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Chernela, Janet 2017. "Tukanoan Women and the Management of Intraspecific Diversity in *Manihot Esculenta* in the Northwest Amazon of Brazil." Ms. Provided for the exhibit, "Atura, Beiju, and Manioc," MUSA, Museu da Amazônia (the Museum of Amazônia), Manaus, Brazil.

Portions of the paper were published in:

Chernela 1986. Os Cultivares de Mandioca (Tukano). In SUMA: Etnológica Brasileira, Vol. I, Etnobiologia, ed. Berta Ribeiro. Rio de Janeiro. Pp 151-158.

Tukanoan Women and the Management of Intraspecific Diversity in *Manihot Esculenta* in the Northwest Amazon of Brazil

Janet Chernela,
University of Maryland
chernela@umd.edu

Abstract Tukanoan women farmers, with the highest number of subspecies of manioc (*Manihot esculenta*) reported, practice a strategem of intraspecific diversification. Women's multiple allegiances and ongoing contact with diverse localities serve as the dispersal routes through which manioc subspecies and knowledge about them pass throughout the river basin. Knowledge sharing and cultivar circulation can be traced to women's marital and kin networks. These findings demonstrate a wide distribution of manioc cultivars, propitiated by rules of exogamy, patrilineal descent, and patrilocal postmarital residence.

Introduction

Women horticulturalists among the Eastern Tukanoan indigenous populations of the Upper Rio Negro in the Brazilian Amazon place high value on intraspecific diversity in garden composition. Management practices that enhance diversity contrasts with the goals and techniques of conventional western agriculture in which a few utilizable traits are

selected. It is now recognized that reducing intraspecific diversity contributes to crop vulnerability.

The 1980 publication of Kerr, Clement, and da Silva Filho first drew the attention of researchers to the high numbers of manioc varieties cultivated by native Amazonian populations. In a survey of seven indigenous populations, the authors showed a mean of twenty-two cultivars of manioc per tribe (Kerr, Clement, and da Silva Filho 1980). The same paper lists forty types of manioc for the Desana alone. Boster later estimated over one hundred cultivars of non-toxic *M. aipi* type cultivated by the Aguaruna and Uambisa of Peru (1983:61). Carneiro (1983:81) lists fifty cultivars locally recognized by the Kuikuru of the Upper Xingu, six of which represent 96% of all manioc planted. Since those pioneering works, a number of studies of intraspecific diversity have been published (Emperaire et al. 2006, Katz 2010, Van Velthem 2012, Van Velthem and Emperaire 2016).

The findings presented here are part of a long term study of manioc cultivation among the Kotiria (alt. Wanano), one group of Eastern Tukanoan speakers who live along the Uaupés (alt. Vaupés River, a tributary of the Rio Negro in Brazil). An earlier publication by the author identified 137 named subspecies of manioc (*Manihot esculenta*), the highest number of the "bitter" or "toxic" type observed and reported to date (Chernela 1984, 1986). The mechanisms behind the maintenance of intraspecific variation have never been examined.

In this paper I consider the role played by Tukanoan women as managers of botanical material and genetic diversity, pointing to the accumulated knowledge of women farmers who consciously procure new varieties and introduce them to first-time users. The

paper draws a classic study I conducted in the reported histories of cultivar composition in two villages over fifty years.

Tukanoan women are opportunely situated as overseers of biological diversity for several reasons. Diversity in garden repertoires mirrors the social and linguistic diversity that characterizes the women in Tukanoan settlements. Women's first-hand knowledge of at least two different localities, often at a distance, provides them opportunities to observe and compare local variants, making them especially appropriate collectors and distributors of biological diversity and novelty.

As elsewhere in Amazonia, manioc is the staple food product in the Uaupés (also spelled Vaupés) basin, where it provides between 85 and 95% of daily caloric consumption. The fleshy tubers of the plant are prepared into a few essential food products that comprise the basis of the Tukanoan diet. These include a hard bread, dry flour, as well as number of sweet and fermented beverages. The bread and sweet beverage accompany all daily meals, while the fermented beer is the center of ceremonial consumption. Although processing the pulp into flour is an arduous and time-consuming task, roasting the flour preserves it indefinitely and furnishes a reliable source of ready and portable food. Surplus flour is one of the few produced household commodities sold for currency or traded for manufactured goods throughout the river basin.

