



## Traditional knowledge of biodiversity – plant use of the Chácobo in Bolivia

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### Abstract

The Chácobo are a Panoan speaking tribe of about 500 members in Beni, Bolivia. Originally nomadic, the Chácobo were relocated to their current main location in the 1960s. Researchers have visited the Chácobo exist since 1911. A first more detailed anthropological report exists from the late 1960s, and ecological-ethnobotanical studies were conducted in the 1980s and 1990s. Our present work aims to conduct a complete ethnobotanical inventory of the entire adult Chácobo population, with interviews and plant collection conducted directly by Chácobo counterparts.

We hypothesized that plant use now centers on income generation, and traditional plant use related to household artifacts and medicine, as well as traditional crop varieties had almost disappeared. Our recent work shows a more complicated picture. Missionary influence led to a knowledge decline in the generation that was adolescent during missionary rule, while the younger generation is recuperating the previous knowledge. Traditional crop varieties are still widely grown. Most Chácobo know, and can name, traditional artifacts, although only the older generation has still the skills to manufacture them. While many Chácobo still know the names and uses of medicinal species, the younger generation is often unsure how to identify them.

**Key words:** Ethnobotany, Repatriation of Knowledge, Nagoya Protocol, Intellectual Property, Plant Use, Amazon, Beni

### Resumo

O Chácobo são uma tribo falando Pano de cerca de 500 membros em Beni, na Bolívia. Originalmente nômade, o Chácobo foram transferidos para o local principal atual em 1960. Os pesquisadores visitaram o Chácobo existe desde 1911. Um relatório antropológico primeiro mais detalhada existe desde a década de 1960, e os estudos ecológicos - etnobotânico foram realizados nos anos de 1980 e 1990. O nosso trabalho presente tem como objetivo realizar um inventário etnobotânico completa de toda a população adulta Chácobo, com entrevistas e coleta de plantas conduzidas diretamente pelo homólogos Chácobo.

Trabalhamos com a hipótese de que o uso da planta agora gira em torno de geração de renda e uso tradicional de plantas relacionadas a artefatos domésticos e medicina, bem como as variedades tradicionais de culturas tinham quase desaparecido. Nosso trabalho recente mostra um quadro mais complicado. Influência missionária levou a um declínio do conhecimento na geração que era adolescente durante o regime missionário, enquanto que a geração mais jovem está se recuperando o conhecimento prévio.

As variedades tradicionais de culturas ainda são amplamente cultivadas. Mais Chácobo sei, e posso citar, artefatos tradicionais, embora apenas a geração mais velha ainda tem as habilidades necessárias para fabricá-los. Enquanto muitos Chácobo ainda saber os nomes e usos de espécies medicinais, a nova geração é muitas vezes sem saber como identificá-los.

**Palavras chave:** Etnobotânica, Repatriamento de conhecimento, Nagoya Protocolo, Propriedade Intelectual, o uso de plantas, Amazon, Beni

### Resumen

Los Chácobo son una tribu del grupo lingüístico Pano de unos 500 miembros, en Beni, Bolivia. Originalmente nómada, los Chácobo se trasladaron a su ubicación principal actual en la década de 1960. Investigadores visitaron los Chácobo desde 1911. Un primer informe antropológico más detallado existe de los finales de los 1960, y se llevaron a cabo estudios ecológico-etnobotánicos en los 1980 y 1990. Nuestro trabajo presente tiene como objetivo realizar un inventario etnobotánico completo de toda la población adulto

Chácobo, con entrevistas y recolección de plantas realizadas directamente por las contrapartes Chácobo. La hipótesis de este trabajo fue que el uso de plantas ahora se centra en la generación de ingresos, y que el uso tradicional de las plantas relacionadas con los artefactos del hogar y la medicina tradicional, así como las variedades de cultivos tradicionales casi habían desaparecido. Nuestro trabajo reciente muestra un panorama más complicado. La influencia misionera llevó a una disminución del conocimiento en la generación que era adolescente durante el gobierno misionero, mientras que la generación más joven está recuperando el conocimiento previo. Variedades de

cultivos tradicionales están siendo ampliamente cultivadas todavía. La mayoría sabe hablar Chácobo, y puede nombrar artefactos tradicionales, aunque sólo la generación más vieja tiene todavía la capacidad para fabricarlos. Mientras que muchos Chácobo todavía saben los nombres y usos de las especies medicinales, la generación más joven es a menudo inseguro cómo identificarlos.

**Palabras clave:** Etnobotánica, repatriación de conocimientos, Protocolo de Nagoya, propiedad intelectual, uso de plantas, Amazonas, Beni

## Introduction

Bolivia has a rich diversity of indigenous cultures, with at least thirty tribes of eleven language groups. However, there are few detailed studies on the use of plants and resources of its various areas of life, and the authorities are still ignoring their knowledge of forest management. The anthropologist Haenke visited the Chácobo in 1958, and published the last account of Chácobo life before the tribe came under the influence of American Evangelist missionaries (Haenke 1958). The Summer Institute of Linguistics (SIL) formerly had a strong impact in changing the culture of many tribes in Bolivia, including the Chácobo. The SIL work with Chácobo communities from 1953 to 1980, and produced the first account of Chácobo linguistics (Prost 1960), followed by an unpublished work on Chácobo customs, with a strong focus on evangelist development (Prost 1970). This account is in interesting juxtaposition to the writings of the German anthropologist Kelm (1973), who visited the Chácobo in 1970, in the middle of SIL rule. The SIL finally was replaced in 1980 by the Swiss Protestant mission, established in Riberalta. Overall, missionary influence led to a profound change of lifestyle, and a permanent process of acculturation (Cordoba 2012). Brian Boom (Boom 1987) led the first ethnobotanical study of Chácobo between 1983-1984, documenting their knowledge after almost 30 years into its cultural change. Since then, essentially nothing has been published with regard to Chácobo ethnobotanical knowledge, although Sylvie

Bergeron conducted another study in 1995, but the respective volume (Bergeron 1998) was never released to the public, and only a few results on anti-malarial species were released by Muñoz et al. (2000).

