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Source: Journal of Ethnobiology, 26(1) : 107-125

Published By: Society of Ethnobiology

URL: https://doi.org/10.2993/0278-0771(2006)26[107:AEIOTI]2.0.CO;2

Journal of Ethnobiology 26(1): 107–125 Spring/Summer 2006

AN ETHNOBOTANICAL INVESTIGATION OF TREE IDENTIFICATION BY THE AGUARUNA JÍVARO OF THE PERUVIAN AMAZON

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ABSTRACT.—A year-long ethnobotanical study was carried out in several indigenous communities on the Nieva River, in the Peruvian Amazon, to determine how the Aguaruna Jívaro identify trees of their local environment. Eight key informants provided freelists of tree names and in follow-up interviews explained how they identify 63 of the named trees chosen for detailed study. Voucher specimens were collected for the 63 taxa. This study made use of the Aguaruna concept of ***kumpají***, glossed as companion, which denotes species thought to be morphologically similar but not subsumed under a shared name. Questions designed to elicit identification methods included asking what distinguishes each tree from other trees informants consider to be its companions. Results indicate that the Aguaruna rely on both sensory and ecological clues to identify trees. Sensory clues appear to play a greater role than ecological ones.

Key words: identification, ethnobiology, Aguaruna, covert categories, Amazonian flora.

RESUMEN.—Se realizó una investigación etnobotánica a lo largo de un año en comunidades indígenas del río Nieva, en la Amazonía Peruana, con el objetivo de descubrir cómo identifican los Jívaros Aguaruna los árboles de su medio ambiente local. Ocho colaboradores principales proporcionaron listas de asociación libre de los árboles. Se escogieron sesenta y tres árboles de las listas para hacer entrevistas detalladas sobre el proceso de identificación. Este estudio también utilizó el concepto Aguaruna ***kumpají***, que significa compañero, que indica especies consideradas similares morfológicamente, aunque no tienen nombres relacionados. Entre las preguntas realizadas para conocer los métodos de identificación se incluyeron algunas para saber en qué se distingue cada árbol de los otros árboles considerados como ''compañeros''. Los resultados indican que los Aguaruna utilizan tanto indicios morfológicos como ecológicos para identificar los árboles. Al parecer, los indicios morfológicos juegan un papel más importante que los ecológicos.

RÉSUMÉ.—Une recherche en ethnobotanique a été effectuée pendant une année parmi plusieurs communautés indigènes de la rivière Nieva de l'Amazonie péruvienne. L'objectif était de découvrir la façon dont les Aguaruna de la famille Jívaro identifient les arbres de leur environnement immédiat. Huit collaborateurs principaux ont d'abord fourni des listes indépendantes de noms d'arbres. Puis, à la suite d'interviews ultérieures, ils ont expliqué comment ils en arrivaient à indentifier les 63 arbres choisis parmi les listes. Des spécimens d'herbier ont été montés pour l'ensemble des 63 taxons. Cette étude a aussi utilisé le concept aguaruna de ***kumpají***, que signifie compagnon. Ce concept désigne des espèces considérées semblables du point de vue morphologique, bien qu'elles ne soient pas groupées sous un même nom. Parmi les questions conçues pour obtenir des informateurs leurs méthodes d'identification, l'une d'elles cherche à vérifier ce qui distingue chaque arbre des autres arbres malgré qu'ils soient vus comme compagnons. Les résultats indiquent que les Aguaruna utilisent des critères morphologiques et écologiques pour identifier les arbres. Les critères morphologiques jouent toutefois un rôle plus grand que ceux tirés de l'écologie.

INTRODUCTION

Anecdotal evidence suggests that many indigenous groups of the Amazon basin can identify tree species simply by observing the visual, olfactory and gustatory characteristics of the trunk and bark (see Berlin 1992:7; Davis 1996:453; Gentry 1993:4). This stands in contrast to the identification methods outlined in Western taxonomic keys that rely heavily on floral, fruit, and leaf characters to make tree identifications. A notable exception to standard scientific floral key production is seen in the work of the late Alwyn Gentry, one of the foremost neotropical botanists of recent years. He has even commented specifically on the difficulty of identifying neotropical plants by flower or fruit characters, since there is a high degree of morphological convergence of these structures (Gentry 1993:3). In his classic work, *A Field Guide to the Families and Genera of Woody Plants of Northwest South America*, Gentry presents a key to the woody flora of the Amazon based mostly on characters of the trunk, bark and leaves. Gentry's key represents a pioneering approach to identifying woody flora of the Amazon, emphasizing sterile characters that appear to share something in common with indigenous methods of botanical identification.

A few studies have touched on the subject of how indigenous peoples of the Amazon identify woody flora. In his classic paper ''The Knowledge and the Use of Rain Forest Trees by the Kuikuru Indians of Central Brazil,'' Carneiro (1978) describes several different methodologies for eliciting tree identifications from his informants. López Zent (1999) has briefly noted the steps that the Hoti of Venezuela go through when identifying woody flora. Typically, the Hoti first examine the outer trunk and bark. If that is not sufficient to make an identification, they cut the bark in order to smell it, to look for latex, and to observe the appearance of the inner wood. If those last steps still yield no identification, they observe fruit or flowers, if present, and look for dried leaves on the ground. López Zent (1999) also provides examples of sets of contrasting morphological and habitat characters for a few trees in the same Hoti folk genus.

In 1974, Berlin, Breedlove and Raven (1974:153) identified what they believed were the three most basic questions of cognitive ethnobotanical research. These are: what groups of plants do people recognize?; how are these groups organized hierarchically into taxonomies?; and how are individual plants recognized and identified? They noted that, of these three major concerns, identification remained largely unstudied. With a few exceptions (Carneiro 1978; Ellen 1993; López Zent 1999), this remains true to this day. Roy Ellen (1993) has discussed theoretical aspects of identifying living organisms, arguing that there are two major processes involved. The primary process is based on cognitive prototypes; people perceive the gestalt of an organism. This is supplemented by individual distinctive features that are used to confirm the original identification or for difficult cases. Ellen also believes, however, that informants will often be able to consciously analyze their general impression according to some of the discrete sensory impressions that make it up.

