THE USE OF TROPICAL FOREST (AGROECOSYSTEMS AND WILD PLANT HARVESTING) AS A SOURCE OF FOOD IN THE BRIBRI AND CABECAR CULTURES IN THE CARIBBEAN COAST OF COSTA RICA[1]

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Ramos García-Serrano, Carlos and Juan Pablo Del Monte *(Departamento de Producción Vegetal: Botánica y Protección Vegetal, Escuela Superior Técnica de Ingenieros Agrónomos, Ciudad Universitaria Sn, 28040 Madrid, Spain; email jpmonte@pvb.etsia.upm.es).* THE USE OF TROPICAL FOREST (AGROECOSYSTEMS AND WILD PLANT HARVESTING) AS A SOURCE OF FOOD IN THE BRIBRI AND CABECAR CULTURES IN THE CARIBBEAN COAST OF COSTA RICA. *Economic Botany 58(1):58–71, 2004.* *For the Bribri and the Cabecar Indians of Costa Rica the environment is divided in two: the "near", indigenous space; and the "far", natural space, which they think does not belong to them. In the former, the following agroecosystems can be distinguished according to biodiversity and intensity of human activity: tropical home garden, rotating slash-and-burn agriculture, plantain polyculture, and plantain monoculture. In the "far" space, these two culturally close groups harvest wild plants observing ancestral rules, which have helped ensure a sustainable use of forest resources. Their diet is based on 84 species, of which 24 are harvested in the "far" environment (hombrón, semko, platanillo, tacaco, etc.) and 60 are obtained in the "near" environment (maize, bean, cacao, manioc, etc.). Owing to acculturation, exotic species (mainly rice, sugarcane, plantain, cacao and citrus fruit) have become part of their diet and crops.*

El Maneso del Bosque Tropical (Agroecosistemas y Recoleccion de Flora Silvestre) coho base de la Alimentacion en las Culturas Bribri y Cabecar de la Costa Caribeña de Costa Rica. Los indígenas bribris y cabécares de Costa Rica consideran que su entorno se divide en dos: el "cercano" o indígena, y el "lejano" o espacio natural, que no les pertenece. En el espacio "cercano," en función de las biodiversidad presente y la intensidad de la actividad humana, se distinguen los siguientes agroecosistemas: huerto tropical indígena, la agricultura rotativa de roza y quema, el policultivo del plátano, y el monocultivo del plátano. En el espacio "lejano," estos dos etnias culturalmente cercanas recolectan plantas silvestres observando una reglas ancestrales, que aseguran un uso sustentable de los recursos del bosque primario. Su dieta se basa en 84 especies, de las que 24 son recolectadas en el espacio "lejano" (hombrón, semko, platanillo, tacaco, etc.) y 60 son obtenidas en el espacio "cercano" (maíz, frijol, cacao, yuca, etc.). No obstante y debido a la transculturación que han sufrido estas etnias, se han introducido en su dieta y en sus cultivos especies alóctonas (como arroz, caña de azúcar, plátano, coco y cítricos).

Key Words: Agroecosystems, Bribri, Cabecar, Costa Rica, ethnobotany food plants, indigenous cultures.

The majority of the Bribri and the Cabecar Indians, the two Caribbean Talamanca tribes in Costa Rica, occupy an area of about 3600 km^2 in indigenous reserves of La Amistad National Park, in the Región Huetar Atlántica, province of Limón. The area includes part of the canton of Limón in the north and part of the canton of Talamanca in the south (Fig. 1). Most of the Cabecar settlements are located in the north and west of the area, based in La Estrella Valley and its mountain spurs, while those of the Bribri lie mainly in the south and east in the Talamanca Valley and the surrounding mountain ranges.

Eight of the 12 life zones defined by Holdridge et al. (1971, 1987) for Costa Rica have been identified in the Bribri and the Cabecar area (Castro 1985; Gómez 1986; Hartshorn 1991; Junkov 1985; Masterson and Chavérs 1986; Ra-

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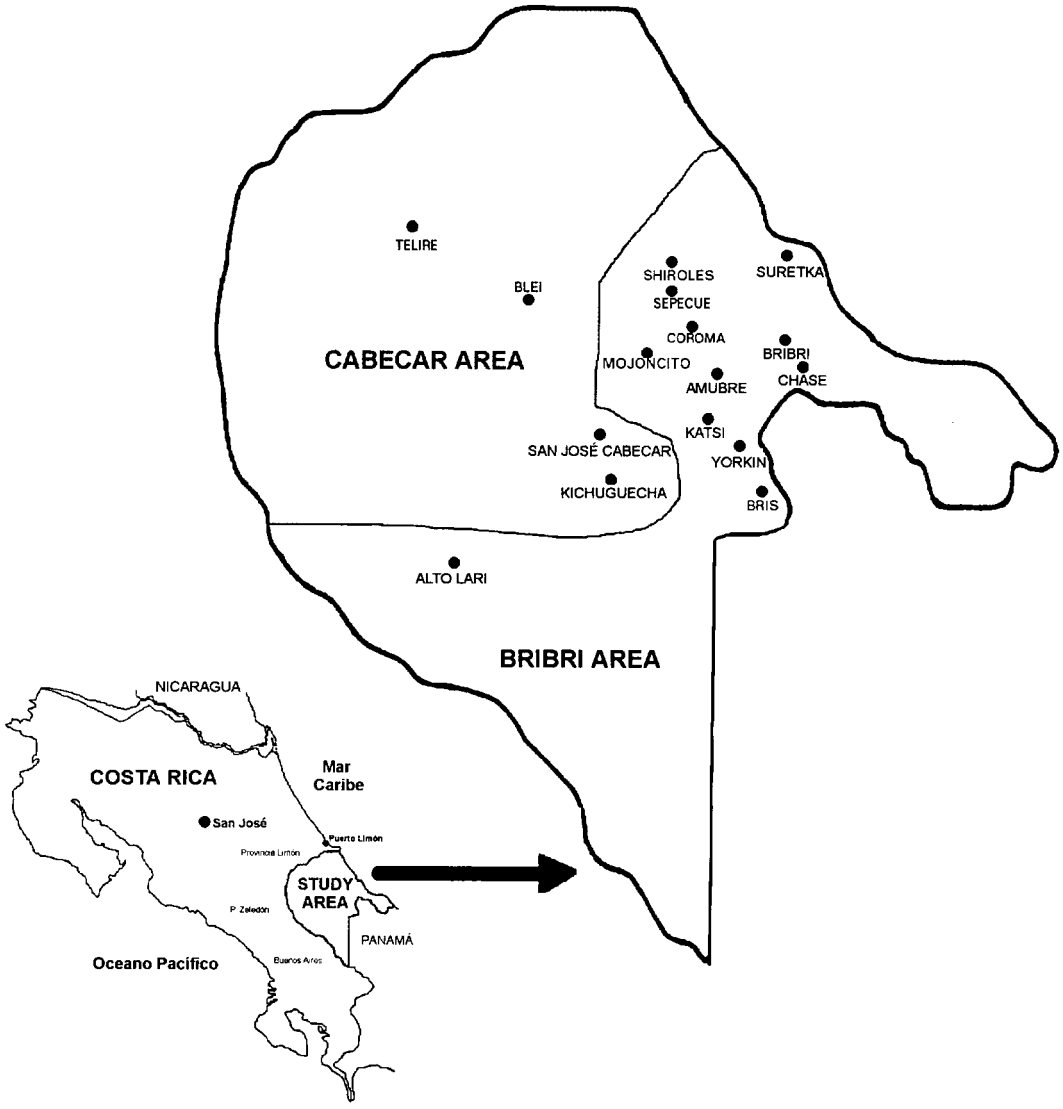