Methodology

The findings reported here were observed in two riverine villages in the Brazilian, or southeastern, section of the Uaupés basin (and reported in Chernela 1986).¹ One of these, a Kotiria village, is located on the main stem of the Uaupés River at the Colombian-Brazilian border. The other, a Tukano village, is located along the Tiquié River -- an

affluent of the Uaupés, in Brazil. Garden plots were measured and mapped onto a numbered grid. Using a system of random numbers, five 100m² quadrants from each garden were selected for sampling. These were mapped and enclosed with cord. Individual plants in contact with the cordline along the perimeter of the quadrant in contact with the cordline, were registered by names provided by the gardener. Plants were counted and catalogued and annotated for indications of predation and disease. This method was accompanied by on site interviews with gardeners in order to determine the distinctive traits of each named cultivar class and the means by which the gardener acquired the cultivar.²

Samples of fifty-five varieties were deposited in Brazil's national germplasm bank, the National Center of Genetic Resources (Centro Nacional de Recursos Genéticos -- CENARGEN), for further study of genetic properties relating to immunological functions, nutrient absorption, toxicity, and other phytochemical features. An equal number of samples were deposited in the Brazilian Center for Agricultural Research (Empresa Brasileira de Pesquisas Agropecuarias, known by the acronym EMBRAPA), in Manaus, where they are undergoing experimental and observation for characteristics relating to productivity in diverse conditions.

Ethnographic Background: Women and Manioc

The Central Northwest Amazon consists of the drainage basin of the Uaupés river and adjacent areas in Colombia and Brazil. The region is occupied by approximately 20 intermarrying named, putative descent groups,⁴ each possessing a distinct, identifying language yet sharing a common culture. The result is a uniquely coherent culture complex, in which unilineal descent and cross-cousin marriage are major integrating structural

principles. In this broad regional network, marital and kin ties unite some 14,000 people⁵ of diverse languages over an area of approximately 11 million hectares.⁶

Three related sets of social rules and practices make the case of the Eastern Tukanoan speaking peoples of the Uaupés basin distinct in Amazonia: 1) a reckoning of descent through the male parent (patrilineality or agnation), thought to manifest in spoken language; 2) a rule of exogamy, according to which marriage is permitted only outside the descent group;⁷ and 3) a practice of post-marital residence (virilocality), in which wives most typically reside in the villages of their husbands.

In the lived experience of such norms, Tukanoans such as the Kotiria and Tukano recognize two groups of relatives: the *koro* for agnatically- (also patrilineally-) related kin and *phaña* (for in-laws). Relatives related through father are considered members of one's own group (*koro*), and considered 'kin.' This kind of relationship, where relatives are thought to be "like me," is based in common agnatic, inalienable heritage and *intrinsic* 'mutuality of being' (Sahlins 2013:20). Those related through mother are differentiated as "other than me" and referred to as *phaña*. The first type of relationship, based upon relatedness through the *koro* -- is based on sameness; the second -- *phaña* -- is based on difference. The distinction is reified in everyday speech and in ceremony.

One belongs to the *koro* of one's father and, ideally, lives in the village belonging to that *koro*. Through myths and oral histories, the *koro* are attached to locations along the river edge, and, ideally, will have villages at those sites. Members of a *koro* typically speak a common language and address one another as consanguineal kin; they may use a specific kin term or the broader, *y# korok#/ko*, meaning "my kinsman/kinswoman."

The koroa are linked to one another across generations through marriage. Such marriages with phaña over generations create alliances, reified through ceremonial discourse, ritual gift-giving, and the co-production of future generations (Århem 1981, Chernela 1993, 2001; Calbazar 1995, 2000; Hugh-Jones 2013). The category phaña does not preclude close, ongoing ties of solidarity and mutuality.