Some authors have discussed identification in the context of children's ethnobotanical knowledge. Dougherty (1979), for example, investigated how children in Berkeley, California, form a hierarchical system through contrast and inclusion based on morphological features. Stross (1973) found that when Tzeltal Maya children mistakenly identify one folk genus with another, this usually corresponds to a covert recognition by adults that the two folk genera in question are morphologically similar. Both examples underscore the importance of morphological clues in identification.

Other research has investigated the related question of how people identify plants with particular kinds of medicinal properties from the many species growing in their local environment. For the Peruvian Amazon, Glenn Shepard (2002) reports that the Matsigenka make use of taste, smell, and irritation to recognize medicinal plants, whereas the Yora mainly rely on smell, visual and tactile clues. Lisa Gollin (2004) has investigated the sensory clues, particularly taste, smell and tactile ones, that allow Kenyah Leppò Ke of Borneo to recognize medicinal plants.

BACKGROUND

I conducted research on Aguaruna Jívaro plant identification from January to December, 2004. The study focused on how people identify members of the life form category ***númi***, which can be glossed as 'trees excluding palms' (Berlin 1992:173). The work involved five Aguaruna communities of the Peruvian department of Amazonas (Bajo Cachiaco, Kayamas, Tayunts, Alto Pagki and Atash Shinukbau), on the upper Nieva River (see Figures 1 and 2). The study communities are located in the eastern foothills of the Andes, at elevations of approximately 250 m to 500 m above sea level. In the Holdridge scheme of life zone classification (Holdridge 1967), these communities and the land adjacent to them correspond to tropical wet forest and premontane tropical rainforest (Atlas 2004:42–43). The study focused on the basic question: What are the clues that allow the Aguaruna to recognize and identify tropical forest trees?

Trees play a number of important roles for the Aguaruna. Many of the trees included in this study have cultural uses. A few of these, including ***tsáik*** (*Cedrelinga cateniformis* Ducke) and ***séetug*** (*Cedrela odorata* L.), are valued timber species that are selectively logged in the study communities for local use or sale to outside buyers. Some, including ***ugkuyá*** (*Tachigali formicarum* Harms), are used locally for posts in house construction. Others, including ***samíknum*** (various Fabaceae), are valued for firewood. A number of the trees included in this study also have medicinal properties. For example, the bark of ***yantsáu*** (various *Guarea* species) is valued as a remedy for gastrointestinal parasites. The Aguaruna also value trees with fruits eaten by local mammal and bird species, especially, those

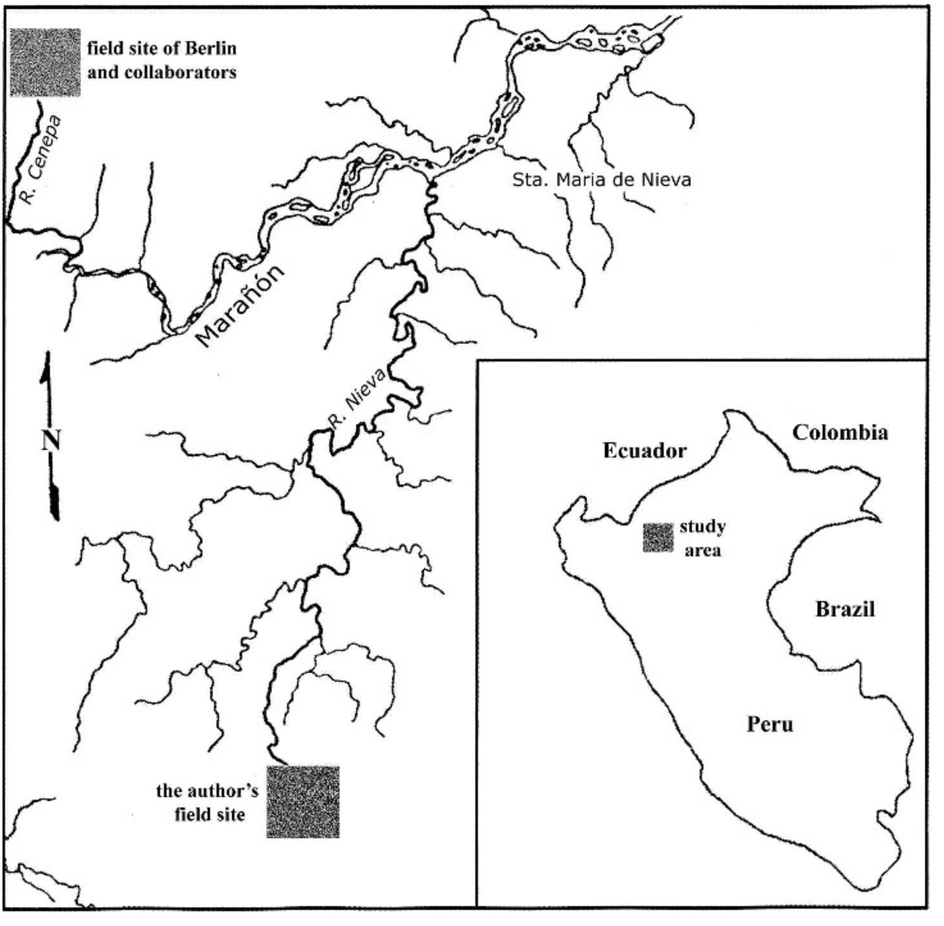

FIGURE 1.—The study area for this research. Adapted from Berlin and Markell 1977.

that are significant food sources for important game animals. ***Antumú chinchák*** (various Melastomataceae) is one tree considered to be a significant food source for many local bird species. Finally, some trees have spiritual significance for the Aguaruna. According to one story, the tree ***wantsún*** (various *Tachigali* species) first conjured human beings into existence. Since the wood of ***wantsún*** tends to rot quickly when the tree is cut, the Aguaruna consider it to have an ephemeral nature. When human beings were created from ***wantsún***'s magic, they took on the same ephemeral nature and thus, have finite life spans (Chumap Lucía and García-Rendueles 1979).

