep making tortillas on top of it (Katz, 2006b). In spite of the strong symbolic charge of this task, the young girls are likely not to master the grinding technique any more in the following years, as it has already happened in many Mexican villages. Yet, this Neolithic technique has been surviving up to present because of its symbolical strength. Bauer (1990) showed that corn motor grinders were invented at the end of the 19th century and were already used then in haciendas, while it took decades to reach villages, because men were reluctant to have their wives' work replaced by machines.



Grinding corn in a motor mill, and making tortillas on top of the grinding stone, Yosotato (E. Katz)

Table 5: Summary of the corn processing techniques in the Mixtec region: dishes made out of processed dry corn

Degraining dry corn+. Cooking in lime + rinsing
Pozole: cook the whole grains in water. Eat with meat and mole amarillo.
+ Grinding 1 time (“break the grain”)
Masa de barbacoa: “broken grains” are slowly cooked in pots in earth oven (barbacoa) or firewood (masa de olla). Eaten with meat cooked in the earth oven.
Atole de granillo: cook the broken grains in water until thickening, but still liquid;
+ Grinding twice (1. “break the grain”, 2. grind the dough)
Tamale: take a piece of dough, fill it up with meat and chili sauce, or beans, or another ingredient, wrap it in corn or banana leaves, tie the package with pieces of leaves, steam the package.
Atole: cook the dough in water until thickening, but still liquid, it is drunk plain, with ground fruit or chocolate, cooked together with the corn dough.
+ Grinding 3 times (1. “break the grain”, 2. grind the dough, 3. “regrind” the dough to make it finer)
Tortilla: Make a ball out of the fine dough, flatten the ball, cook it on the ceramic grill on both sides, keep it warm in a cloth or a calabash
Mole Amarillo: the corn dough is diluted with broth and slowly cooked with ground chili pepper until

thickening. It comes out as a thick sauce, eaten with meat. It may fill up tamales.



Pozole with mole amarillo and meat, Chichahuaxtla (E. Katz)

As far as corn classification is concerned, some culinary criteria are taken into account by the women (see Table 6). These criteria are usually never mentioned by agronomers.

Table 6: Corn classifications in the kitchen (San Pedro Yosotato)

Color of the seeds. Tortillas are made with corn of any colour. Pozole, atole, tamales are made with white corn. In the Coast, they make a fermented drink with red corn.

Weight of the corn ear (heavy/light), what refers to the starch content of the ear. The higher the altitude where the corn grows, the longer it takes to grow, the heavier is the ear.
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Seed coat (thick/tender). The high altitude corn varieties have a thick seed coat, the low altitude ones a tender one. If thick, it is harder to get rid of it when cooking the corn in lime.

Quantity of lime used in the first cooking, and cooking time. The quantity of lime used is more important for the high altitude varieties, since they have a thick seed coat. Less lime is used for the lowland varieties, and a shorter cooking time.
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For the culinary use of beans, the main criteria is if the pod is hard or tender. If tender, the beans are cooked in their pods, if hard, there are taken out of the pods. In all the areas studied, the farmers are not self-sufficient in corn and beans, as they hold very small lands (usually from ½ ha to 3 ha). In the highlands communities, they consume their harvest in 2 to 6 months, in the lowlands in 4 to 9 months. This situation has prevailed for decades, and often for centuries, as Monaghan (1990) noted it for Santa Maria Yucuiti, neighboring community of Yosotato, in the 19th century.

Food changes: more meat, less greens, more industrial food

A daily meal is usually composed of boiled beans eaten with a chili pepper sauce and corn tortillas. Beans are a standard, but if there are no beans, they may be replaced by greens (quelites). Greens may also be eaten together with beans, and when people have enough resources, they may add meat. In a house meal, the main dish must be a broth or a mole (thick chili sauce) of beans, greens or meat. When people go to the field, they take along a taco, a tortilla filled either with beans, greens, meat, with no broth, spiced by chili pepper or chili sauce, or with any type of vegetable ground with chili pepper into a “sauce”. Thirty years ago, Mixtec and Triqui people ate little meat. Many Mixtecs in Yosotato and Alcozauca (Guerrero) ate meat about once every other week (Casas et al., 1987). Nowadays, in Yosotato and Chichahuaxtla, younger people in particular eat much more meat. As many people receive remittances from their migrated relatives, as well as help from the State, they can afford to buy meat. They also buy more industrial food and drinks, and consume less wild greens, which were always seen as “poor people’s food” (Katz, 1992). Young people have lost knowledge on this type of plants, as well as of “famine plants”. Local people and doctors mention the incidence of diseases such as diabetes, which used to be rare. The doctors recommend eating vegetables. In Chichahuaxtla, some people have started cultivating mostaza (Brassica napus, “wild” colza), a local spontaneous green, which in reality had been voluntarily or involuntarily introduced by the Spaniards. They sell it successfully on the local market. According to Lazos, inhabitants of Tilantongo and Itundujía also consume quite a few industrial products, while in the dry area of Nochixtlan, as people receive only small remittances and are much poorer, they consume neither much meat nor industrial products.