Traditional knowledge (TK) is an important component in improving the management of natural resources (Mackinson and Nottertad 1998, Berkes et al. 2000, Huntington 2000) and practices relating to the protection of ecosystems and species (Shackeroff and Campbell 2007). This type of knowledge is developed by local communities through experiences adapting to their environment. It is dynamic and continuously modified. However, very little attention has been directed to understanding the changes resulting from adaptations to new environmental, cultural, social, and economic conditions (Gómez-Baggethun and Reyes-García 2013). Such changes may lead to the loss of local knowledge systems (Benz et al. 2000, Brosi et al. 2007), which could result in a reduced ability to cope with changes in their environment, but also their perception of natural resources and influence use.

In the last fifteen years, a large number of studies have sought to understand how social, economic, cultural, environmental, and geographical factors influence the TK about plants at small scales, from the local to personal. Factors such as gender, age, ethnicity, birthplace, and level of education have been identified as important on an individual level (Luoga et al. 2000, Byg 2004, Byg and Balslev 2006, Paniagua Zambrana et al. 2007). Family size,

integration into the market economy (e.g. sale of animals and agricultural products), or amount of material goods at family level (e.g., possessions of farm animals, tools, and transport) have been linked to the household levels (Byg and Balslev 2001, 2004, Reyes-García et al. 2005). Access to commercial centers, and to health, education, electricity or water, as well as land tenure systems and settlement history have shown a greater relevance at the community level (Takasaki et al. 2001, Byg et al. 2007, Vandebroek 2010). Although many of these studies might reflect the specific relation that each culture has with natural resources, we can not assert that such experiences do not reflect patterns and behaviors that may be similar, or even identical, between different cultures and regions. Furthermore, in the absence of a unifying theory or common research methods, it is difficult to clearly recognize whether or not these patterns exist at broader scales (Albuquerque and Medeiros 2012). Several studies have used literature metadata to analyze large-scale usage patterns of plants (Moerman et al. 1999, Molares and Ladio 2009, Saslis-Lagoudakis et al. 2011). In many cases, however, comparisons are difficult to make, given the diversity of the objectives and methods employed.

Evidence of these patterns can serve for generating strategies for the preservation of knowledge at regional scales, without neglecting characteristics of each region. If levels of TK can be predicted from socioeconomic data, conservation actions could focus better on the population sectors with more knowledge and facing greater risks of loss. To compare the influence of these factors on the knowledge of multiple cultures, communities and individuals, research designs very carefully to allow the elucidation of common patterns (Albuquerque and Medeiros 2013).

## Material and Methods

### *The study area - The Chácobo and Pacahuara*

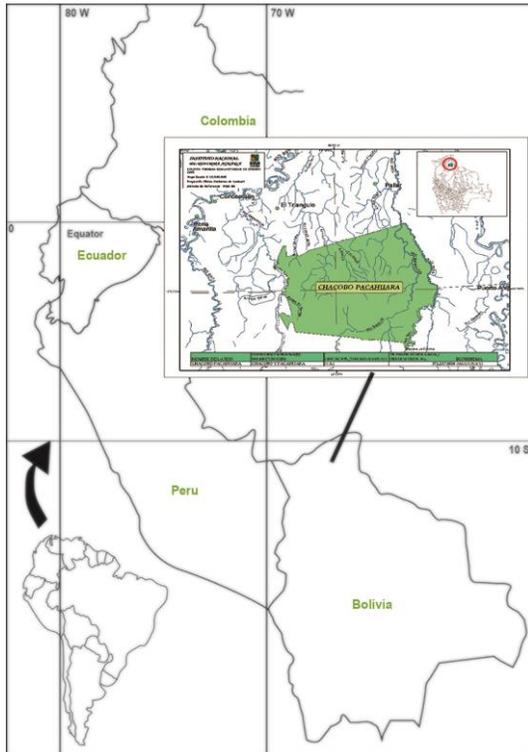
The Chácobo belong to the Panoan linguistic group that includes about twelve

tribes (Chácobo, Pacahuara, Matis, Matses, Yaminahua, and others). At the end of the 1890s, the Chácobo lived as semi-nomadic hunters and cassava and corn cultivators, probably in two groups, one with six families and one with four, in northwestern Bolivia, roughly between Lake Roguagnado and the river Mamore, south of their current territory. During the rubber boom in the early 1900s, they were forced by more aggressive tribes to move north, where rubber tappers, who also brought disease and epidemics to the tribe, threatened them. The Chácobo managed to avoid most of the outside influences however, while other tribes in the region were hunted like animals to be enslaved to work in rubber stations. The Chácobo had their first permanent contact with the outside world only in 1953 with people from the Tribes Missions, and in 1954 the Bolivian government established an agency about 15 km from the current location of Puerto Limones. The missionary linguist Gilbert Prost arrived in 1955 under the auspices of the Summer Institute of Linguistics (SIL). According to Prost (1970) there were four Chácobo groups living between the Benicito and Yata rivers, with about 200 people (Boom 1987). Prost and his wife continued to live among the Chácobo until 1980.