A detailed treatment of Aguaruna uses for local tree species is beyond the scope of this article. The subject of utility is, in fact, quite independent of the present discussion of how identification occurs. A classic and ongoing debate within the field of ethnobiology relates to the relative strengths of intellectualist and utilitarian explanations of folk classificatory systems (e.g., Anderson 2000; Berlin 1992; Hunn 1982; Posey 1984). On this matter, however, identification should be less controversial than classification. Clearly, one must recognize

FIGURE 2.—Jempentsa Mujaji, a mountain near the study community of Pagki.

a plant before one can use it. The motive for identifying a tree might be utilitarian, but the actual process of identification should not be influenced by utilitarian concerns. This is still true even when a person uses a plant without being able to name it. For example, an Aguaruna man who fells an unknown tree and discovers that it is very hard, might decide to use the tree as a post for house construction. In this case, recognition of usefulness still relies on the prior recognition of a physical property. Nor will the act of using the tree provide the man with any additional information that could enable him to make a more precise identification.

As the taxonomist Tod Stuessy notes (1990:10), the process of identifying individuals and the process of constructing a biological taxonomy are logically closely related. In an important sense, making an identification is the reverse of constructing a taxonomic hierarchy, since the former involves distinguishing an organism from all others based on a unique set of characters, while the latter requires grouping of organisms based on similarities. Berlin (1992) has suggested that it should be possible to discover discrete observable characters that allow informants to assign one name rather than another to a plant. Based on his work with the Itzaj Maya, Scott Atran (1999) has proposed that members of small-scale societies tend to use both ecological and morphological criteria for determining relationships between two organisms or for predicting which properties they are expected to share. Following Berlin's (1974, 1992) and Atran's (1999) proposals, the hypothesis evaluated here is that the process of tree identification among indigenous peoples involves both sensory and ecological reasoning, at least part of which can be verbalized by informants in terms of discrete clues. Sensory reasoning here refers to visual, tactile, olfactory or gustatory clues. Ecological reasoning here refers to clues related to plant communities, plant-animal interactions, hydrological features (e.g. proximity to a river drainage), soil types, and topographical features.

Berlin et al. (1974:155) argue that folk specific taxa within the same folk genus should be easily differentiated by ''a few obvious morphological features.'' It follows that one means of understanding indigenous methods of tree identification would be to ask informants to contrast particular trees with other trees in the same folk genus. However, approximately 82% of Aguaruna folk genera are monotypic (Berlin 1976:389), so this method would have limited utility for the majority of tree taxa recognized by the Aguaruna.

The Aguaruna concept of ***kumpají***[1] 'its companion' denotes organisms thought to be morphologically similar but not necessarily subsumed under a common linguistic label (e.g., 'it looks like a tuliptree', 'it is similar in appearance to a hemlock'). An Aguaruna example of ***kumpají*** are the three trees ***shijíg*** (*Hevea* spp., Euphorbiaceae), ***tákae*** (*Brosimum* spp., Moraceae) and ***barát*** (*Ecclinusa lanceolata* (Mart. & Eichler) Pierre, Sapotaceae), which are grouped together because they all have white latex, although it is not obvious just from looking at the names that they are related in the folk taxonomy. All the members of a particular polytypic folk genus are automatically considered companions to each other, but the term also allows for the grouping of two or more folk genera into covert categories.

The Aguaruna word ***kumpají*** is derived from the similar Spanish word *compañero*, meaning friend or companion. The Aguaruna also employ another term, ***patají***, meaning 'its family member', synonymously with ***kumpají***. There is no evidence to suggest that the word ***patají*** is borrowed from another language. Although ***kumpají*** is currently the more widely used term, the existence of the synonym ***patají*** strongly suggests that the concept itself is not borrowed.

This research uses the ***kumpají*** concept to further explore the morphological and ecological clues that allow the Aguaruna to identify trees. I have assumed that asking informants to compare and contrast trees that they consider to be companions will help distinguish the characters that allow them to recognize broad membership in groups of related trees and to make finer distinctions between the members of each group.

METHODS

Key informants for this study were selected in a purposive fashion based on expertise in the folk biological domain ***númi*** (trees excluding palms). Freelists of ***númi*** were collected from 23 potential key informants in the five study communities. While collecting each freelist, I also asked informants what other trees, if any, are the ***kumpají*** of each tree named. This allowed me to corroborate the covert groupings collected by Berlin (1976) and to clarify the degree of agreement between informants about which trees are grouped together as companions. Eight of the original 23 informants were selected as key informants based on length of freelist, the recommendation of my Aguaruna field assistants and willingness to participate further in the study.

There was not enough time to study the identification process for all named Aguaruna tree taxa (well over 300 folk genera). Therefore, I chose a representative sample of some of the most widely recognized folk genera, large enough to illustrate the variety of clues and methods the Aguaruna use in making identifications. The 63 folk genera in this study span 48 biological genera in 17 plant families, which is clearly only a small portion of the biological diversity in the area. They were selected in a purposive fashion appropriate for evaluating the hypothesis that Aguaruna use both sensory and ecological characters to identify trees. My approach is summarized as follows: 1) informants were requested to list features that allow them to recognize each tree, and 2) informants were requested to group ***kumpají*** (i.e., related) trees and compare and contrast the members of each group. Implicit in the second question is that the sample includes groups of related trees. Forty-nine of the 63 study trees comprised 17 widely recognized groupings. The remaining 14 represent folk genera widely considered to be unrelated to any other folk genus.