Fig. 1. Distribution of Bribri and Cabecar tribes in the study area.

mirez and Lewis 1981; Vásquez 1988). These include zones from Tropical moist forest (T-mf), which extends along the coastal plain from Puerto Limón to the border of Panama in the indigenous reserves of Talamanca and Taymi, to Sub-Alpine rain paramo (SA-rp), which can be identified in the most northern part of the Cordillera of Talamanca. Tropical wet forest (T-wf) can be found behind the low hills that skirt the coastal plain of the Caribbean, to the west of Puerto Limón, and in the medium basins of the rivers Sixaola, Estrella and Banano. Premontane wet forest (P-wf) covers the foothills from the border with Panama to the Fila de Matama. Below that range of hills, large parts of the valleys of the rivers Chirripó, Pacuare and Reventazón are covered by Premontane rain forest (P-rf), along the strips of land next to the Cordillera of Talamanca. Lower Montane wet forest (LM-wf) appears in small patches throughout the Bribri and Cabecar area. Lower Montane rain forest (LM-rf) can be found in the Cordillera of Talamanca and its spurs, in the altitude of 1500 to 2500 m, and finally, Montane rain forest (M-rf)

is represented along the Cordillera of Talamanca and its upper spurs.

There are an estimated 3000 to 4500 Bribri and from 2000 to 3000 Cabecar Indians. It is believed that the origin of these two culturally close groups are tribes of the Tupi-Guarani family (Brazil, Lesser Antilles and Venezuela) and the Chibcha (Colombia) who spread out along the Atlantic coast and inland of Central America, reaching in some cases the Pacific coast.

The Bribri and the Cabecar believe that the environment is organized in a hierarchy similar to their social system. The earth and everything it contains, people, plants, animals, stones, and the sub-soil ("the veins of the earth"), belongs to /BkubLu/, the master spirit, who lives in the depths of the Kamuk hill. He has under him /DuaLok/ or /Duarko/ and other owners of the forest, the water and the animals. These, in turn, have workers who assist them in taking care of their properties, such as /Shurakma/, the maker of large earthenware jars, and /Daleklablu/, who is in charge of *Bactris gasipaes* Kunth (peach palm), and an endless number of devils or spirits called */Be/*. Every plant and animal has its /Tmí/, a king or a queen, for example: /Tsiru'/, the queen of cacao; /SaLbLu/, the king of monkeys; /TsuibLu/, the king of the armadillo; and /NmabLu/, the king of the fish. Natural resources belong to these spirits and have to be borrowed from them by giving them something in exchange or by deceiving them. This explains certain practices and behaviors of the Bribri and the Cabecar in relation to their environment, such as referring with false names to the products to be harvested. Thus, they may say, 'We are going to gather manioc', when they go fishing or, 'I am going to cut snake beards', when they are going to collect lianas to anchor constructions (Bozzoli De Wille 1972, 1977, 1986; Gabb 1981). Moreover, in their beliefs, some plants and animals are their brothers or brothers-in-law, and have to be treated as such (Bozzoli de Wille 1986; Pittier 1905, 1938).

In the Bribri and Cabecar world, the physical distance of the species from the community marks the relationship between people and plants. The use of plants and the rules and restrictions limiting the use of plants depend on this relationship. According to the traditional beliefs of the Bribri and the Cabecar, the environment is divided in two parts, which can be defined as the "near" and the "far." In the "near" space, i.e., the indigenous, humanized space, they can modify and shape the landscape, while the "far" space, i.e., natural, primary forest space, does not belong to them and can be used only by observing strict rules. The rules are contained in the /Suwá/, a concept which can be translated as wind, puff or knowledge. These rules resemble some of the principles governing social relationships of the Bribri and the Cabecar, such as respect for what belongs to others and not borrowing from a neighbor more than what is strictly necessary (Bozzoli de Wille 1986). Maize, manioc and cacao, and in general crop species, are close to the settlements and therefore the tradition imposes relatively few limitations on their use. The plants on tacotales (fallow land), such as *Gynerium sagittatum* (Aubl.) Beauv. (caña blanca) and *Ochroma pyramidale* (Cav. ex Lam.) Urban. (balsa), grow a little further away and their use is limited by some restrictions. The use of trees in the primary forest, for instance *Minquartia guianensis* Aubl. (manú) and *Tapirira brenesii* Standl. (campo santo), is restricted and regulated to a great degree. Generally, major restrictions concern the use of plants by /okömpa/, masters of ceremonies at burials and gravediggers, and by /awapa/, traditional healers. Minor limitations are usually related to the management of species by women in the "near" space, and are often temporary. However, in some cases major restrictions apply to women even in the "near" space. For instance, women cannot sow *Aristolochia odoratissima* L. According to the Caribbean Talamanca Indians' culture, those who infringe the regulations will be exposed to illnesses or death sent by the spirits who own the natural elements. These punishments are executed by /SkuLakma/, who is a /Yeria/, a hunter, who points his bow at the transgressor and shoots his arrows, which turn into poisonous snakes upon reaching their prey (Gagini 1921; Pittier 1938).