In addition to translating the New Testament into Chácobo, they made some observations on cultural and linguistic practices. In 1964, Prost managed to buy a territory in the north of the Chácobo's ancestral lands, forming the community of Alto Ivon, and most of the remaining population moved there. In 1965, the Bolivian government finally assigned 43,000 hectares of land to the Chácobo, although this area was less than 10% of their original territory. The influence of Prost caused profound cultural change among the Chácobo, including the abandonment of traditional costume and dance in 1969. Currently the population of the Chácobo community numbers about 500 people, with Alto Ivon as the largest settlement and Tokyo, Motacuzal, Siete Almendros, and other smaller communities along the Yata River. The current territory of the tribe

encompasses 450,000 hectares, and is roughly equivalent to the original extent of the tribe's ancestral lands (Fig. 1). The elevation is about 200 m, and can be classified as Amazon rainforest.

However, the territory encompasses not only humid tropical forest, but also large tracts of periodically inundated savannas, dominated *Mauritiella armata*, and large, drier, savanna areas with forest islands (Fig. 2). Rubber trees (*Hevea brasiliensis*) and Brazilnut (*Bertholletia excelsa*) are abundant. The average annual temperature is 26.8 °C, with an average annual rainfall of 1560 mm, based on observations in Riberalta. A distinct dry season lasts from June to November. Formerly the Chácobo were led by a Cacique.



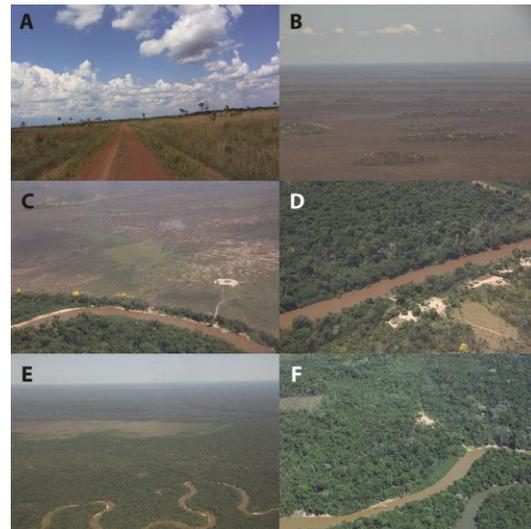
**Fig. 1.** Chácobo territory 2013.

#### Ethnobotanical and botanical collection

Our project explores the current traditional ecological knowledge (TEK) on plant use of the Chácobo and Pacahuara in Beni, Bolivia and has three goals: 1) to discover and document current traditional plant knowledge through interviews and surveys, 2) to inventory the current flora of the region, and 3) to repatriate the acquired

The community of Alto Ivon, the center of the Chácobo territory, is located about 112 km south of Riberalta, along the river Ivon, a tributary of the Beni.

The village has considerably changed since the 1960s, and now features a large secondary school (Fig. 3). Today there are two indigenous organizations: The Capitanía Mayor Chácobo, closely linked to the evangelists, and the Chácobo- Pacahuara Association, recognized by the Central Indígena de la Región Amazónica de Bolivia (CIRABO), supported by the Central de Pueblos Indígenas del Beni (CPIB) and the Confederación de Pueblos Indígenas de Bolivia (CIDOB).



**Fig. 2.** Chácobo ecosystems: A. Savanna dominated by *Mauritiella armata*; B. Savanna with *Tabebuia* dominated forest islands; C. Chácobo settlement in forest – savanna transition zone; D-F. Settlements on small tributaries (Rio Benicito, Rio Yata).

knowledge as well as previous data to the community.

Before starting fieldwork we conducted a thorough prior informed consent session in May 2013, involving representatives of all 27 villages in the Chácobo Territory. This session included the repatriation of the results of our previous

study on palms (Arecaceae) (Paniagua-Zambrana, Bussmann, Blacutt & Macia 2011). The results of the study, presented as full color book in Spanish, with the participating Chácobo collaborators as authors, was received with great enthusiasm. The local showed great enthusiasm to start the new study right away. Based on this 12 additional local counterparts were selected by the local population to be trained as interviewers and plant collectors. The methodology follows Paniagua Zambrana et al. (2010), but has been expanded to include all plant species. We expect to overall interview about 400 counterparts – the entire adult Chácobo population.

In September 2013 we conducted a two-week workshop on ethnobiological methods and plant collection, training the 12

selected counterparts (Fig. 4). Training was conducted directly in the field in the central village of Alto Ivon, and involved theoretical exercises (overview on methodology of interviews, collection and herbarium techniques), as well as extensive practical exercises (structuring and testing of questionnaires, test interviews among the participants, field interviews with local community members, plant collection in the field, preparation of herbarium specimens, plant and artifact collection in the local community, databasing, initial data analysis, Fig. 5). The counterparts, after this initial training, started the work to interview a subset of at least 25% of the adult population of the Chácobo territory on their traditional plant use.



**Fig. 3.** Early 1970 (above, adapted from Kelm 1972), and contemporary (below) Alto Ivon, Beni, Bolivia.



**Fig. 4.** The Chácobo Ethnobotany Project team, Alto Ivon, September 2013.

## Results

We predict that plant use, in particular for medicine and food, has profoundly changed since Boom's (1987) study, but that plant use for commercial purposes has markedly increased. The selection of counter follows the snowball technique to construct semi-structured interviews and have interviewees participate in free-listing surveys. In addition to the

regular interviews a subset of particularly knowledgeable interviewees ("experts") is being accompanied on "walks in the woods."

This interview pattern covers the entire Chácobo territory, and reflects that the sedentary lifestyle of the tribe is again replaced by migration patterns, based on seasonal availability of resources. The availability of previous field data gives the unique opportunity to study the long-term

change in knowledge of an indigenous group in the age of globalization. Our previous studies in Peru provide a solid comparative framework. (Bussmann & Sharon 2006,

2007, 2009, 2010; Bussmann et al. 2007a,b, 2009; Rodriguez et al. 2007; Revene et al. 2009).