For each of the 63 study trees, I first asked each of the eight key informants ***Wajúk dékame ju̲ numísh*?** 'How do you recognize this tree?'. Typically, they would answer by describing specific parts or ecological features of the tree in question. For example, an informant might answer: ***Dékajai numíji pushújin, saepé̲ kagkígkiju, puwáji púju asámta̲i*** 'I recognize it by its grayish trunk, rough bark and white sap', or ***Wáinjai mujánum tsapáu asámta̲i*** 'I know it because it grows in the mountains'.

The second set of questions was designed to elicit the reasoning that grouped folk taxa as ***kumpají***. I tried to elicit how the members of each group are similar to each other, and how they are different. To give an example using the two related trees ***úchi dáum*** (*Couma macrocarpa* Barb. Rodr.) and ***úchi táuch*** (*Lacmellea oblongata* Markgr.), the questions would be: ***Wágka betékaita úchi dáum úchi táuchjai?*** 'How are ***úchi dáum*** and ***úchi táuch*** similar?' and ***Wágka betékchau-waita úchi dáum úchi táuchjai?*** 'How are ***úchi dáum*** and ***úchi táuch*** different?' In this case, informants might describe the similarities by saying: ***Úchi táuch úchi dáumjai betékai maí puwáji púju, néje̲ nenéntuch asámtai*** '***Úchi táuch*** and ***úchi dáum*** are similar because they both have white sap and round fruit'. Informants might describe the differences by saying: ***Úchi tauchá dúke̲ wíjuch esájmauch, néje̲ pípich, tújash, úchi daumá dúke̲ tentéch, néje̲ imá múun*** '***Úchi táuch*** has long thin leaves and small fruit, while ***úchi dáum*** has oval leaves and larger fruit'. Generally, informants answered such questions by describing particular tree parts or ecological features. Since not all trees were considered to have companions, and not all informants recognized exactly the same groupings, there were a total of 173 groups of ***kumpají*** among the eight informants.

I included isolated folk genera in the sample in order to widen the botanical range of trees covered in the study, since trees considered to be related by the Aguaruna are often also closely related under western taxonomy. For isolated genera, informants could answer the first question, how they recognize a type, without being able to explain why they do not belong to a ***kumpají*** group.

The questions described above are designed to elicit informants' idealized mental images of the study trees and did not rely on observing actual examples of the trees in question. This approach has several theoretical and practical advantages. First, it encourages informants to focus only on the features that are essential for inclusion in the category in question. Noticeable variation can be found among individuals of the same biological species. Most Aguaruna tree names encompass multiple biological species, making the potential physical variation even greater. When informants describe an idealized image of a tree, they will not be distracted by trivial individual variation. Observing actual identifications of the 63 study trees in the field would be quite impractical, since it would require selecting individuals of all of these trees and then, showing the same trees independently to each of the eight key informants.[2] Over the course of my research, I did observe living examples of the study trees, in order to verify my understanding of the adjectives used to describe the trees and for making botanical collections.

Collections of the study trees were made in the vicinity of the five participating communities.[3] I attempted to confirm the Aguaruna name for each tree collected with more than one informant, although this was not always possible, since some trees were only found in one location. Due to the occasional difficulty in locating fertile material, I was unable to collect three of the study trees. Also, at the time of this writing, some of my specimens have not yet been fully determined. For this reason, I have used specimens collected by Brent Berlin and his collaborators[4] near Aguaruna communities on the Cenepa river, along with my own data, for determining which scientific names correspond to each Aguaruna name.

RESULTS AND DISCUSSION

Table 1 shows the botanical range for all Aguaruna trees included in this study. I have arranged the Aguaruna tree names to show which ones informants grouped together as companions and which were considered to have no companions. The tree names listed in Table 1 that are comprised of two words correspond to polytypic folk genera. For example, Table 1 shows that group 3 contains the trees ***wáwa kúnchai*** (*Dacryodes kukachkana*) and ***ú̲juts*** (*Dacryodes* sp.). The folk genus ***kunchái*** is polytypic, since many informants also recognize the existence of three other folk species, ***númi kúnchai*** (*Dacryodes peruviana* (Loesn.) Lam.), ***tsáju kúnchai*** (*Dacryodes nitens* Cuatrec.) and ***múun kúnchai*** (*Dacryodes kukachkana*). In cases such as this, I chose only one species from each folk genus for my study sample, in order to include a wider range of biological diversity. Much cross-cultural evidence supports the idea that members of a polytypic folk genus often correspond to botanically related species (see for example Berlin 1992: 102–133).

Many of the folk taxa listed in Table 1 correspond to more than one botanical species, within a single genus. Some Aguaruna names correspond to species in more than one genus of the same botanical family, while one Aguaruna name, ***pítuuk***, corresponds to species in two different families, specifically, *Perebea xanthochyma* H. Karst. and *Trophis racemosa* (L.) Urb., in the Moraceae and *Agonandra silvatica* Ducke in the Opiliaceae. In some cases, the botanical ranges for Aguaruna names overlap. For example, in group 17, the names ***awánu*** and ***séetug*** both refer to the species *Cedrela odorata* L. Although this would appear to

TABLE 1.—Aguaruna names and corresponding scientific names for members of the ***kumpají*** groups and isolated folk genera in the study.