Women, Marriage, and Allegiances: Daughters in one village, wives and mothers in another

A local settlement is typically comprised of the males and the unmarried females of the koro, who form the 'agnatic core,' along with the in-marrying wives. Because of the combined rule requiring that one marry a person of a different descent group (koro) than one's own, with the customary practice of virilocality, a wife typically leaves her natal village to reside among the kinsmen of her husband. Therefore, in-marrying wives are members of different koroa than those of their husbands and children. Married women, then, are daughters in one village, while also wives and mothers in another.

Marriage is thus construed as '*external*,' permitted between, but not within, koroa. Thus, while the koro is the entity with which people identify, in practice it cannot exist alone. In this sense it may be likened to an electrically-charged ion. As no koro is able to reproduce itself, it is "incomplete;" it may never constitute a complete 'society' or an 'ethnicity.'" This is as true of the local descent group as it is of the named maximal descent groups, such as Desana, Barasana, Bará, Siriono, Tuyuka, Tukano, and Kotiria. As we will see, the 'incompleteness' of the koroa is at the core of Tukanoan social life.

Instead, the koroa are conceived by members as existing within a field of other similarly organized and 'incomplete' agnatic groupings whose members must find spouses

among others. From both egocentric and sociocentric viewpoints, then, the koroa of the Northwest Amazon form part of an extensive, intermarrying universe which accentuates, yet also, encompasses, difference.

Exogamy and marriage thus serve to knit the peoples of the Uaupés basin into a single, integrated network united by kin ties and marriage. In this interlaced web of social ties, extending over 11 million ha., women are the primary agents of articulation, linking descent groups at every level. In this context no single language group or settlement may be viewed as an isolate from either a social, demographic, or ecological viewpoint.

One of the ways in which women are extremely important is their role in linking different koroa and settlements across space. If this articulation has roots, they may be found in the practices of warfare and bride capture, as small-scale raiding for women typified Tukanoan history (Chernela 1993, 2001, 2008, 2011).

It is by way of the networks of women, who provide the social linkages between settlements, that manioc cultivars, and the knowledge about them, travel. Women, then, are the gardeners and repositories of botanical information.

The two villages of this study are unambiguously affiliated with two non-overlapping language linguistico-descent groups, the Kotiria and Tukano. The wives in these villages, however, represent six different language groups. In Village 1, where males and their descendants were members of the Kotiria language group, the eight in-marrying wives were members of five different language groups: Tukano (1), Desano (2), Cubeo (2), Tariano (3). A recently deceased wife had been Baniwa (Kuripaco). In village 2, where males and their descendents were members of the Tukano language group, the five in-

marrying wives were from three different language groups: Tuyuka (2), Desana (2), and Piratapua (1).

Agriculture

The Tukanoans practice a system of cultivation known as shifting, swidden, or slash-and-burn. Such systems are widespread in tropical areas and have been well described in the literature (Ruthenberg 1975). The Tukanoan system of agriculture is one of the most extensive, characterized by shifting of the cultivation plot so that the period of use is a fraction of the period of forest regeneration. In the slash phase, the forest is partially felled, with large trees and debris left in place. The fallen vegetation is burned shortly before the onset of the rainy season. (Uaupés farmers draw the ash and soil into mounds and insert manioc cuttings into the accumulated composition.) The burned matter provides a superficial lens of nutrients that wash into the soil with subsequent rains. Yields decline rapidly and the garden is returned to fallow after two harvests. The parcel is left to return to forest for at least 20 years.

When managed in several gardens of various stages of maturation, manioc is a highly reliable crop. A Uaupés farmer typically manages three or four plots simultaneously, including a newly-felled plot; a 1-2 year-old plot; and a 2-3 year-old plot.

Swidden plots are generally multi-cropped rather than monocropped with the various cultivars spatially intermixed. In addition to manioc, Tukanoan gardeners plant bananas (*Musa banana*), pineapple (*Ananus comosus*), yams (*Xanthosoma jacquinii*), sugar cane (*Saccharum officinarum*), urucu pigment (*Bixa orellana*), sweet potato (*Colocasia* spp.), numerous fruit trees such as pupunha (*Bactris gasipaes*), papaya (*Carica papaya*), inga (*Inga edulis*), as well as a wide range of medicinal plants.