**Fig. 5.** Chácobo counterparts collecting plant biodiversity and associated traditional knowledge.

To allow better interview and collection planning, we conducted a previously unplanned survey flight over the complete Chácobo territory to get better information about ecosystem distribution and status, and distribution of the Chácobo population.

With the background of taxonomic and herbarium training we simultaneously initiated the floristic survey of the Chácobo territory. The survey follows the well-established Missouri Botanical Garden floristic studies methodology and selects locations throughout the Chácobo territory, representing all of the plant communities present, to record fertile species. The local

assistants have been trained in botanical collection techniques and will continue to collect plants throughout the growing season, providing far superior coverage of plants that may not be in flower when MBG botanists are present. While all fertile species will be collected the main focus will emphasize the presence and distribution of culturally important plants, for which interviewees will be asked to confirm correct identification. The results will include a checklist of species present on Chácobo territory and basic mapping of the distribution of culturally important species. We will compare our floristic survey with historical records of plants collected in the Missouri River Region

(Boom 1987). The herbarium material is being deposited in the National Herbarium La Paz. No material is being exported.

Since inception of the training workshop in September 2013, our local Chácobo counterparts have so far conducted over 250 interviews and walk in the woods in all areas of the Chácobo territory. The initial goal was to interview about 25% of the adult population (about 125 people).

A preliminary analysis of the interviews depicts some very interesting trends, in particular in comparison to older accounts of Chácobo life going back to 1922 (Nordenskjöld).

#### *Changes in Chácobo life 1910-2014*

Certainly, the first striking examples in Chácobo life initially observed by an outside visitor are changes in fashion. The first accounts of the Chácobo all indicate the wide use of bark-cloth, and little enthusiasm for the rather conservative clothing style, which missionaries tried to introduce. Nowadays the Chácobo population simply uses regular “modern” clothing as available in the markets of Riberalta, (Fig. 6), while traditional bark cloth is used for festivals.



**Fig. 6.** A. Chácobo families 1958 (image provided by CIRABO), B. 1986 (adapted from Boom 1987), C-D. 2013.

The changes in the use of traditional implements, while occurring, are much more subtle. Most households still have large ponding tubs, consisting of whole logs. These, as well as the large wooden boards used to pound food, have not changed since Nordenskjöld’s time (Fig. 7). Large clay pans for roasting *Manihot* flour (jibé) and smaller ceramic pots are also still found in most

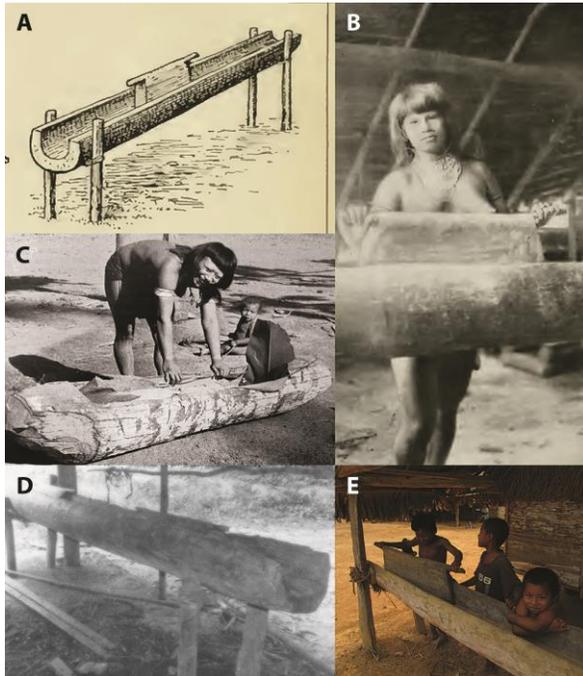
houses (Fig. 8). The large ceramic chicha (beer) vessels, very common in early accounts, are however not any longer produced, although chichi still is a mainstream of the local diet, and production – chewing parts of the pounded *Manihot* in order to start fermentation, has not changed (Fig. 9).

The Chácobo use a great diversity of forest plants for medicinal purposes. While early anthropological and missionary accounts mention hardly any medicinal species (Haenke 1958, Prost 1970, Kelm 1972), Brian Boom collected 360 plant

species in his study, of which 174 species were said to be of medicinal value, but his collaborators often did not indicate exactly how they were using each of them (Boom 1987).

In clear contrast, several Chácobo healers were identified in the present study.

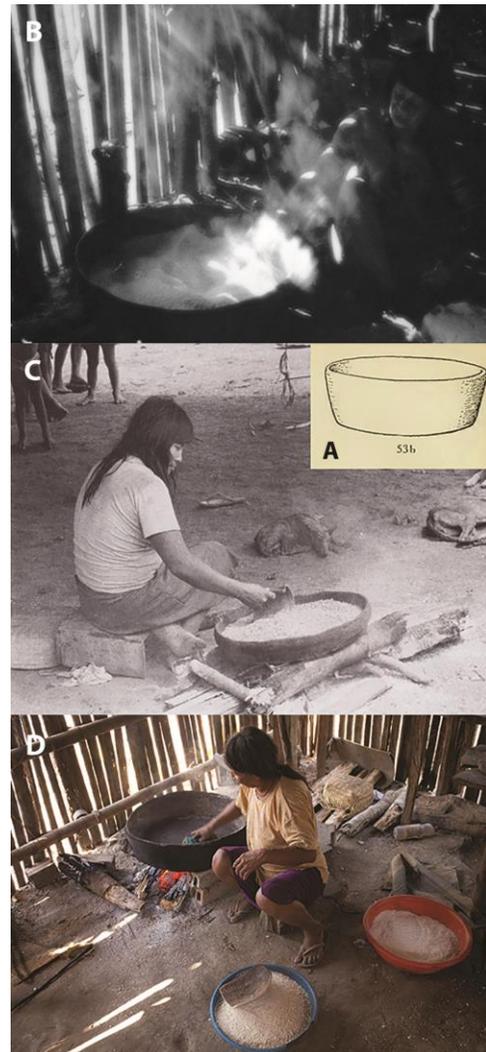
The knowledge of medicinal plants was particularly alive among older informants interviewed, an indication that traditional medicinal knowledge was already in the process of being lost in the 1980s.