Aguaruna name	Latin binomial	Family	Voucher[1]
Kumpají groups:			
Group 1			
úchi dáum	*Couma macrocarpa* Barb. Rodr.	Apocynaceae	J188
úchi táuch	*Lacmellea oblongata* Markgr.	Apocynaceae	J199, K432, K490
Group 2			
wampúush	*Ceiba pentandra* L. (Gaertn.)	Bombacaceae	J266
ménte	[indet.]	Bombacaceae	J122, J123
Group 3			
wáwa kúnchai	*Dacryodes kukachkana* L.O. Williams	Burseraceae	J58
ú̲juts	*Dacryodes* sp.	Burseraceae	J48
Group 4			
shijíkap	*Protium* sp.	Burseraceae	J54
chípa	*Protium fimbriatum* Swart	Burseraceae	J70, K264, B930, B1502
pantuí	*Protium grandifolium* Engl.	Burseraceae	J49
	Protium sagotianum Marchand	Burseraceae	A163
	Protium nodulosum Swart	Burseraceae	A26
	Protium robustum (Swart) D.M. Porter	Burseraceae	K384
shíshi	*Protium grandifolium* Engl.	Burseraceae	J64
	Protium spruceanum (Benth.) Engl.	Burseraceae	A427
Group 5			
wayámpainim	*Garcinia madruno* (Kunth) Hammel	Clusiaceae	J275
pegkáenum	*Garcinia macrophylla* Mart.	Clusiaceae	J119, K321
Group 6			
putsúu sámpi	*Inga* sp.	Fabaceae	J60
wámpa̲	*Inga edulis* Mart.	Fabaceae	J63, K1179
	Inga striata Benth	Fabaceae	BO99
buabúa	*Inga multinervis* T.D. Penn.	Fabaceae	A10
	Inga cf. *multinervis*	Fabaceae	J71
	Inga urabensis L.Uribe	Fabaceae	K193
sejempách	*Inga marginata* Willd.	Fabaceae	J212
	Inga semialata (Vell.) Mart.	Fabaceae	A1500
	Inga punctata Willd.	Fabaceae	K817
Group 7			
samíknum	*Macrolobium acaciifolium* (Benth.) Benth.	Fabaceae	J82
	Macrolobium sp.	Fabaceae	A510
	Pithecellobium basijugum Ducke	Fabaceae	B749, H232
wampíshkunim	*Macrolobium limbatum* Spruce ex Benth.	Fabaceae	J56
Group 8			
pandáij	*Ormosia* cf. *amazonica* Ducke	Fabaceae	J114, J115
tajép	*Ormosia* cf. *coccinea* (Aubl.) Jacks.	Fabaceae	J72

TABLE 1.—Continued.

Aguaruna name	Latin binomial	Family	Voucher[1]
Group 9			
tigkíshpinim	*Tachigali* sp.	Fabaceae	J261
ugkuyá	*Tachigali formicarum* Harms	Fabaceae	J264
wantsún	*Tachigali* cf. *bracteosa* (Harms) Zarucchi & Pipoly	Fabaceae	J270
	Tachigali chrysophylla (Poepp.) Zarucchi & Herend	Fabaceae	A1242
	Tachigali rugosa (Mart. ex Benth.) Zarucchi & Pipoly	Fabaceae	A275, H654, H514
Group 10			
ká̲wa tínchi	*Nectandra olida* Rohwer	Lauraceae	J268
	Ocotea floribunda (Sw.) Mez	Lauraceae	A212
káikua	*Licaria* sp.	Lauraceae	J196
	Ocotea costulata (Nees) Mez	Lauraceae	K663
wampúsnum	cf. *Nectandra schomburgkii* Meisn.	Lauraceae	J53
takák	*Ocotea gracilis* (Meisn.) Mez	Lauraceae	J272
batút	*Ocotea floribunda* (Sw.) Mez	Lauraceae	A472, A138, B875
	Ocotea cf. *wachenheimii* Benoist		H483, K335
máegnum	*Ocotea floribunda* (Sw.) Mez	Lauraceae	A343
ká̲wa	*Ocotea floribunda* (Sw.) Mez	Lauraceae	A170
Group 11			
káashnum	*Eschweilera gigantea* (R. Knuth) J.F. MacBr.	Lecythidaceae	J102, B783
	Eschweilera tessmannii R.Knuth	Lecythidaceae	K568
shuwát	*Eschweilera* sp.	Lecythidaceae	J217
	Eschweilera andina (Rusby) J.F.Macbr.	Lecythidaceae	A1295
Group 12			
tséek	*Miconia ternatifolia* Triana	Melastomataceae	J75
	Ossaea bullifera (Pilg.) Gleason	Melastomataceae	T577
	Miconia decurrens Cogn.	Melastomataceae	K391
	Miconia vittata (Linden & Andre) Cogn.	Melastomataceae	K839
ukuínmanch	*Miconia lourteigiana* Wurdack	Melastomataceae	J267
	Miconia serrulata (DC.) Naudin	Melastomataceae	A729, K909
	Miconia tomentosa (Rich.) D. Don ex DC.	Melastomataceae	A169
antumú chinchák	*Miconia* sp.	Melastomataceae	J216
	Leandra secunda (D. Don) Cogn.	Melastomataceae	A553
	Leandra longicoma Cogn.	Melastomataceae	B1505
	Miconia paleacea Cogn.	Melastomataceae	A1202, B1753
	Miconia subspicata Wurdack	Melastomataceae	H571
	Triolena pluvialis (Wurdack) Wurdack	Melastomataceae	A1514
chijáwe	*Miconia bulbalina* (Don) Naudin	Melastomataceae	J112, A477
	Miconia serrulata (DC.) Naudin	Melastomataceae	K941

TABLE 1.—Continued.