Although manioc typically accounts for over 85% of all crops yield, the high number of intraspecific varieties justifies characterizing a field predominated by manioc cultivars as a polyculture. James Boster, for example, regards "a pure stand of Jivaroan manioc as a polycrop" (1983, p. 61).

Although *Manihot esculenta* has the capacity to reproduce sexually (Rodgers 1965), there is a low frequency of inflorescence and high frequency of deformed or sterile flowers (Harlan 1975, p. 143). Manioc cultivators seldom, if ever, use seeds as propagules. Indeed, Rodgers reports that he never observed a manioc seedling in a garden (1965). Given that vegetative reproduction is a generalized practice in manioc cultivation, cultivars are genetically stable.

Plants harvested from older gardens are replanted in newer ones. The farmer removes the leaves and branches and fragments the brittle stem into 15-20 cm. noded segments, creating six to eight daughter plants. The mother plant is thus divided into several physiologically independent, but genetically identical individuals. The new field is essentially a clone of the old: a continuation of the previous garden in a new location.

When compared to other Amazonian cultivators, Tukanoan land use patterns are comparable to those of the indigenous Machiguenga of Peru (Johnson 1983) and the Xinguan Kuikuru of Central Brazil (Carneiro 1983). Average garden size is 0.46 ha/person for Tukanoan gardeners as compared to 0.65 ha/person for Kuikuru (Carneiro 1983) and 0.33 ha/person for Machiguenga (Johnson 1983) (Table 1). However, as the next table shows, Tukanoan villagers harvested more manioc per day than the average Kuikuru cultivator. The average daily yield in weight of roots harvested ranges from 37 kilos per day for subsistence purposes to 280 kg per day for feast preparation (Table 2).

TABLE 1. AVERAGE SIZE OF GARDEN PLOT: KUIKURU, MACHIGUENGA, AND TUKANOAN COMPARED

Name	Average Size of Garden
Kuikuru (Carneiro 1983)	0.65 ha
Machiguenga (Johnson 1983)	0.33 ha
Tukanoan (Chernela)	0.46 ha

TABLE 2. AVERAGE DAILY MANIOC HARVEST: KUIKURU, AND TUKANOAN COMPARED

Kuikuru (Carneiro 1983:96)	15-30 kg/day
Tukanoan (Chernela)	37 kg/day

Taxonomy

Tukanoan plant taxa reveal perceived degrees of differentiation and relationship. The inclusive term, *dʰhkkʰ* corresponds to the English gloss "manioc," subsuming all sub-specific taxa. The distinctions between the 137 different categorical domains of cultivar types recognized by Tukanoan gardeners is based upon criteria such as number of leaf lobes, lobe shape, stem color, color of young foliage, color of petiole, branching of plant, surface and flesh of root (Chernela 1985). Even so, the relationship between such observable morphological features and genetic variation is difficult to establish without experimental evidence.

Women and Diversity

The most powerful predictor of the vectors of cultivar distribution are the village linkages created by marriage and kinship. Because they continue to maintain contact with their natal families, despite great distances, women horticulturalists link numerous villages,

establishing a broad network across which manioc cultivars are identified, exchanged, and transported.

Women's multiple allegiances and ongoing contact with diverse locales serve as the dispersal routes through which manioc subspecies and knowledge about them pass throughout the river basin. While a woman moves to her husband's village upon marriage, she maintains ties to her parents, brothers and unmarried sisters, who remain in the village of her childhood. She may also maintain ties to her adult sisters who have married into the villages of their husbands. A woman thus maintains contact with numerous and often widely dispersed locations in the river basin. Her ties may even extend outside the basin to families of migrant Tukano. It is through these networks that cultivars are transported.

Gardeners actively seek new cultivars in their travels. Visits to relatives are frequently long, ranging from several weeks to several months in length. The visiting farmer has ample time to observe the gardens of her hosts. She assists her relatives in garden work and thereby observes the full range of her hosts' manioc inventory. Diverse cultivars, their cooking qualities, and growth performance are a frequent topic of inquiry and conversation.