**Fig. 7.** Chácobo grinding tub: A-B. 1910 (adapted from Nordenskjöld 1922), C. 1970 (adapted from Kelm 1972), D. 1986 (adapted from Boom 1987), E. 2013.

Bergeron in contrast found 472 plant species, of which 166 were classified as medicinal (Bergeron 1998). In our current study species identification is still in progress, but so far over 230 medicinal plant species could be elucidated.

The Chácobo most often described the preparation of remedies by boiling the leaves, bark or fruits to cure diseases, which is still maintained at present. Sometimes other plant parts (leaf, bark, latex, resins, and fruits) are applied directly to the body region that was affected, particularly in cases when using latex or other plant extracts. However, Boom did not find a true healer among the Chácobo who would have been able to corroborate or supplement the information obtained from his informants (Boom 1987).



**Fig. 8.** Chácobo jibe production: A. Jibe pan 1910 (adapted from Nordenskjöld 1922), B. 1958 (image provided by CIRABO), C. 1986 (adapted from Boom 1987), D. 2013.

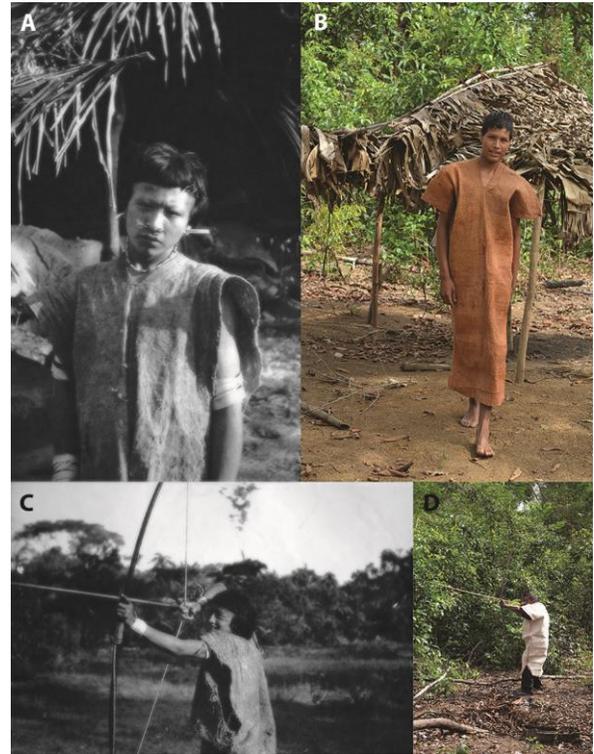
The use of plant poisons, which had high importance when Boom visited the Chácobo, is still practiced today. The latex of *Odontadenia laxiflora* (Apocynaceae) is applied to arrowheads to catch fish in deep water. *Derris floribunda* (Fabaceae) was originally cultivated for fishing, while *Derris amazonica* and *Serjania lethalis* and *S.*

*pyramidalis* (Sapindaceae) were collected only in the forest. Nowadays all species are only collected. Stems of these species are still macerated and applied to shallow water during the dry season to suffocate the fish, which are collected when they come to the surface.



**Fig. 9.** Chácobo chicha production in 1958 (above, image provided by CIRABO), and 2013 (below).

Bows and arrows were originally the most important fishing and hunting implements, and bark cloth was used as regular hunting garment. Today bark cloth is only used for festivals, but bows and arrows are maintained as hunting implements, especially for fishing (Fig. 10). The Chácobo most frequently use the hard wood of palms like *Astrocaryum aculeatum* and *Bactris gasipaes* (Arecaceae) to manufacture bows and arrows. The handles of the arrows are made from the flowering stems of wild cane (*Gynerium sagittatum*, Poaceae), and when this was not available the stems of *Geonoma*



**Fig. 10.** Chácobo bark clothing: A. 1958 (image provided by CIRABO), B. 2013, and hunting technique: C. 1958 (image provided by CIRABO), D. 2013.

*maxima* var. *chelidonura* (Arecaceae). Boom also found *Ischnosiphon arouma* (Marantaceae) for this purpose. Boom identified five very different types of arrows designed to hunt different types of animals: Tepi and quërëquë (for ground birds), tohua quëspini and paca (for large animals) and bicobi (for fish). In 2010 the Chácobo were mainly using .22 caliber rifles and 20 gauge shotguns for hunting, but all arrows could still be found and were produced by the older generation (Fig. 11).