Methods

The field work was conducted in the area of lower Coen, which is inhabited by the Bribri, and in the Estrella Valley, an area occupied by the Cabecar. Field trips took place during 1992–1995 at different times of the year, in order to cover all the phenological states of the species and to obtain taxonomically identifiable samples. Specimens of all species were collected at least once in the dry season and once in the

rainy season. The samples were obtained along various itineraries accompanying an /okóm/ and two /awapa/ and other informants from the communities of Coroma and San José Cabecar on their collecting journeys. Samples were obtained following the ethical advice for collectors in the UNESCO sponsored 1992 Manila Declaration Concerning the Ethical Utilization of Asian Biological Resources (Anon 1992). The voucher specimens were deposited at the Herbarium of the National Museum of Costa Rica. A duplicate set was made of part of the collection and deposited at the Botanic Department of the Escuela Técnica Superior de Ingenieros Agrónomos of the Polythecnic University of Madrid. The interviews with the informants, both in the forest and in the communities, took place following a semi-structured interview format (Martin 1995) for qualitative data collection, and were audiotape-recorded. Literal transcriptions and translations of the recordings were prepared by the Department of Indigenous Philology of the University of Costa Rica in San José The translations were confirmed by a bilingual informant. The analysis of the agroecosystems was based on the studies of Hart (1985). In order to attain a more holistic understanding of the Atlantic Talamanca tribes' use of plant resources sociocultural aspects and sustainability concerns were given special emphasis in the study.

Description of the Agroecosystems and the Use of the Primary Forest

According to the data collected, the Bribri and the Cabecar use a taxonomically diverse group of plants for food consisting of 84 species (Appendix). These include 49 domesticated species (some of them exotic), and 35 wild and semi-domesticated species. Apart from the primary forest, food plant products are obtained mainly from three different agricultural systems: tropical home garden, rotating slash-and-burn agriculture, and plantain polyculture (i.e., the near space). In addition, monoculture of plantain has emerged in areas where the Bribri and the Cabecar are in close contact with the outside world and have undergone relatively intense acculturation. In the three systems where many species are handled, in the "near" space, the Bribri and the Cabecar reproduce to a great extent the structure of the primary forest. The systems have multiple functions and are characterized by a great complexity and a high degree of interrelation among the biotic components. Sociocultural norms and the tribes' interest in conserving the environment influence the management of the systems (Camacho 1974).

Tropical Home Garden

The basic function of the home garden is to provide products for family subsistence. It offers a varied, stable and continuous harvest of fruit, legumes, vegetables, tubercles, as well as medicinals and material for construction, household and crafts. In the home garden both cultivated and non-cultivated species are handled and mixed. The agroforestal methods the Bribri and the Cabecar practise in the home garden make it possible to maintain the local capacity to satisfy various needs throughout the year and at the same time to conserve the ecological characteristics of the tropical forest (Granados, Matarrita and Brenes 1981).

A home garden is usually located close to a family house. The average size is between 1 and 2 ha, depending on the availability of land and the number of family members. This agricultural system is mostly found in communities located on alluvial terraces and flat inter-alluvial areas in the mountainous sector; it is also found in foothill and valley settlements close to the Cordillera (Fig. 2). Owing to acculturation, the indigenous home garden system has practically disappeared and been replaced by plantain monoculture in the communities more accessible to and linked with the outside world.

This system has four different vegetation strata similar to the stratification of the primary tropical forest vegetation. Trees measuring more than 25 m in height, such as *Cedrela odorata* L. (cedro) and *Cordia alliodora* Ruiz & Pav.) Cham. (laurel) represent the top. The second stratum consists of 15 to 20 m tall trees, among them *Cecropia insignis* Liemb., *C. obtusifolia* Bertoloni, *C. peltata* L., *C. polyphlebia* Donn. Sm. (guarumo), *Ochroma pyramidale* (Cav. ex Lam.) Urban. (balsa), and *Bactris gasipaes* Kunth (peach palm). The third stratum includes permanent crops, such as *Coffea arabica* L. (coffee), *Theobroma cacao* L. (cacao), musaceas, and shrubs such as *Neurolaena lobata* R. (L.) Br. (gavilana) and *Inga* spp. (ingas), which measure less than 10 m in height. Finally the bottom stratum has various types of crops, including *Capsicum annuum* L. (chili pepper),

Fig. 2. Maize crop, cocoa trees and start fruit trees in the tropical homegarden (Coroma village).

Manihot esculenta Crantz (manioc), and *Xanthosoma violaceum* Schott. (tiquisque), as well as medicinal herbs. The composition of the cultivated species in the home garden is defined by cultural tradition. Another characteristic derived from home garden's physiognomic-structural similarity to the primary tropical forest is the absence of a linear crop layout. Thus, the system appears to be a chaos without internal logic, as the species are sown or planted in different places, at different distances and in different mixtures with other, non-cultivated species, in accordance with what the Bribri and the Cabecar consider appropriate for each garden, from an ecological and cultural point of view. The result of these characteristics is a high plant density in a reduced area and a highly variable structure in a plot and among different plots. The variability is also intra-specific; for instance, in one home garden it is possible to find up to eight different kinds of plantains.