She may request cuttings to take to her own garden, or be offered them by her hosting kin. On return to her husband's village, these will be distributed among her fellow wives and in-laws. The recipient of such a gift is bound by rules of etiquette to reciprocate when she encounters unknown variants in her own travels. Moreover, if the donor is in has suffered loss due to inability to work because of illness or absence, poor burn, garden loss due to predation or flooding, the recipient is expected to return a portion of the received type to her.

Marriage alliances, therefore, form the connecting routes through which manioc subvarieties and information about them are transmitted. These findings demonstrate a wide distribution of manioc cultivars, propitiated by rules and practices of exogamy, descent, and patrilocal postmarital residence.

Paths of Cultivar Exchange

By means of interviews, manioc acquisitions in two villages, Yapima (Site 1) and Barreira (Site 2), were registered over a fifty year period. By identifying landmarks whose establishment dates were known, we selected datum points for each village: 1935 for village 1 and 1945 for village 2.

For purposes of this study, the gardens received from a woman's husband's mother upon marriage were considered to be her base-line garden. Phrasing questions in terms of these datum points, farmers were asked the origin of each cultivar observed, including originating village and relation of donor to recipient. Cultivars present before these dates were considered local, while subspecies introduced after these dates were regarded as imports. With some exceptions (described below) women were able to recall the sources of new manioc acquired by them since the baseline garden.

The study showed that manioc cultivars derive from a wide field. Site 1, the Kotiria village Yapima, located on the middle Uaupés River, possessed a population of 77 inhabitants. Of the 59 subspecies in use in Yapima, 19 had been in the village at least since 1935 and 40 introduced since that date. The 40 cultivars introduced into site 1 originated in 19 different locations. Distances from source site to Yapima ranged from 16 km to 465 km, with a mean distance of 122 km.

Site 2, the Tukano village Barreira, located on the Tiquié affluent of the Uaupés, contained thirty-four residents. In spite of its smaller size, 75 cultivars were found in use in village 2 as compared to 59 in the larger village 1. Of the 75 cultivars in use in village 2, 24 were present in 1945, and 51 introduced since that time. Of the 48 cultivars introduced, forty-three could be dated and provenienced. These derived from 14 locations situated at distances ranging from 8 to 685 km, with a mean of 316 km.

Tables 3. Origin of cultivars introduced into Village 1, Yapima [distance in km]

Ig. Abiu	85
Acaricuara	241
Aracapa	110
Ig. Arara (Miraflores)	465
Bacaba	25
Cuiubi	30
Dom Bosco	101
Ig. Mutum (R. Aiar	140
Iauarete	102
Jacare (R. Aiari)	16*
Juquira	135
Matapi	19
Mirapireira	60
Miriti Cach (R. Querari)	138
Piracema (R. Querari)	135
Sao Gabriel	430
Taraqua	22
Tiririca	18
Villa Fatima	45
Mean	121.9 km

Origin of introduced cultivars in Village 2, Barreira [distance in km]

Local of origin

Uirarara	410
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Sta. Luzia	425 (75*)
Ig. Cabaris	105
Ig Turi	480 (55*)
Cunuri	390
Boca Castanha	8
Cabaris	115
Pari Cachoeira	70
Tapurucuara	685
Santana	405
Castanha	32
Umari	415
Pacu	435
Sao Paulo	460

Mean 316 km

(*) A forest trail; all other distances refer to km by river

Networks of Cultivar Transfer and Kinship Ties

Routes between wives' premarital and post-marital residences were the most powerful predictors of the dissemination of manioc subspecies throughout the basin. With the exception of only three cases, all introduced cultivars were obtained by a married woman while visiting kin. The most prevalent pattern of introduction involved the agency of mother-to-da or sister-to-sister. This narrow field of relations accounted for 60% of cultivar transfers recorded in village 1 and 72% in village 2 (see Table 3).

The three exceptions deserve explanation. In one case, a couple migrating outside the region returned with a reputedly fast-growing variety that they obtained in the gardens of nonIndians. The network of manioc importation thus extends beyond the boundaries of concentrated Tukanoan settlement to peripheries where non-Tukanoan populations are tapped.

Fifty-year History of Cultivars in 2 Villages

In the Kotiria village Yapima, 19 of the 59 subspecies found had been in use in the village since at least 1935. Of the 40 introduced since 1935, 9 had been introduced between 1935 and 1960, and 31 since 1960.