Industrial food in a shop in Yosotato (E. Katz) Papaloquelite, *Porophyllum ruderales*, Yosotato (E. Katz)

Food as a heritage: food fairs in fashion

In September 2011, a small food fair happened in Cuquila, and will happen every year to celebrate the anniversary of the creation of a new hamlet. Some typical local dishes were sold, served in ceramic pots by women in traditional costume: mole of mushrooms and of rabbit, squash drink, tepache (fermented drink of sugar cane). The idea was also to sell the local arts and crafts, ceramics and weavings. Ceramic cooking pots, containers and plates are no more commonly used (while they still were in the 1980’s), since people now have gas stoves, aluminum pans and industrial plates. A fair of pulque (century plant fermented drink) now occurs every year in the town of Tlaxiaco. All this valorization of regional indigenous food and drinks is fairly new. It may be a sign of progressive loss of local specialties and culinary knowledge, but it also shows an empowering of the Mixtec people

now proud of their culture. In the past decades, they were considered as the poorest and more backward people of the country. They lived their culture but did not show it off.



Food fair in Cuquila, September 2011 (E. Katz)

Amazonian culinary knowledge: making a poisonous plant edible

The main cooking utensils of the Northern Amazon are cooking pots, cassava graters, wood mortars, and numerous basketry sieves, containers and sleeve press (tipiti). Cassava processing is very complex and requires years of training. As seen above, not all ethnic groups make graters. They are usually made of chips of quartz inserted in a wooden base. Presently quartz may be replaced by metal. In the Rio Negro, when elaborate graters were not available, people used the root of the paxiuba palm. Nowadays, they use motor graters.



Small Baniwa grater (E. Katz)

Bitter cassava is either washed, peeled and grated, or soaked in water for several days then peeled before being further processed. In the Rio Negro, people use a mixture of grated raw and soaked cassava roots, usually about 2/3 of grated roots for 1/3 of soaked roots. Grated roots are rinsed and pressed through a large round basketry filter (comata) and left there for several hours above a container. Starch deposits in the bottom. The liquid is separated from the starch and boiled for several hours to neutralize the cyanhydric acid content. When freshly boiled, it tastes sweet and may be consumed. It is called manicuera in Nheengatu. It may be left to ferment (tucupi), or be further cooked until concentrating (tucupi preto). It is used then in the fish broth. The yellow top of the starch (bora) is taken off to be used in some type of cassava bread (beiju). The starch either may be used to thicken broth or liquids, or may be toasted in tapioca pop grains. The pulp left in the filter is

further pressed in a long sleeve press (*tipiti*). Then it is sieved and toasted on a large metal grill plate. After a first toasting, it is sieved again in a finer sieve. If people make cassava bread (*beiju*), the pulp is poured on the grill plate in a round shape, further shaped with the hand and with the help of sort of wooden spatula. When cooked on one side, it is turned on the other side with the help of a basketry flat fan. If people make “flour” (*farinha*), the pulp keeps being toasted until well dry. Different dishes are made out of bitter cassava. *Mingau* is a gruel, usually drunk in the morning, made out of cooked starch or *farinha*, in water or *manicuera*, plain or with grated fruits such as pineapple, or palm fruit juice such as *açaí* (*Euterpe* spp.). During the day, people drink *chibé*, water with *farinha*. Beer (*caxiri*) is made by mixing *manicuera* with a slightly burnt round cake; it is left to ferment, then it is filtered and mixed with sugar or sugar cane juice, and is drunk after about three days. In the past, or in a traditional context, some cassava is chewed to induce or accelerate fermentation. Beer can also be made of other plants (corn, peach palm) or of a mixture of cassava with other plants (yam, sweet potato and other tubers). Pineapple beer is called *aluá*. White varieties of cassava give more starch. Usually white cassava is used for bread and yellow one for “flour”. Flour is now consumed more commonly than cassava bread, especially in towns, because it is prepared about once a month. Fresh cassava bread only keeps for 2 or 3 days, and dry ones for several weeks or months. In the Rio Negro, in spite of ethnic diversity, these techniques are shared by all people of Arawakan or Tukanoan descent. There are some slight differences according to places or ethnic groups. For instance the (Arawakan) Baniwa make very large thin *beiju*, and often dry them, while the Tukanoans prefer the thick *beiju* of cassava pulp and *bora*, called *beiju curadá*.