Aguaruna name	Latin binomial	Family	Voucher[1]
Group 13			
yantsáu	*Guarea macrophylla* subsp. *pendulispica* (C. DC.) T.D. Penn	Meliaceae	J52
	Guarea guidonia (L.) Sleumer	Meliaceae	K60, A1476, H546, K1456, KU78, KU436
bíchau	*Guarea macrophylla* ssp. *pendulispica*	Meliaceae	J74
	Trichilia pallida Sw.	Meliaceae	KU53
Group 14			
satík	*Cecropia engleriana* Snethl.	Moraceae	J206
	Cecropia membranacea Trécul	Moraceae	K805
súu	*Cecropia engleriana* Snethl.	Moraceae	J273, KU132
	Cecropia ficifolia Warb. ex Snethl.	Moraceae	K442
	Cecropia marginalis Cuatrec.	Moraceae	T16
	Cecropia membranacea Trécul	Moraceae	K680
	Cecropia sciadophylla Mart.	Moraceae	K213
Group 15			
ejésh	*Iryanthera tricornis* Ducke	Myristicaceae	J80
	Virola pavonis (A. DC.) A.C. Sm.	Myristicaceae	K197
úntuch tsémpu	*Iryanthera juruensis* Warb.	Myristicaceae	J55, B1606
	Virola elongata (Benth.) Warb.	Myristicaceae	K665
Group 16			
shijíg	*Hevea guianensis* Aubl.	Euphorbiaceae	J84
	Hevea pauciflora (Spruce ex Benth.) Müll. Arg.	Euphorbiaceae	A99
tákae	*Brosimum parinarioides* Ducke	Moraceae	J86
	Brosimum multinervium C.C. Berg	Moraceae	K996
shijigká sáei	*Clarisia racemosa* Ruiz & Pav.	Moraceae	J258
barát	*Ecclinusa lanceolata* (Mart. & Eichler) Pierre	Sapotaceae	J197
Group 17			
awánu	*Cedrela odorata* L.	Meliaceae	J83
séetug	*Cedrela odorata* L.	Meliaceae	J67
tsáik	*Cedrelinga cateniformis* (Ducke) Ducke	Fabaceae	J271, K410, A18
Isolated genera:			
shikiú	*Erythrina* sp.	Fabaceae	J249
	Erythrina ulei Harms	Fabaceae	K887
chikáunia	*Myroxylon balsamum* (L.) Harms	Fabaceae	J207
tagkáam	*Parkia multijuga* Benth	Fabaceae	B742
shishíim	*Couroupita subsessilis* Pilg.	Lecythidaceae	J68
apái	*Grias peruviana* Miers	Lecythidaceae	J57, B884, T5
	Grias neuberthii J.F. Macbr.	Lecythidaceae	H488, H41
shína	[indet.]	Moraceae	J105
pítu	*Batocarpus orinocensis* H. Karst.	Moraceae	J42, A100
magkuák	*Cespedesia spathulata* (R.&P.) Planch.	Ochnaceae	J87, A111

TABLE 1.—Continued.

Aguaruna name	Latin binomial	Family	Voucher[1]
uwáchaunim	*Calycophyllum* sp.	Rubiaceae	J81
	Calycophyllum megistocaulum (K. Krause) C.M. Taylor	Rubiaceae	K263
bukún	*Chimarrhis glabriflora* Ducke	Rubiaceae	J92
	Chimarrhis hookeri K. Schum.	Rubiaceae	A504
	Macrocnemum roseum (R.&P.) Wedd.	Rubiaceae	K59
súwa	*Genipa americana* L.	Rubiaceae	J43, H261
tiík	*Zanthoxylum valens* (J.F. Macbr.) J.F. Macbr.	Rutaceae	J251
páunim	*Vochysia elongata* Pohl	Vochysiaceae	J262
	Vochysia braceliniae Standl.	Vochysiaceae	BO47, A202, B812
	Ruizterania trichanthera (Warm.) Marc.-Berti	Vochysiaceae	H1140
pítuuk	*Perebea xanthochyma* H. Karst.	Moraceae	J252
	Trophis racemosa (L.) Urb	Moraceae	K107
	Agonandra silvatica Ducke	Opiliaceae	H1500

[1]Collection numbers preceded by J indicate my own collections, which are deposited in the herbarium of the Universidad Nacional Mayor de San Marcos, in Lima, Peru. Other letters indicate collections from Brent Berlin and his collaborators, as follows: A = Ernesto Ancuash, B = Brent Berlin, Bo = J.S. Boster, H = Victor Huashikat, K = Rubio Kayap, Ku = Kujikat, T = Santiago Tunqui. All material collected by the above collaborators is deposited at the Missouri Botanical Garden, in St. Louis, Missouri.

make the terms synonyms, the Aguaruna do not consider them to be the same tree. Part of this ambiguity is likely due to slight disagreement between informants as to the exact range of some tree names. The disagreement is surely heightened by the fact that collections used to determine the botanical range (see Table 1) come from slightly different times and places. I made my own collections in 2004, on the Nieva river, while Berlin and his collaborators (1976) made their collections on the Cenepa river, in the 1970s.

The underlying hypothesis of this research, that the process of tree identification involves both sensory and ecological reasoning, was successfully tested. Eight informants provided descriptions of the 63 study trees, yielding a total of 504 descriptions. Each of these descriptions consisted of a freelist of salient features, which could include physical qualities of specific tree parts, assessment of overall growth habit, or ecological qualities, such as favored habitat and association with animals or plants. Analyzing the data involved counting the overall number of descriptions that include particular characters (e.g., leaf size, sap color, habitat). The data collected only partially support the research hypothesis. All of the descriptions involved sensory reasoning. Likewise, all companion comparisons involved sensory reasoning. However, only 21% of the tree descriptions involved ecological clues. Ecological clues were involved in only six percent of companion similarities and 11% of companion differences. Sensory clues mentioned by informants referred to specific tree parts (e.g., ***saepé̲ kapántui*** 'the bark is red', ***dúke̲ dupájmai*** 'the leaves are thick') or to general growth habit (e.g., ***shíig kampújam tsakátsui*** 'it doesn't grow very tall'). Aguaruna names for various parts of a tree and their English gloss appear in Table 2. Ecological clues included references to animals

TABLE 2.—Aguaruna names for the parts of a tree.

Aguaruna name	Part of tree
númi[1]	trunk
sáep[1]	bark
púwaj	sap
kanáwe	branches
kágkap	buttressed roots
dúka	leaves
néje	fruit
yagkúj	flowers
jigkái	seeds

[1]Two of the Aguaruna terms for tree parts, ***númi*** 'trunk' and ***sáep*** 'bark', overlap in meaning. It became clear during the study that informants can use either the word ***sáep*** or ***númi*** to describe the color or texture of the outside surface of a tree. On the other hand, they only use ***sáep*** to describe the bark thickness or smell, and only use the word ***númi*** to describe the hardness of the trunk or the color of the heartwood.

or plants associated with a particular tree (e.g., ***múnji numínum pujáu*** 'stinging ants live in its trunk', ***júu numínum atsáwai*** 'the trunk doesn't have moss growing on it'), or referred to the ecological zone where the tree is found (e.g., ***asáuknum tsapáwai*** 'it grows in secondary forest'). On the whole, the results suggest that sensory clues play a greater role than ecological ones in tree identification among the Aguaruna.