In the Tukano village Barreira, 24 of the 75 cultivars found had been in use in the village since 1945. Of the 51 introduced varieties, forty-three could be dated. Fifteen had been introduced between 1945 and 1960 and 28 since 1960.

In spite of the differences in numbers of cultivars in the two villages, the relative retention of cultivars over time is surprisingly similar. In both cases, local cultivars (those present before the datum points) constituted about a third of the cultivars in use at the time of the study. Of the remaining two-thirds introduced since the datum points, a suggestive pattern emerged. The most recently introduced cultivars, defined as those introduced after 1960, constituted the highest portion of cultivars in both the villages. 53% of all cultivars in use in village 1 had been introduced since 1960, and 37% in village 2 over the same time period. In other words, local diversity remained at a relatively stable 30%, whereas recently introduced cultivars dominated older introductions by 2-3 times.

In other words, the number of introduced cultivars exceeded the baseline cultivars by between two (village 2) and three times (village 1). These data suggest that the most recently introduced cultivars undergo a period of observation and experimentation.

Field Composition and Selection of Cultivars

Although garden sizes vary, new gardens tend to be similar to their forerunners in terms of numbers of individual plants and land in cultivation. Two countervailing mechanisms prevail in Tukanoan garden management. The first of these is the constant

introduction of new cultivars for propagation and diversity enhancement. The introduction of exotic cultivars is counterbalanced by the elimination of a portion of these. We may reasonably assume that cultivars that continue to be in use are the result of two kinds of selective processes: 1) natural selection, including predation, disease, and decay; and 2) "artificial" selection. These processes would reduce the number and frequency of the older varieties.

Given that each individual stem can produce as many clones as it has nodal segments, each sequential garden has the potential of producing infinitely multiple yields with an identical range of intraspecies diversity. Instead, however, natural and artificial selection determine the composition of each succeeding garden. With each new garden, the cultivator remakes the composition of her cultivars, abandoning some plants and propagating others.

Harvesting takes place daily. A farmer harvests only those she needs for that day's meals. As she harvests, she selects the plants which will be replanted and discards others. A farmer may eliminate poorly performing cultivars from future gardens by simply not replanting them. Conversely, if she values a particular variety, she can very easily retain or increase it by cutting the stems into numerous small cuttings, each of which will mature into a new plant.

A gardener's selection decisions are based upon several criteria, including rate of growth and size of yield, resistance to disease and predation, and a number of culinary and preparatory criteria, including ease of peeling, required cooking time, and taste preferences. Cultivars reported to have been cultivated since 1935 had the most reliable yields.

When a cultivar is lost, a farmer may call upon her outstanding "debtors" from among her fellow village wives or far-flung relatives. and request replacements. Generally, she is assured a supply since many women in the village will have the same cultivars and each farmer retains outstanding debts in manioc. Since a single plant gives multiple offspring a farmer can rapidly recuperate a lost cultivar.

Risks and Toxicity

Manioc subspecies were examined in the field for signs of predation and disease. Tukanoan farmers reported crop failures range from 1) minimal loss of individual plants, 2) total loss of a single subspecies, 3) loss of more than one subspecies, 4) total field failure. According to these accounts, the principal cause of loss is predation. Common animal predators included the leaf-cutter ant *Atta sexdens* (leaves), caterpillars (leaves), rodents (roots), ungulates such as deer (leaves) and tapirs (leaves), with damage from ants being the most extensive and persistent. On occasion, leaf cutter ants can destroy an entire garden. The least toxic varieties suffer the greatest predation. Indeed, predation in this portion of the Upper Rio Negro was so severe that it was impossible to grow non-toxic cultivars.

Farmers also graded toxicity levels. The least toxic varieties, which require far less cooking time, were continually predated upon and often depleted altogether. Although these sweet varieties (*M. aipi*) were often lost, they were frequently reintroduced because of the ease in preparation. Sweet cultivars were usually obtained from missionaries, whose own wide networks contributed to the Tukanoans.