In this system non-cultivated species are managed as a crop. They are looked after and protected during their growth while the home garden lasts by eliminating the undergrowth by slashing it and by pruning and removing branches. These species complement the functions of cultivated species and help satisfy needs which are not met with crop species. Wild species are maintained in the home garden for the following purposes: (a) for food, especially non-cultivated herbaceous species, e.g., *Dioscorea spp.* (flame) and *Urera baccifera* (L.) Gaud. (cardillo); (b) to obtain a large number of aromatic and medicinal plants; (c) to fight plagues and diseases and to increase soil productivity, as no chemical agricultural inputs are used in the home garden; (d) to obtain material for fishing, e.g., *Hura crepitans* L. (jabillo; its sap is used), *Garcinia mangostana* L. (mangostán; its bark is used), and *Wigandia caracasana* HBK (tabacon; its bark is used); (e) to obtain soap, e.g., *Enterolobium cyclocarpum* (Jacq.) Gris. (guanacaste; its seed is used); and (f) for other uses, e.g., *Heliconia latispatha* Benth. (bijagua; its leaves are used to build roofs, line baskets and to cover pots); and *Musa* spp. (/spako/; its leaves are used to wrap the mojozo, crushed maize corn, to prepare the chicha). In addition to the intra-specific variability, another special feature of the Bribri and

Cabecar home garden is the considerable number of different uses some of the wild species have, most notably three varieties of *Bactris gasipaes* Kunth (peach palm), to which these tribes attribute more than a dozen uses as human food and as material for construction and ceremonial rites.

ROTATING SLASH-AND-BURN AGRICULTURE

Rotating slash-and-burn agriculture satisfies basic food needs, although when there is surplus production plant materials derived from this system are exchanged for other products, and sometimes, especially in the case of maize, they are sold (Granados, Matarrita and Brenes 1981). In this system annual or seasonal crops, and especially basic grains, *Oryza sativa* L. (rice), *Zea mays* L. (maize), and *Phaseolus vulgaris* L. (bean), are rotated alternating with fallow periods. Crop rotation takes place both within a plot and among several plots after the two or three year production cycle. During the rest period, the Bribri and the Cabecar harvest other cultivated species, as well as non-cultivated species in a slash-and-burn plot.

Each indigenous family usually has up to three trabajaderos (slash-and-burn plots) for rotation at the same time. The average plot size does not exceed one hectare. In order to avoid problems caused by pigs and other domestic animals, the slash-and-burn plots lie some distance from the family houses; it may take some 15 minutes, or in some cases more than two hours, to reach them on foot. In any case, the Bribri and the Cabecar consider that the plots are within the "near" environment. Owing to the distance, however, it is impossible to avoid damages caused by wild animals, such as deer (*Odocoileus virginianus*), the tepezcuintle (*Agouti paca*), the saino (*Tayassu tajacu*) and birds. In the indigenous Caribbean Talamanca territory, rotating slash-and-burn agriculture is found in the valleys, foothills and in mountainous zones. It is practiced more intensely and more frequently in the foothills of the Cordillera, on slopes with a gradient of 15 to 20%, and in some cases of more than 50% with plots facing ravines and main rivers (Fig. 3).

During the first months after sowing, a slash-and-bum plot is relatively homogeneous with regard to the variety of crops. However, with time the plot becomes increasingly diverse regarding

Fig. 3. Bean and plantain crops in rotating slash–and–burn field.

cultivated and non-cultivated species and its structure becomes more complex. At the end of the cycle, three strata can be identified in a rotating slash-and-burn plot. The first and highest stratum consists of tall, scattered tree species; the second stratum is intermediate in height with musaceas and some shrubs such as ingas; and basic grains, as well as *Cucurbita pepo* L. (ayote) and *Sechium edule* (Jacq.) Sw. (chayote) dominate the third stratum. As is the case in the indigenous home garden system, the crops do not follow any linear order in space resulting from sowing.

The native farmer chooses the plot site on the basis of his observation of the environment and traditional knowledge of the fertility of the soil. In general, three characteristics are taken into account when the choice is made: the color of the soil (black colored soil of alluvial origin is preferred); soil texture; and the capacity of the soil to adapt to certain crops, which is evaluated on the basis of the existing vegetation. Areas covered with stubble, gramineous plants or fern

are avoided. If no suitable site can be found, an area of the primary forest is cleaned.

Chapia or tumba (the cut of the existing vegetation) is done with the machete or with an axe, and sometimes fire is used to clear the plot. Useful wooden species are spared in this process. Land preparation for sowing takes place during the time of the lowest rainfall, usually between January and April. The slashed biomass is left to dry and dehydrate for several weeks. Once it is dry, it is eliminated by burning after precautions are taken to prevent the fire from spreading to the rest of the forest and from affecting the species of interest that were left in the plot. Usually the plot is left to cool for about three days before the basic grains are sown. Vargas (1980) mentions an alternative method of preparing the land for sowing. It consists of cutting the vegetation; not burning the plant biomass, but letting it dry and decompose instead for more than a month, before the beginning of the heavy rains around the month of May; and sowing in the organic matter which is in the process of decomposing. This form of land preparation is a clear adaptation to the conditions of high humidity in the foothills and mountainous Caribbean Talamanca areas, but it is not very common today. The traditional sowing system consists of the espeque (making holes in the earth with wedges or sticks) and sowing up to 15 seeds of rice, eight of maize and six of beans in each golpe (hole). A foreign method being adopted by the Caribbean Talamanca tribes is the bean or maize tapado (covered). It entails distributing the seeds at random or by broadcast sowing in the charrales (fields that have not been prepared). Subsequently, the plots are cleaned, and the seeds are covered and they will germinate and grow in the decomposing plant remains.

The distribution of basic grain crops in a plot and the timing of sowing vary. A typical crop rotation in Atlantic Talamanca is maize and bean, and rice. Maize and bean represent direct spatial and chronological interaction as sowing of the bean takes place when maize has already developed and can serve as a tutor. Rice is sown after the harvest of maize and bean and a short rest period. Other crop rotation combinations include: maize and rice, bean and rice, and maize and bean. Moreover, sometimes only one of these basic grains is grown on a plot during one cycle. The basic grain crops do not form monoculture systems, since while the basic grain crops develop, other cultivated species are introduced in the agroecosystem. These include tubercles, such as manioc, ñampi, tiquisque and camote; sugarcane; ayote; plantain; and citrus fruit. In addition, the tree component that was deliberately left in the plot provides useful plant material or protects the crop.