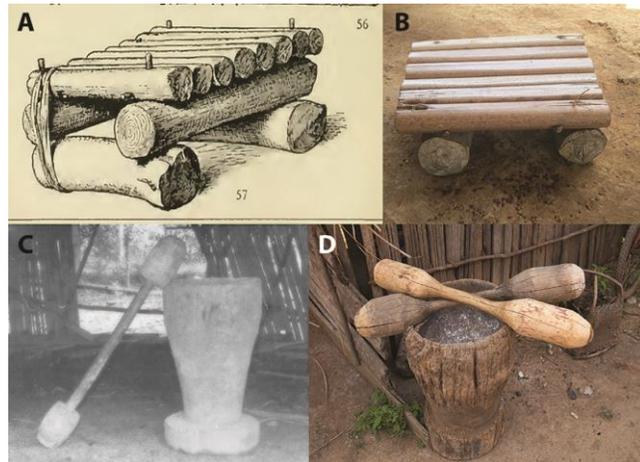
Little stools from the petioles of *Mauritia flexuosa* and balsa wood (*Ochroma*

sp.), first documented by Nordenskjöld (1922) are found in many houses, and the traditional mortar for pounding food is still

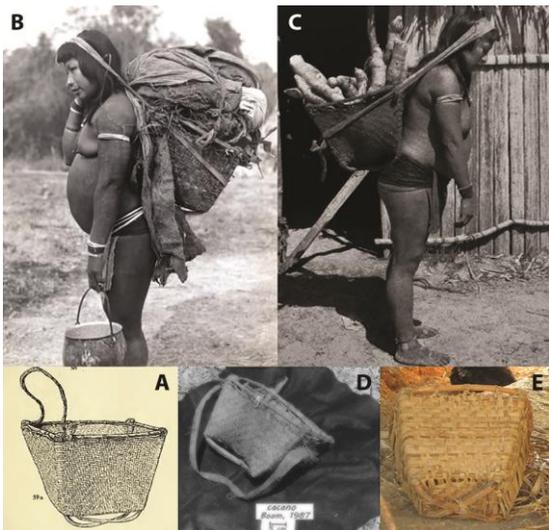
commonplace, although nowadays mostly used to de-husk rice (Fig. 12).



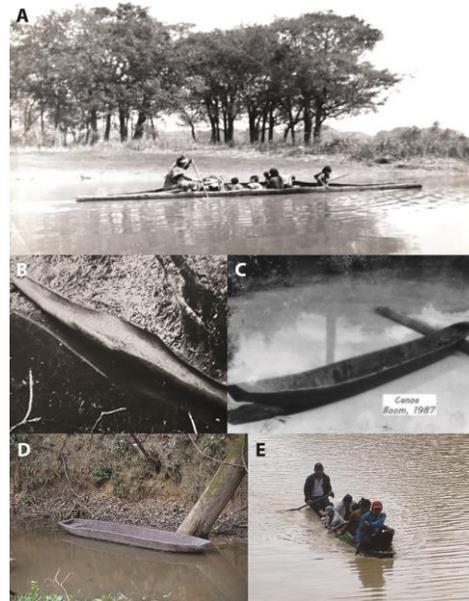
**Fig. 11.** Chácobo hunting arrows: Above 1986 (adapted from Boom 1987), below 2013.



**Fig. 12.** Above: Chácobo chair made from *Mauritia flexuosa* petioles and *Ochroma* wood: A. 1910 (adapted from Nordenskjöld 1922), B. 2013. Below: Mortar: C. 1986 (adapted from Boom 1987), D. 2013.



**Fig. 13.** Chácobo “cacano” burden basket: A. 1910 (adapted from Nordenskjöld 1922), B. 1958 (image from CIRABO), C. 1970 (adapted from Kelm 1972), D. 1986 (adapted from Boom 1987), E. 2013.

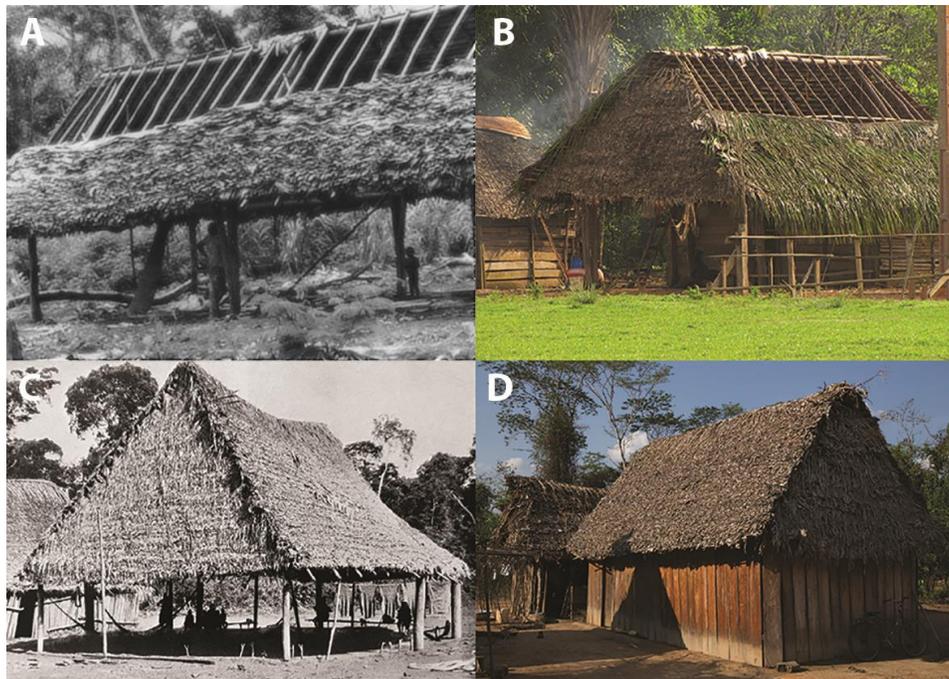


**Fig. 14.** Chácobo canoe construction: A. 1958 (image from CIRABO), B. 1970 (adapted from Kelm 1972), C. 1986 (adapted from Boom 1987), D-E. 2013.

Many species were used to make baskets (Fig. 13). The ropes for large burden baskets (cacano) baskets are made from the inner bark of *Couratari guianensis* (Lecythidaceae), and *Uncaria guianensis* (Rubiaceae) is used for the frame. The strap that is placed on the forehead of the person is made from the inner bark of *Ficus obtusifolia* (Moraceae). The poropachi, a light cargo basket is woven from young leaves of *Attalea phalerata* (Arecaceae). This has not changed since Nordenskjöld (1922), and the same species are still used to make baskets. However, only a few older women in the

communities still have the skills to weave baskets, and modern implements like backpacks are clearly replacing traditional materials.