Subvarieties with higher toxicity levels demonstrated greater resilience, probably due to pest resistance. It should be noted, too, that some of the most poisonous are also valued for their culinary values. The acidic taste is cultivated in flours of different types.

The dangers of toxicity are not idle concerns or remote legend. During my stay among the Kotiria, two men died when they dipped their gourds into the cooking manioc liquid and drank it down before the prussic acid had completely evaporated.

Discussion and Conclusions

There is renewed interest among researchers in botany, agronomy, and genetics to recover intraspecific variation, much of which has been lost through modern agricultural practices. Currently, in Brazil, hundreds of germplasm banks exist that aim to preserve variations in botanical traits that could be lost through generations of plant selection. Because they maintain diversity, Indigenous peoples are recognized as important sources for these collections.

These data suggest, too, directions for future research in the area of conservation of intraspecific diversity of one culture -- *Manihot esculenta* (manioc) -- domesticated by native Americans and which today represents one of the principal food sources in the world. Manioc is an example of a plant whose rich genetic diversity has been controlled and preserved by indigenous horticulturalists over (thousands of) generations of experimentation. This study reviews the ways that one group of indigenous farmers, women of the Eastern Tukanoan societies of the Uaupés basin, are a significant source of

biodiversity knowledge and practice. These farmers value and seek heterogeneity rather than homogeneity, thereby increasing and enriching genetic variation.

The data presented here indicate the frequency and extent of the transport of cultivars through a river basin of more than 11 million hectares. From the two study villages, data showed that manioc cultivars circulated throughout an unexpectedly vast area: over twenty locations in the river basin, at distances up to 316 ks (Chernela 1986).

The study also found that manioc cultivars followed networks of matrimonial alliance and kinship. Because women move great distances on marriage to the villages of their husbands, but continue to maintain contact with their natal families, female horticulturalists link numerous villages, establishing a network across which manioc cultivars are identified, exchanged, and transported. As women weave together distinct descent units and settlements, so too married women create the connecting routes through which manioc subvarieties and information about them are transmitted. These findings demonstrate a wide distribution of manioc cultivars, propitiated by rules of exogamy, patrilineal descent, and patrilocal postmarital residence.

Women are the ties that bind villages to one another. Minimally a woman will maintain ties to her village of birth, in which parents and brothers reside, and that of her husband and children. Her stakes in the future are widely and the widely dispersed throughout the basin.

A study of the management of diversity by native Amerindian women farmers is an important and neglected research direction. The data presented here illustrate the role of women in the far-reaching distribution of cultivars across a river basin following routes of women's residence and visiting patterns.

Yet little attention has been paid to the role of women as primary repositories of knowledge of genetic diversity. Their observation of and experimentation with interspecific and intraspecific biodiversity has enhanced and maintained genetic variation over millennia. The indigenous model values -- and seeks -- heterogeneity instead of homogeneity.

Acknowledgments

This paper was originally written for the exhibit, "Atura, Beiju, and Manioc," MUSA, Museu da Amazônia (the Museum of Amazônia), Manaus, Brazil. Portions of this paper were published in Chernela 1986.

Notes

1. Data in these villages were collected between 1978 and 1981 and reported in Chernela 1986.
2. The name of this river appears as Vaupés in Spanish spellings and Uaupés in Luso-Brazilian spellings.
3. The number of groups varies according to definition of area -- each possessing a distinct, identifying language yet sharing a common culture.
4. The figure of 14,000 is based upon the 1987 reported census figure of 14,164, compiled by the Centro Ecumenico de Documentação e Informação (CEDI), Museu Nacional, Rio de Janeiro. It exceeds by 5,000, the estimates of Sorensen (1967) and Jackson (1976).
5. The figure of 150,000 square kilometers is the sum of 90,000 km² reported by Jackson (1976) for the Colombian Vaupés, and 60,070 km² reported by the Centro Ecumenico de Documentação e Informação (CEDI), Museu Nacional, Rio de Janeiro, for the Brazilian Uaupés.
7. The Cubeo (Goldman 1963), Makuna (Arhem 1981, 1989), and Arapaço (Chernela 1988, 1989) are exceptions to the pattern of linguistic exogamy.
8. It was not possible to determine the exact date for each of the cultivars.

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