After the basic grain crops have been cultivated for one or two cycles, the plot is abandoned and left to rest for about 12 years until either *Cecropia insignis* Liemb. (guarumo) or *Ochroma pyramidale* (Cav. ex Lam.) Urban. (balsa) flowers for the first time, a sign that the land has recovered its fertility and can be sown again. In the meantime, for another two years the Caribbean Talamanca Indians continue harvesting edible species in the abandoned plot. As secondary bush and tree vegetation takes over the fallow, non-cultivated useful species appear, such as *Astrocaryum standleyanum* L. H. Bailey (palmito de chonta), used for construction and clothing. In addition, the plots turn into important hunting areas because animals, such as the tepezcuintle, the saino, the chancho de monte and deer, go there in search of edible (for both humans and animals) seeds from trees, including *Spondias dulls* Parkinson (jocote), *Brosimum costarricanum* Liebm. and *B. terrabanum* Pittier (ojoche), *Bactris gasipaes* Kunth (peach palm), *Pachyra aquatica* Aubl. (castaña de agua), *Inga coclensis* Pittier. (guaba), and *Psidium guajava* L. (guayaba).

Plantain Crop

The *Musa* × *paradisiaca* L. plantain is a traditional exotic crop species in the native Atlantic Talamanca communities. It has succeeded cacao as the most important cash crop in the Caribbean Coast of Costa Rica owing to the low prices of cacao and the spreading of *Monilia spp.* infection in that plant, as well as the growing contacts with plantain companies. This has changed the form in which the Bribri and the Cabecar grow plantain. Plantain polyculture and monoculture systems were analyzed following the terminology proposed by Borje and Castillo (1994 pers. comm.) and paying attention to the complexity levels of the agroecosystems and the acculturation process in the Bribri and Cabecar communities.

Plantain Polyculture

In the plantain polyculture system, plantain tree, the dominant species of the plot, grows to-

Fig. 4. Association of plantain and tubercles in plantain polyculture.

Fig. 5. View of environment in harvesting area (Talamanca Mountains).

gether with other crops and plant species not cultivated to generate income but for domestic use and consumption. This traditional system is more frequent in areas where, in spite of acculturation, important elements of the Bribri and Cabecar traditions still exist, i.e., in foothills and in La Estrella Valley and in the Talamanca Valley (Fig. 4). The structure of this agricultural system is similar to that of the home garden with regard to the formation of several growth strata and the irregular distribution of the different species. There is less biodiversity in plantain polyculture system than in the home garden, but more than in the rotating slash-and-bum system. Plots are selected with the same criteria as for rotating slash-and-burn agriculture. In general, the planting density of plantain is very low to allow other species to grow. Plantain polyculture management is also similar to home garden management. Tradition and cultural beliefs greatly influence the management practices and especially those related to plantain. For instance, according to the tradition, plantain can be planted at any time of the year during the period of the waning moon. If sowing takes place in the new moon, the "sons of water" will grow very tall, have few roots, and they can topple easily. If sowing takes place in the full moon, the plantain tree grows little and develops many roots; it is strong, but the fruit is not very large and often bursts when mature. When sowing takes place in the waning period, the tree will be medium sized and the fruit large. Cleaning and eliminating weeds from the plantain tree take place in the new moon and pruning a little after new moon.

The plantain polyculture can be seen as a gradual change from the home garden system towards a less diverse system in which plantain becomes the main crop owing to its growing importance as a commercial product.

Plantain Monoculture

First only non-indigenous farmers practiced plantain monoculture in the indigenous reserves, in relatively large properties compared with the average indigenous plots. However, as a result of the growing contacts with the outside world and the growing acculturation, an increasing number of Bribri and Cabecar farmers in the lowlands of La Estrella Valley and the Talamanca Valley take up plantain monoculture and abandon the traditional agroecosystems.

In addition to the change of the type of crop, plantain monoculture has implied the introduction of totally alien inputs to the traditional indigenous Caribbean Talamanca agriculture. These inputs include agrochemicals to fight pests, diseases and weeds, fumigation equipment, as well as plastic bags to protect the fruit and synthetic cords to support the plants. The use of these new inputs is causing a series of threats to the natural ecosystem, including river and soil contamination and erosion, which lead to a decline in long term productivity.

Harvesting in the Primary Forest

The primary forest is not intact in the indigenous reserves of the Caribbean Talamanca. The Bribri and the Cabecar harvest the primary forest in the mountainous areas far away from the communities, in what they consider the "far" environment (Fig. 5). They collect plant material practically for all purposes, for food, medicine, construction and household, fuel, hunting and

fishing, crafts, clothing (textiles and dying materials) and for ritual ceremonies. However, at present the number of species harvested in the primary forest and the yields are less important than in the past. Species harvested for food in the primary forest include herbaceous species, such as *Passiflora vitifolia* HBK, *Sechium tacaco* (Pittier) C. Jeffrey, *Phytolacca rivinoides* Kunth et Bouche, and two species of the genera *Carludovica*; and trees and palms, such as *Annona reticulata* L., *Iriartea gigantea* Wendl. ex. Burret, three species of the genera *Brosimum* and four species of the genera *Theobroma*. Half of the species collected for food are also used for other purposes.

The forest is not considered public. In order to obtain forest products, the Bribri and the Cabecar need to ask for permission of the clan in charge of the respective forest area. In some cases, forest products must be bought. Not respecting a clan's control over an area of forest can create friction between clans. In the past, mostly young people collected wild plants, usually once a month. Nowadays young generations mostly look after the plantain crop and do not know the secrets related to the attributed properties of the plants. Wild plant harvesters are now mainly older Bribri and Cabecar people, both men and women, who also use the products derived. Generally, those who do harvest in the primary forest still respect the traditional rules and restrictions and ask /DuaLok/ and the other owners of the forest for permission to obtain the products needed.

In the past, the primary forest served as a close and well-stocked warehouse satisfying fresh food and other needs. Wild plant harvesting ensured the survival, autonomy and reproduction of the Bribri and Cabecar cultures.

Discussion

The Bribri and the Cabecar live in a relatively small area with a radius of 34 km and the two tribes are culturally very close. Cabecar settlements were mainly located in isolated and hard-to-reach inland areas. Generally, the Bribri occupied less isolated inland areas similar in environmental characteristics to the Cebecar settlements, as well as areas in the lowlands close to the coast. With regard to the use of tropical forest, there are no substantial differences originating from the past. The Bribri and the Cabecar have developed, during the course of their history, a varied set of methods to obtain food plants. These methods have evolved from wild plant harvesting and tropical home gardens to rotating slash-and-bum agriculture. Subsequently, under the influence of the "Western" culture some of the communities of these tribes have gradually adapted home garden practices to cultivate one dominant species converting home garden system to plantain polyculture, and eventually to conventional plantain monoculture.