Similarly, canoes are still an important means of transportation. However, while Nordenskjöld (1922), Haenke (1058) and Kelm (1972) described canoes made from bark, the modern variety is made of hollowed out tree trunks, which is already indicated in Boom (1987) (Fig. 14). House construction and roofing have however not changed much in the last 100 years (Fig. 15).



**Fig. 15.** Chácobo roof building: A. 1986, with *Phenacospermum* (adapted from Boom 1987), B. with *Phenacospermum* and *Attalea phalerata* 2013. Chacobo houses: C. The men's meeting house 1970 (adapted from Kelm 1972), D. Contemporary houses in Alto Ivon, 2013.

In the 1980's cassava (*Manihot esculenta*, Euphorbiaceae) was clearly the most important food for Chácobo, and seven varieties were planted, covering almost 62% of all cultivated land in the community. Cassava was harvested from May. Maize (*Zea mays*, planted in 18% of the land) and upland rice (*Oryza sativa*, planted in 7% of the land), both Poaceae, were alternately planted with cassava (Boom 1987). By 2010, rice has become the staple food, leaving

cassava and corn with a more secondary role, clearly reflecting a change in diet Chácobo, and also showing the influence of the market, because a large part of the rice crop is sold. However, the original traditional maize and cassava varieties are still grown. Another important crop were the bananas or plantains and bananas (*Musa x paradisiaca*, Musaceae), planted in gardens and clearings. Boom found eight local varieties of bananas (Boom 1987). In 2010 most of these varieties

were still planted, although the surface area of bananas had decreased (Fig. 16).



**Fig. 16.** Crop diversity. Above: Banana varieties encountered by Boom (adapted from Boom 1987), all of which were still grown in 2013; Below: *Manihot* varieties 2013.

Boom mentions that 27 edible species were grown in small gardens planted near homes, the most common species being mango (*Mangifera indica*, Anacardiaceae), avocado (*Persea americana*, Lauraceae), papaya (*Carica papaya*, Caricaceae) and lemon (*Citrus aurantifolia* Rutaceae) (Boom 1987). In our work done in 2010 we found all these species, and also orange (*Citrus sinensis*, Rutaceae) in home gardens.

Shrubs such as guava *Psidium*, *Myrica* sp. and *Eugenia* sp., all Myrtaceae, were also common in the forest ghardens. Another plant commonly grown in home-gardens is still *Bixa orellana* (Bixaceae), used for coloring food, as well as melon (*Citrullus vulgaris*, Cucurbitaceae) and sugarcane

(*Saccharum officinarum*, Poaceae). Pineapple (*Ananas comosus*, Bromeliaceae), bean (*Vigna unguiculata*, Fabaceae), yams (*Dioscorea trifida*, Dioscoreaceae), waylusa (*Xanthosoma* sp., Araceae), sweet potato (*Ipomoea batata*, Convolvulaceae) and squash (*Lagenaria siceraria*, Cucurbitaceae) are also still an important component of local diet.

In contrast, in the 1980's the Chácobo also sowed Huanimá (*Bactris gasipaes*, Arecaceae) in abandoned clearings to collect palm fruits. In 2010 the palm was only found rarely around the villages, and was no longer planted.

One of the most profound changes in Chácobo life seems to be a return to former

migration patterns, nowadays mostly linked to commerce and income generation. Originally Brazil nuts (*Castaña*, *Bertholletia excelsa*, Lecythidaceae) formed an important source of fats in the Chacobo's diet. People still eat the nuts raw or roasted, but most of the population collects Castañas only for sale. In the 1980s Brazil nuts sold for 2,500 Bolivianos per kilo (U.S. \$ 2.50 in 1983) in Riberalta, and Jihui (rubber, *Hevea brasiliensis*, Euphorbiaceae), was sold for 1,400 bolivianos per kilo (U.S. \$ 1.40 in 1983). At that time the rubber business was the most important source of income for Chácobo. In 2010 the marketing of these products has changed dramatically. Rubber has no importance whatsoever as a source of income, and is only used traditionally to manufacture some household utensils. The harvest of Brazil nuts meanwhile represents now the main source of income form many Chacobo. A product that is being taken advantage of recently are palm hearts from Acai (*Euterpe precatória*, Arecaceae), which is collected by walking increasingly longer distances and sold to contractors who enter the communities to purchase large quantities delivered to the canning factories in Guayaramerín and Riberalta.

The production of oil from the seeds of Brazil nuts was reported by Boom (1987), but has completely ceased nowadays.. The chestnut harvest takes place from January and March, and during that time now almost the entire Chácobo population migrates to the South of the territory where the largest concentration of *Bertholletia* is encountered. During the rest of the year Alto Ivon remains the main population center. However, many Chácobo have "second" homes in Tokyo, where most of the fields are located at present, or in Triangulo, closer to their main fishing sources, and conveniently located at the road to Riberalta, leading effectively to a semi-nomadic lifestyle.

Originally we hypothesized that many household artifacts as well as traditional clothing had disappeared from Chácobo life. Many of these artifacts were mentioned in the 1922-1970 accounts, but not in later studies. Boom (1987) and Bergeron

(1998) in particular indicate that traditional tools and clothing had disappeared. This turned out to be an interview artifact. Early anthropologists, who focused on Chácobo daily life (Haenke 1958, Kelm 1972), while Boom and Bergeron focused only on plants collected from one 1ha forest plot. Our combined study indicates that in fact most artifacts of the Chácobo are still known, and also used, by a large part of the population. This includes traditional clothing that is still being prepared and used on important occasions, as well as hunting and household implements. In daily life however, no traditional clothing and ornaments are found anymore, and the large monkey tooth breastplates mentioned by Nordenskjöld (1922) and Haenke (1958) have indeed disappeared. Traditional ceremonies and songs are also virtually unknown and unpracticed at this point.