Table 7: Summary of the cassava processing techniques in the Rio Negro

1. 1/3 of the cassava tubers are left in water for several days, then are peeled (the peel comes out easily with the hand), washed and ground
2. 2/3 of the cassava tubers are peeled, washed and grated.
3. The grated cassava is kneaded with water above a *comata* (basket filter) and left for several hours. The toxic juice flows out in a bucket, and the starch (*goma*) deposits in the bottom. *Goma* may be used to thicken fish broth or make gruels (*mingau*). It may be dried, or also toasted to make *tapioca*.
4. The toxic juice is separated from the starch and boiled for several hours. When freshly boiled, it is called *manicuera*. Slightly fermented *manicuera* is called *tucupi*. If boiled for a longer time until concentrate, it is called *tucupi preto*.
5. The tubers that were left in water are grated and mixed with the dry grated pulp
6. The grated pulp is pressed in a *tipiti* to dry out
7. The dry pulp is sieved in a basketry sieve (*peneira*)
8. It is grilled on a ceramic or metal grill (*forno*)
9. It is sieved again and grilled again to make flour (*farinha*) or put in the shape of a circle on the grill to make *beiju* (cassava bread), cooked on one side, then turned on the other side with a basketry fire fan.



Pressing cassava in a tipiti, Baniwa woman sieving cassava pulp and Tukano woman making cassava flour (E. Katz)



Tukano and Baniwa cassava bread (E. Katz)

Tukano woman making cassava beer in Santa Isabel (E. Katz)

The techniques for processing bitter cassava are roughly the same from the Rio Negro to the Guianas (Mowat, 1989). Traditionally the Carib people do not make “flour” (Lucia Van Velthem, pers. com.), but the Makushi, for instance, have mastered this technique. The Patamona have learnt this processing fairly recently from the Makushi, and consume it occasionally. They make a very concentrated dark cassava juice, even more concentrated than the Rio Negro tucupi preto. They use white cassava to make beiju, and yellow cassava for highly fermented beer (pajuaru). They only use dry grated cassava for their beiju. The Patamona pajuaru is analogous to the Rio Negro caxiri. It is made out of burnt beiju, fermented for about three days. They consume it in festive context. On a daily basis, they consume a very slightly fermented cassava drink, called locally caxiri. It is made of grated cassava pulp cooked for several hours and drunk just the day after. It is consumed at breakfast, as they do not make mingau, and together with other dishes. They also make aluá of wild cashew apple.



Cooking cassava bread in a Patamona village (Z. Oliveira)

Out of bitter cassava, the Ka'apor do not make beiju, only farinha. They eat it with all their dishes, especially game, as well as with ground fruit, such as cupuaçu (*Theobroma grandiflorum*) or bacuri (*Platonia insignis*). Chibé (water with farinha) plays an important part in social relationships, especially in celebrations and political meetings. The Ka'apor make a non-fermented drink out of the huge sweet cassava variety, manjukaba, which has a sweet taste. Their main festive drink is cashew apple beer. They know how to extract the cashew nut, what requires a specific knowledge. The nut shell holds toxic components that burn and stain the skin. In the Rio Negro, nobody takes the risk of extracting the nut shell, people only eat the fruit.

The Rio Negro people and the Patamona eat fish fairly often, when available, especially in chili pepper broth, called quinhapira ("chili pepper-fish") in the Rio Negro (Nheengatu language) and damorida in Roraima (it is common to the Roraima Arawak and Carib people), which is consumed with beiju. Fish may be replaced by ants or game. The Rio Negro people do not drink when they eat it, and finish their meal by drinking chibé, while the Patamona drink caxiri at the same time. Traditionally they made ceramics pot in both area, and boiled or grilled food, directly or in leaves. They smoke-dry fish and game.