The outside world has influenced the use of tropical forest in the Bribri and Cabecar communities in different degrees. The agricultural systems and the management of natural resources in the settlements situated in remote inland areas have been least influenced by outside cultures. These, mainly Cabecar areas frequently isolated by heavy rainfall and river flooding, still depend exclusively on home garden, rotating slash-and-bum agriculture and wild plant harvesting as food plant sources. The indigenous population closer to the coast lives in more accessible environment, has more contact with the outside world, and is engaged in commerce. In these communities, the traditional agricultural systems have disappeared to a great extent and been substituted by plantain monoculture, and markets have become the most important food sources. The acculturation process goes hand in hand with the introduction of crop species and the subsequent increasing dependence on the outside world.

Of the 84 food plants identified, 51 plants are obtained only from one agroecosystem or from the primary forest, 23 from two sources and 10 from three different sources. It was concluded that 63 food plant species grow in the tropical home garden, 21 grow in the plantain polyculture system, 24 are harvested in the primary forest, and 18 species can be obtained in the rotating slash-and-bum plots. Regarding the uses of these plants, 55 species are used only for food, while 12 are also used for medicine, seven for ceremonial rites, five for textiles, and five are also used for construction.

Presently, cultivated species dominate the diet of the Caribbean Talamanca tribes while the importance of non-cultivated species is diminishing. Among the cultivated species, exotic species are gaining ground from autochthonous species owing to the acculturation process. These tendencies are leading to the loss of the traditional botanical knowledge among the Bribri and

Cabecar people. Important autochthonous species in the diet include: *Zea mays* L. (maize), *Phaseolus vulgaris* L. and *Ph. lunatus* L. (bean), *Bactris gasipaes* Kunth (peach palm), *Persea americana* Mill. (avocado), *Manilkara zapota* (L.) Van Royen (zapote), *Carica papaya* L. (papaya), *Capsicum annuum* L. (chili pepper), *Theobroma cacao* L. (cacao); cultivated tubercles, such as *Manihot esculenta* Crantz. (manioc), *Xanthosoma violaceum* Schott., *X. sagittifolium* (L.) Schott. (tiquisque), and *Dioscorea trifida* L. f. (ñame); and wild tubercles, such as *Dracontium pittieri* Engl. (hombrón), *Carludovica palmata* Ruiz et Pav. (semko), *Heliconia mariae* J.P. Hooker (platanillo), *Psidium friedrichsthalianum* (Berg.) Nied. (cás), *Sechium edule* (Jacq.) Sw. (cheyote). Important exotic species include: *Oryza sativa* L. (rice), *Musa* × *paradisiaca* L. (plantain), *Saccharum officinarum* L. (sugar cane), *Coffea arabica* L. (coffee); *Cocos nucifera* L. (coconut), *Citrus spp.* (citrus fruit).

Excluding the plantain monoculture areas, maize is the most important cultivated species in the Bribri and Cabecar communities. It is used for the preparation of the chicha, the mojozo (a ferment for the chicha), the bollo tamal (meat pie), the atol (a shake made with dry maize grain powder), roast elote (sweet corncob), and the sancochado (a stew). Influenced by Guanacastecos (inhabitants of the northern plains of Costa Rica) and by Nicaraguans living on the Caribbean coast of Talamanca, some families have adopted Central American food, such as tortilla and tamale. Maize is also used to feed pigs and domestic birds. Rice, an exotic species of great importance in the basic diet in Caribbean Talamanca today, is traditionally sown in foothills and highlands and, more recently, on lowlands, where the yield is higher. The bean crop areas are concentrated in foothills and plains. The Caribbean Talamanca tribes consume less beans than maize and rice because of production problems related to the high humidity which make it impossible to obtain good harvests.

Traditional Bribri and Cabecar people have a profound knowledge of the ecology of their environment, as demonstrated, for instance, in the criteria used for selecting a plot for rotating agriculture and plantain polyculture. Traditional exploitation practices have undoubtedly had a great impact on the sustainability of plant resources: with the exception of plantain monoculture, Bribri and Cabecar farmers reproduce the structure of the primary forest in their agroecosystems; and their agroecosystem management methods and wild plant harvesting practices do not disturb the reproduction dynamics of plant populations (Peters, Gentry and Mendelsohn 1989; Nepstad and Schwartzman 1992). Religious beliefs and myths influence the use of plants, and the observance of ancestral rules and restrictions, which govern especially the use of wild species, forms part of the traditional understanding of and respect for the tropical forest and contributes to the sustainable use of plant resources. In some Bribri and Cabecar areas this cultural heritage is being lost, together with the rain forest. It is hard to judge which of the two, the disappearing botanical knowledge and traditions or the decreasing biodiversity, is the cause and which is the consequence of the other.

Generation after generation the Bribri and the Cabecar have had an agreement with nature, which has allowed both to survive to our day (Stone 1961). Agriculture, and to varying degrees wild plant harvesting and hunting and fishing, continue being the main activities of the Bribri and Cabecar communities. They have been based on a balanced system of exploiting nature. In the past, practically everyone in the village participated in these activities observing the related rules and prohibitions strictly. Today, young generations do not follow many of the rules. In substitution, new forms to control the abuse of natural resources are appearing, such as the constitution of native ecological organizations and the demarcation of territories under community administration.

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APPENDIX. BRIBRI AND CABECAR FOOD PLANTS.