Table 3 indicates how often informants referred to various characters in answering the question, ''How do you recognize this tree?''. A thorough description

TABLE 3.—The most common characters from tree descriptions.

	Total # of IDs out of 504	% of IDs
Sensory characters		
Outer trunk color	247	49.0
Fruit color	217	43.1
Leaf shape	192	38.1
Fruit shape	191	37.9
Overall height of tree	163	32.3
Thickness of trunk	143	28.4
Flower color	125	24.8
Leaf size	120	23.8
Quantity of branches	117	23.2
Bark odor	83	16.5
Fruit size	82	16.3
Fruit dehiscence	82	16.3
Outer trunk texture	77	15.3
Sap color	77	15.3
Leaf color	54	10.7
Straightness of trunk	51	10.1
Ecological characters		
Animal association	100	19.8
Habitat	12	2.4
Plant association	1	0.2

of all the sensory characters named by informants for the 63 study trees would require many pages and is beyond the scope of this article.[5] Table 3 includes only those sensory characters mentioned in at least 10% of informants' descriptions of the study trees. For the purpose of comparison, Table 3 also includes all of the ecological clues mentioned by informants. Some particular tree parts appear to be more significant for identification than others. Fruit characters are well represented and include color, shape, size and dehiscence. Outside trunk appearance is also quite salient, particularly color and texture. Salient leaf characters include shape, size and color. Informants also mentioned growth habit quite often, particularly tree height and thickness and straightness of the trunk. Flower color, quantity of branches, bark odor and sap color are also salient characters.

As previously noted, 14 of the 63 study trees are considered by a majority of informants to have no companions. The other 49 make up 17 groups of companions recognized by a majority of informants. Two of the companion groups (12%) have members from different botanical families, while 15 of the 17 (88%), have members from a single botanical family. Eight of the ***kumpají*** groups (41%) seem to correspond to a single biological genus (see Table 1). For example, Group 4 (Figure 3) appears to correspond fairly well to the genus *Protium* in the family Burseraceae. In this group, the folk species ***shíshi*** and ***pantuí*** show some overlap in range, possibly due to slight disagreement between informants over the biological referent of these names. Other groups correspond to several biological genera within a single family. Group 1, for instance, includes the genera *Couma* and *Lacmellea* in the Apocynaceae. In the two cases of companion groups with members from multiple botanical families, the members do, nevertheless, show distinct morphological similarity. Group 17 contains trees from the genus *Cedrela*, in the Meliaceae and *Cedrelinga*, in the Fabaceae, which both have thick ridged bark. Indeed, even the scientific names imply morphological similarity. Group 16 (Figure 4) includes species from the genera *Brosimum* and *Clarisia* in the Moraceae, the genus *Hevea* in the Euphorbiaceae and the genus *Ecclinusa* in the Sapotaceae. Although this grouping does not hold together biologically, it makes sense to the Aguaruna, since all of the trees involved have sticky white sap. Overall, the data suggest that the Aguaruna group trees together as ***kumpají*** in a way that is usually compatible with western taxonomy.

Table 4 indicates how often informants referred to various characters in comparing and contrasting members of companion groups. It includes only those sensory characters mentioned in at least 10% of either companion group differences or companion group similarities. It also includes the relatively less important ecological characters for the purpose of comparison. Characters that are particularly important for the broad recognition of companion groups include fruit color, shape and dehiscence. Sap color and bark odor are also relatively important for explaining the cohesion of the companion groups. A number of features are important in making the finer distinctions between members of ***kumpají*** groups. Leaf size and shape are especially significant, while leaf color plays a more minor role. Growth habit features such as overall tree height and trunk thickness are also important for making fine distinctions. Additionally, outside trunk appearance, including color and texture is important for distinguishing between members of companion groups. Fruit size and shape

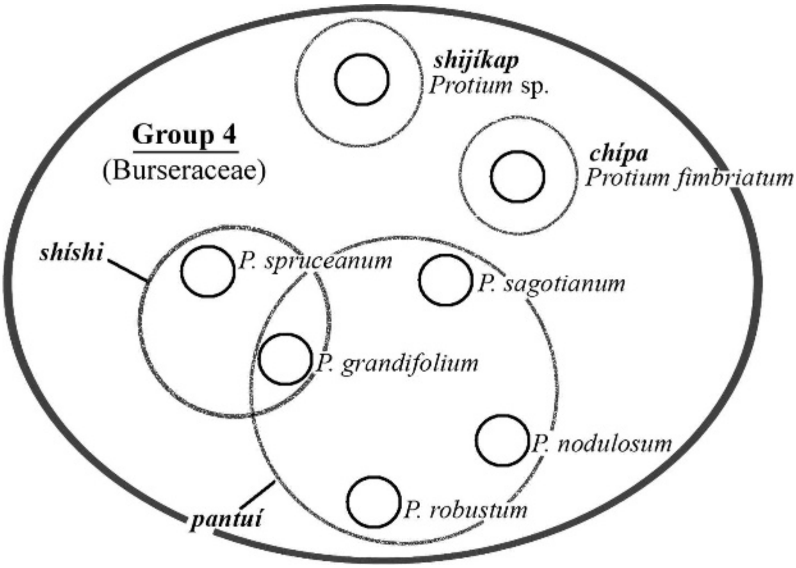

FIGURE 3.—The correspondence between biological species and the folk genera that make up ***kumpají*** Group 4.

are important for making finer distinctions. Fruit color is important in this regard as well, although not as important as it is for making broad distinctions.