The Chácobo plant knowledge seems to be a different story. Little about medicinal plant use was reported in anthropological studies. The missionaries of the Summer Institute of Linguistics tried to eradicate traditional medicinal plant use and traditional agricultural practices (Prost 1970), because they regarded this as pagan. The introduction of pigs and cattle in particular, to meet the meat supply when the forests around Alto Ivon were depleted of game, changed the daily life of the tribe profoundly (Kelm 1972). However, the Chácobo still maintained traditional clothing and ceremonies when the missionaries were not in the village, and changed to more western clothing when they were, in order to not offend them (Kelm 1972). Both accounts report on a wide array of artifacts, and some food plants, but essentially neglect the medicinal knowledge of the tribe completely. In contrast, the two botanical studies in the 1980s and 1990s report on a large number of useful medicinal and food-plants, but fail to mention many artifacts.

Our current interviews found essentially all household and hunting artifacts mentioned 50-100 years ago present in Chácobo villages. We also found that medicinal plants are still widely used. The

older population (<60) has maintained the broadest plant knowledge. The “missionary generation”, now about 40-55 years old, does however show a pronounced loss of knowledge. Interestingly, the younger population is active in trying to again recuperate ancestral knowledge and techniques. It does however clearly know detail about medicinal plants, and often seems to be unsure about preparations. Further analysis is needed to confirm this trend.

### **Discussion and Conclusions**

During the initial project startup workshop, two publications (Bussmann & Paniagua Zambrana, 2011, Paniagua Zambrana et al. 2011) were repatriated to the entire Chácobo community.

In September 2013, during the training workshop, copies of earlier studies (Bergeron, S. (1998), and Prost, D.M. (1970) were repatriated to the Chacobo (Fig. 17). This is of special significance, because Bergeron can be seen as a follow up study to Boom, and although this document was published in Spanish, no copies were available anywhere in Bolivia, and had never been given to the Chacobo. The only surviving copy was found at the library of the Institut Français d'Etudes Andines in Lima. This work is the more important because it also contains a section on Chácobo linguistics with regard to plant names. A copy of Probst was obtained directly from the Summer Institute of Linguistics in the US.

Although prepared in Spanish this work had never been given to the Chacobo. In order to give the Chácobo a complete overview on the available documentation of their history we are currently translating further anthropological literature (Keim 1972, Hanke 1958, Nordenskjöld 1922) from English and German to Spanish, to repatriate

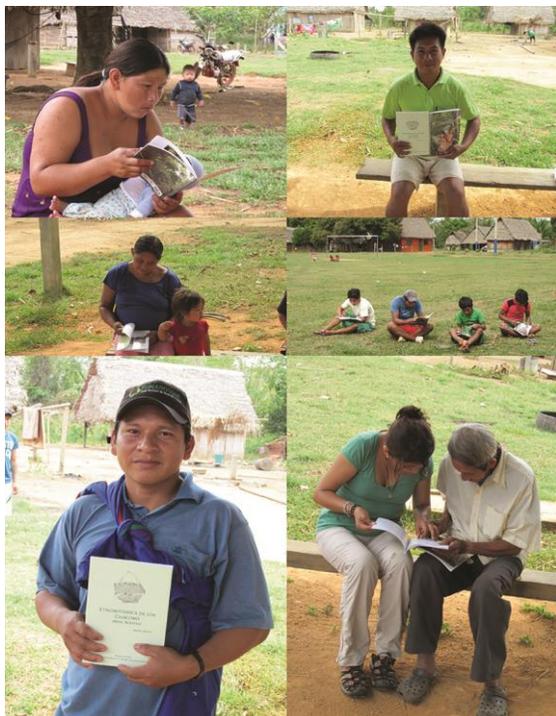
these materials during the final project workshop.

After concluding the fieldwork we will host a useful plants workshop to share the information found, in printed and electronic forms, with the local population, and discuss with the Chácobo how best to honor and preserve traditional knowledge within the community in the future. We will create a database that contains the information collected during interviews and the floristic survey. All members of the tribe will have access to compiled interview data for purposes of learning and education. The data collected will be a valuable resource to the community as a tool to preserve their traditional knowledge, and will encourage the launch of research projects and community activities so the information does not become static. Species identified as being most important to the community can be targeted for conservation and restoration activities.

First results of the present study clearly indicate that much of Chácobo traditional knowledge on biodiversity has been maintained at least over the last century. It has become profoundly clear that interview focus and techniques, as well as the ethnicity and religious orientation of the interviewer have a high capacity to influence the outcome of a study.

Training local counterparts in interview and plant collection techniques proofed a sound method to optimize study results. Parts of historic studies could already be successfully be repatriated to the Chacobo.

In the coming year, in collaboration and co-authorship of the Chácobo community the results of the ethnobotanical and floristic studies will be published in peer-reviewed journals, both at local (Spanish) and international level. Local student assistants will gain a valuable introduction to the practice of scientific research. In addition, a useful plant compendium in Spanish and/or Chácobo will be published for the whole Chácobo community.



**Fig. 17.** Repatriation of traditional knowledge on biodiversity.

Our efforts will result in a greater understanding of the traditional ecological knowledge being used today by the Chacobo, and will empower the communities to further promote the preservation and use of traditional ecological knowledge. At the same time this project will serve as example for the study and repatriation of traditional knowledge in other areas worldwide. All results will be covered by the "Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity."

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