Quinhapira (fish and pepper pot) in Santa Isabel (E. Katz)

Food changes: rice and beans versus cassava bread and flour

In the Rio Negro, the town of Santa Isabel has been quite exposed to food changes, especially over the last ten years. As an area located on a big river, involved in extractivism since the end of the 19th century, it had access to products from the outside through extractivism traders. People mention aluminum pans, salt, sugar, coffee, rice, beans, salted meat, canned food and alcoholic drinks, as available since at least the 1930's. Local people exchanged them with forest products, but did not consume them on a daily basis. Over the last 10-15 years, many people have migrated from forest communities to towns, they have been receiving subsidies from the State, such as family allowances and cultivators retirement fees, moreover natural resources such as fish, have been decreasing around towns. People consume much more food from the outside, such as rice, beans, pasta, frozen meat, canned meat and fish, and industrial snacks and drinks. They still eat farinha, but add rice and beans. Their consumption of salt, sugar and oil has increased a lot. Some families have been reducing the consumption of chili pepper, to follow "white people's" food habits. Very few people in Santa Isabel know how to make and consume caxiri, prohibited for a long time by the religious

orders. Different plants, in particular minor tubers, that were used in the caxiri, are now rarely cultivated, as observed by Emperaire. In the Içana and Aiary rivers, Baniwa people who converted to Protestantism abandoned also caxiri. In Baniwa myths collected by F. Silva, plants used to make caxiri are mentioned: yam (*Dioscorea* spp.), peach palm (*Bactris gasipaes*), sweet potato (*Ipomea batatas*), sugar cane and several tubers rarely cultivated today.



Frozen chicken and grocery shop in Santa Isabel do Rio Negro (E. Katz)

The Patamona, located in a more remote area, away from roads, still consume what they produce, eat damorida and drink caxiri on a daily basis. Nevertheless, the schools receive food from the outside for the school children: rice, beans, salted meat, crackers,... A recent decree stipulating that at least a third of the food served in schools should come from local production has not been applied yet.

The Ka'apor, who are involved in illegal timber exploitation, buy now more food from outside, with money earned in this activity. As a consequence, they neglect their orchards. The manjukaba, in spite of its specificities, has only been found in one swidden field, thus is threatened to disappear.

In both countries, the studied indigenous cuisines are complex, elaborated, and use a wide diversity of plants and animals. They have not been valued so far. Industrialized food and drinks, already present for a few decades in places located along roads or large rivers, have now been reaching even remote places and are consumed in bigger quantities. They are likely to displace some more nutritious traditional foods that are more difficult to prepare.

7. Final words as conclusion

Both in the case of Mexico and the Amazon, the case studies showed that indigenous cultivators are not isolated and backward people working with primitive techniques, who refuse the progress. On the contrary they have a good knowledge of their environment, usually based on a long-term occupation of the territory, that they are involved in networks that allow the circulation of knowledge and of biological objects. Their techniques are complex and usually adapted to the local environment. They are opened to innovation and they experiment new plants and new techniques all the time.

As we demonstrated it, food systems of indigenous and mestizo communities are the result of the interaction between knowledges and practices regarding the gathering, production, exchange and purchase of food through kin and kith and outside of the communities, in the social context related to the social structure of their society (matrimonial actions, market, trade) and occasional context (migration, colonization, welfare programs, allowances sent by relatives, in Mexico). Studied in a diachronic and synchronic perspective, these systems turn up/show up crossed by dynamic processes. Taking into account time and space allowed us to see how “traditional” (indigenous and mestizo) communities access to natural resources and the different ways that they use to produce them, to harvest, to collect and to process them depending on the socio-economic, cultural and political framework at regional and national levels (Chambers et al., 1989).

Then traditional knowledge(s) cannot be understood, and not even properly described without a close analysis of the roles played by intermediary actors (merchandization and process(ing) actors and think tanks, NGOs, businesses, actors from public organisations) and of the translations that go together with these processes. In a second step, that we will present in the next reports of these actors, as well as their link with the politicization of the issues of “traditional knowledge” and “natural resources” which will ultimately allow us to examine the articulation of these epistemologies with environmental governance.

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