Botanical name	Vernacular name (1)	Family	Other uses	Plant part used for food	Source (2)	Life zone (3)
Anacardium occidentale L.	/Hokäwa/	Anacardiaceae		Fruits, seeds	HG	T-mf
Ananas comosus (Stickm.) Merr.	/Amu'/, /Biskö/	Bromeliaceae	Textile	Fruits, leaves	HG	T-mf
Annona reticulata L.	/K'ssá/	Annonaceae	Medicinal	Fruits, leaves	Harvested	T-mf, T-wf
Artocarpus communis J.R. et G.	Árbol del pan	Moraceae		Fruits	HG	T-mf, T-wf
Averrhoa carambola L.	Carambola	Oxialidaceae		Fruits	HG	T-mf, T-wf
Bactris gasipaes Kunth	/Dikó/	Arecaceae	Construction, ceremonial	Fruits, seeds, flowers, bark	HG, PP	T-mf, T-wf
Bertholletia excelsa Humb. et Bompi.	Castaña	Lecythidaceae	Hunting (gum)	Fruits	HG	T-mf
Bixa orellana L.	/Kcha'/, /KriKrá/	Bixaceae	Ceremonial	Seeds	HG, PP	T-mf
Brosimum costaricanum Liebm.	/Koki/	Moraceae	Textile (bark)	Leaves, fruits	Harvested	T-wf, P-wf, P-rf
Brosimum terrabanum Pittier	/Koki/	Moraceae	Textile (bark)	Seeds	Harvested	T-mf, P-wf, P-if
Brosimum utile (HBK) Pittier et Engl.	/Koki/	Moraceae	Textile (bark)	Latex	Harvested	T-mf, P-wf, P-rf
Capsicum annuum L. var. *annum*	/Dipá/ /Boró-boró/	Solanaceae		Fruits	HG, PP	T-mf, T-wf
Capsicum baccatum L. var. *baccatum*	/Dipá/, /Sá/, /Shá/	Solanceae		Fruits	HG	T-mf, T-wf
Capsicum frutescens L.	/Shá Bachú/	Solanceae		Fruits	HG, SB	T-mf
Carica papaya L.	/Kitsú/, /Kichö/	Caricaceae	Medicinal	Fruits	HG, SB, PP	T-mf
Carludovica drudei Masters	/Tchima/	Cyclanthaceae		Flowers	Harvested	T-wf, P-wf
Carludovica palmata Ruiz et Pav.	/Semko/	Cyclanthaceae	Textile	Flowers, leaves	Harvested	T-mf, T-wf P-wf, P-rf
Chamaedorea tepejilote Liebm.	/Iawö/, /Iaö/	Arecaceae		Flowers	Harvested	T-mf, T-wf
Chrisophyllum caimito L.	Caimito	Sapotaceae		Fruits	HG	T-mf
Cinnamomum zeylanicum Bl.	Canela	Lauraceae		Bark	HG	T-mf, T-wf
Cissus spp.	/Tsikurrikö/	Vitaceae		Leaves, shoots	Harvested	P-rf, LM-wf, LM-rf
Citrus aurantium L.	/As-só/, /Nemárue/, /Tsina-ri/	Rutaceae	Medicinal	Fruits	HG	T-mf, T-wf, P-wf
Citrus limeta Risso	/NamawöBlona/	Rutaceae		Fruits	HG, SB	T-mf, T-wf, P-wf
Citrus limon (L.) Burm.f.	Limón	Rutaceae		Fruits	HG, SB	T-mf, T-wf, P-wf
Citrus medica L.	/As-sku-sku/	Rutaceae	Medicinal	Fruits	HG, SB	T-mf, T-wf, P-wf
Citrus reticulata Blanco	Mandarina	Rutaceae		Fruits	HG, SB	T-mf, T-wf, P-wf
Citrus sinensis (L.) Osbeck.	Naranja	Rutaceae		Fruits	HG, SB, PP	T-mf, T-wf, P-wf
Cocos nucifera L.	/Kúku/	Arecaceae		Fruits	HG	T-mf, T-wf
Coffea arabica L.	/Kapë/	Rubiaceae		Seeds	HG	T-wf, P-wf, P-rf
Colocasia esculenta (L.) Schott.	/Buë/	Araceae		Tubers	HG, SB, PP	T-mf, T-wf, P-wf
Cucurbita moschata Duch. Ex Poir.	Zapallo	Cucurbitaceae		Fruits	HG	T-mf, T-wf, P-wf
Cucurbita pepo L.	/Apí/, /Pís/	Cucurbitaceae		Fruits	HG, SB, PP	T-mf, T-wf, P-wf

APPENDIX. CONTINUED.

Botanical name	Vernacular name (1)	Family	Other uses	Plant part used for food	Source (2)	Life zone (3)
Cymbopogon citratus (DC) Stapf.	/Tó kri/, /Togli/	Poaceae	Medicinal	Leaves	HG	LM-rf
Dioscorea alata L.	/Salirba/	Dioscoreaceae		Tubers	HG	T-mf, T-wf, P wf, P-if, LM-rf
Dioscorea triflda L.f.	/Tú/, /Serí-dé-ua/	Dioscoreaceae		Tubers	HG	T-mf, T-wf, P wf, P-rf, LM-rf
Euterpe spp.	/K'si' Tebu'/	Arecaceae	Construction	Palm heart, shoots	Harvested	T-mf, T-wf P-wf, P-rf
Garcinia mangostana L.	Jobo	Clusiaceae		Fruits	HG	T-mf, T-wf
Heliconia mariae J.P.Hooker	/Ppó/	Heliconiaceae		Flower (stem heart)	Harvested	T-wf, P-wf, P-rf
Hoffmannia pallidiflora Standl.	/Dikö/	Rubiaceae		Leaves	Harvested	LM-rf, M-rf
Inga coclensis Pittier	/*Díl*, /*Butú*/	Mimosaceae	Construction	Seeds	HG, PP	T-mf, T-wf P-wf
Inga edulis Mart.	/Surrí/	Mimosaceae	Construction	Seeds	HG, PP	T-mf, T-wf
Ipomoea batatas (L.) Lam.	/Arabá/ /Baga Kewö/	Convulvulaceae		Tubers	HG, PP	T-mf, T-wf
Iriartea gigantea Wendl.	/Ktsküt/	Arecaceae	Construction	Stem hearts	Harvested	T-wf, P-wf
Lagenaria siceraria (Mol.) Standley	/Mé/, /Tula/	Cucurbitaceae	Craft	Fruits	HG	T-mf
Litchi chinensis Sonn.	Lichi	Sapindaceae		Fruits	HG	T-mf
Mammea americana L.	/Suhalwö/	Clusiaceae		Fruits	HG	T-mf
Mangifera indica L.	Mango	Anacardiaceae	Firehood	Fruits	HG	T-mf
Manihot esculenta Crantz.	/Arí/, /Skú/	Euphorbiaceae		Tubers	HG, PP, SB	T-mf, T-wf, P-wf
Manilkara zapota (L.) Van Royen	/Büko'/, /Ninhércri/	Sapotaceae	Medicinal	Fruits	HG, PP, SB	T-mf, T-wf, P-wf
Musa x paradisiaca L.	/Chimori/, /Chomó, /Salá/	Musaceae		Fruits. leaves	HG, PP, PM	T-mf, T-wf, P-wf
Oryza sativa L.	Arroz	Poaceae		Grains	SB	T-mf, T-wf
Pachira aquatica Aubl.	Castaña	Bombaceaea		Seeds	HG	T-mf, T-wf, P-wf
Passiflora vitifolia HBK	/Olméme/	Passifloraceae		Fruits	Harvested	T-mf, T-wf, P-wf, P-rf
Persea americana Mill.	/Amó/, /Homó/	Lauraceae		Fruits	HG	T-mf, T-wf
Phaseolus lunatus L.	/Kañí/, /Kedeba/	Fabaceae		Seeds	HG, SB	T-mf, T-wf
Phaseolus vulgaris L.	/Kaní/, /Kani-dororro/	Fabaceae		Seeds	HG, SB	T-mf, T-wf
Phytolacca rivinoides Kunth et Bouche	/Boro Kö/	Phytolaccaceae		Leaves	Harvested	T-wf, P-wf, P-rf
Piper nigrum L.	Pimienta	Piperaceae		Seeds	HG	T-mf, T-wf
Psidium friedrichsthalianum (Berg.) Nied.	/Kachorë/	Myrtaceae		Fruits	HG	T-mf, T-wf
Psidium guajava L.	/Sholí/, /Shori/	Myrtaceae		Fruits	HG, PP	T-mf, T-wf

APPENDIX. CONTINUED.

Botanical name	Vernacular name (1)	Family	Other uses	Plant part used for food	Source (2)	Life zone (3)
Renealmia alpine (Rottb.) Maas.	/Mowö/	Zingiberaceae		Fruits	Harvested	T-wf, P-wf, P-if
Renealmia aromatica (Aubl.) Griseb.	/Maawei/, /Maá/	Zingiberaceae		Fruits	Harvested	T-mf, T-wf, P-wf
Rollinia mucosa (Jaq.) Baill.	/Biribá/	Annonaceae		Fruits	HG	T-mf, T-wf
Saccharum officinarum L.	Caña	Poaceae		Stem	HG, PP	T-mf, T-wf P-wf
Sapindus saponaria L.	/Bilö/	Sapindaceae	Cosmetics (soap)	Leaves	HG	T-mf, T-wf, P-wf
Sechium edule (Jacq.) Sw.	/Se-uák/, /Pis/	Cucurbitaceae		Fruits	HG, SB, PP	T-mf, T-wf
Sechium tacaco (Pittier) C. Jeffrey	/Kúk/, /Churës Qui/	Cucurbitaceae		Seeds	Harvested	T-wf, P-wf, P-rf, LM-wf
Solanum topiro HBK	Naranjilla	Solanaceae		Fruits	HG	T-mf, T-wf P-wf
Solanum wendlandii Hook. f.	Flor de volcán	Solanaceae		Leaves, stem	Harvested	T-mf, T-wf, P-if
Spondias dulcis Forst. f.	Jocote	Anacardiaceae		Fruits	HG, PP	P-rf, LM-wf, LM-rf
Spondias monbin L.	/Bala'/	Anacardiaceae	Medicinal	Fruits	HG	T-mf
Syzygium jambos (L.) Alst.	Manzana	Myrtaceae		Fruits	HG, PP	T-mf, T-wf
Syzygium malacense (L.) Merr. et Perry	Manzana	Myrtaceae		Fruits	HG, PP	T-mf, T-wf P-wf
Theobroma angustifolia Sese et Moc.	/Soró/	Sterculiaceae	Ceremonial, Medicinal	Seeds	HG, Harvested	T-mf, T-wf P-wf
Theobroma bicolor Humb. et Bonpl.	/Sapálbó/, /SkaLöm/	Sterculiaceae	Ceremonial, Medicinal	Seeds	HG, Harvested	T-mf, T-wf P-wf
Theobroma cacao L.	/Sirú/, /Tsirú/, /Tsirö/, /Tsiru-kurú/	Sterculiaceae	Ceremonial, Medicinal	Seeds, wood	HG	T-mf, T-wf P-wf
Theobroma purpureum Pittier	/Lis-ub/, /Tinö/, /Wësöb/	Sterculiaceae	Ceremonial	Seeds	HG, Harvested	T-mf, T-wf
Theobroma simiarum Donn. Sm.	/Uir-úb/, /Wëröm/	Sterculiaceae	Ceremonial	Seeds	HG, Harvested	T-mf, T-wf
Urera baccifera (L.) Gaud.	/Sinálwö/	Urticaceae		Leaves	HG, Harvested	T-mf, T-wf, P-wf, P-rf
Xanthosoma sagittifolium (L.) Schott.	/Buë/, /Buëkö/, /Tü/	Araceae		Tubers	HG, SB, PP	*T-mf*
Xanthosoma violaceum Schott.	/Buë/, /Buëkö/, /Tü/	Araceae		Tubers	HG, SB, PP	*T-mf, T-wf*
Zea mays L.	/Ink/, /Kwö/, /Whú/	Poaceae		Seeds	SB	T-mf, T-wf P-wf
Zingiber officinale (Wild.) Roscoe	/Aiblo/, /Chewö/	Zingiberaceae	Medicinal	Roots	HG	T-mf, T-wf

(1) Bribri and Cabecar name, or Spanish name.

(2) HG = home garden; SB = rotating slash-bum; PP = plantain polyculture; PM = plantain monoculture; Harvested = harvested in the primary forest.

(3) T-mf = Tropical moist forest; T-wf = tropical wet forest; P-wf = Premontane wet forest; P-rf = Premontane rain forest; LM-wf = Lower Montane wet forest; LM-rf = Lower Montane rain forest; M-rf = Montane rain forest; SA-rp = Subalpine rain paramo.