The two aaproaches employed in this study appear to yield fairly compatible results. Both the tree descriptions (Table 3) and the companion comparisons (Table 4) place significantly greater emphasis on sensory clues than ecological ones.

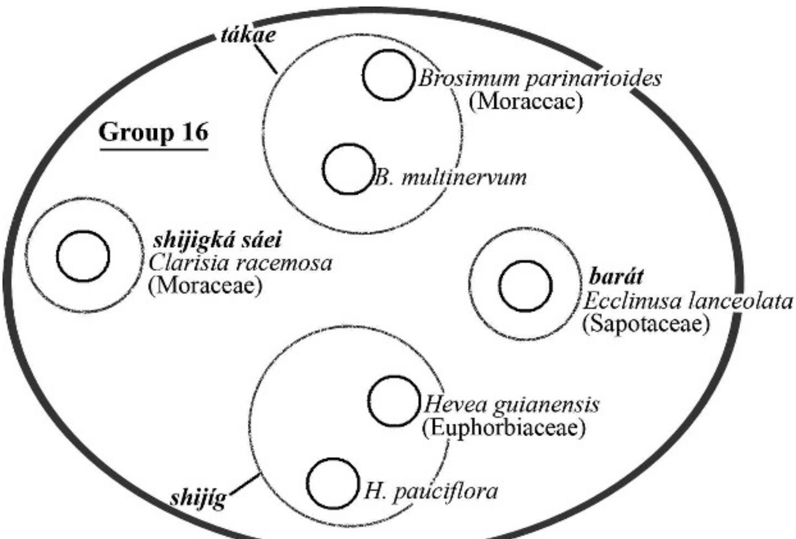

FIGURE 4.—The correspondence between biological species and the folk genera that make up ***kumpají*** Group 16.

TABLE 4.—***Kumpají*** similarities and differences.

	% of ***kumpají*** similarities (out of 173)	% of ***kumpají*** differences (out of 173)
Sensory characters		
Fruit color	32.8	12.4
Outer trunk color	19.8	31.6
Sap color	19.2	4.5
Fruit shape	15.8	18.1
Fruit dehiscence	15.3	2.3
Bark odor	13.6	2.3
Leaf shape	9.0	42.4
Leaf size	7.3	37.9
Outer trunk texture	6.8	14.1
Overall height of tree	6.2	28.2
Leaf color	4.5	10.2
Thickness of trunk	2.8	17.5
Fruit size	2.3	20.3
Ecological characters		
Animal association	6.2	5.1
Habitat	0	7.3
Plant association	0	0

Furthermore, 13 out of 16 (81%) of the sensory characters that are important in the tree descriptions are also important for the companion comparisons. Only the characters flower color, branch quantity and trunk thickness appeared in at least 10% of the descriptions, but did not appear in at least 10% of the ***kumpají*** comparisons.

CONCLUSION

One factor that likely complicates elicitation of identification methods is the tendency of informants to make identifications based on an overall impression (its gestalt) (Berlin et al. 1974: 154). The reliance on the gestalt of an organism in identification may make it difficult for informants to verbalize all the discrete features that help them distinguish a particular tree from other similar ones. One could easily imagine informants responding to questions about how they recognize a specific tree by saying something like ''I can just tell,'' or ''It is just obviously an X.'' Glenn Shepard has suggested that people's reliance on the gestalt of an organism for identification is likely to make it particularly difficult for them to cognize the identification criteria for common, highly utilized or cultivated species (written communication 2003). Berlin et al. (1974) argue that it should be easier for informants to verbalize the relatively minor differences between conspecifics of a particular folk genus than it would be to distinguish between folk genera. A study such as the one I have made can never reveal all of the clues that are important to the Aguaruna for identifying trees. I do share the optimism of several authors (see Berlin et al. 1974; Ellen 1993) that informants will be able to verbalize at least some of the important clues.

I have assumed that answers to the question: ''How do you recognize this tree?'' will correspond to the most salient features of the tree for each informant. However, the most salient features of a particular tree for a particular informant may not always be the same features that person would actually use to identify a living example of that tree. Some features, such as fruit and flowers, are seasonal for many species and may not be present when an actual identification is made. A few informants also mentioned that birds or other animals eat the fruit of certain trees. The role of any such ecological interactions in tree identification is also contingent on circumstances, since the animals in question will not always be present.

It is worth noting that the findings of this research only partly agree with the anecdotal reports mentioned in the introduction of this paper, which have emphasized the ability of indigenous peoples of the Amazon basin to identify trees in their local environment simply by observing trunk and bark characters. As Gentry (1993: 4) put it, ''[a]nyone who has ever observed a good 'matero' effortlessly identify trees with nothing more than a machete slash of the bark and a sniff of his nose can begin to appreciate some of these… characters.'' Trunk and bark characters do appear to be very salient to the Aguaruna. My informants mentioned outer trunk color in nearly half (49%) of their descriptions and outer trunk texture in 15.3% their descriptions (Table 3). Additionally, they mentioned bark odor and sap color in 16.5% and 15.3% of their descriptions, respectively. These last features are included in what Gentry refers to as ''bark and slash characters'' (1993: 4). Data from the companion comparisons also suggest that trunk, bark and sap characters play an important role in tree identification among the Aguaruna (see Table 4). However, my informants' descriptions and companion comparisons also place a heavy emphasis on fruit and leaf characters as well as overall growth habit.

One way to explain the discrepancy between my data and the anecdotal reports is to consider, as López Zent (1999) has done, that some features of a tree present themselves to the attention more easily than others. In some cases, a simple glance at the trunk and up at the leaves may prove sufficient to identify a tree, without needing to cut the bark or observe the sap. Indeed, informal walks through the forest with Aguaruna informants revealed that they usually look at the trunk first, then up at the leaves. This was sometimes enough to make an identification, but, if not, they would cut the bark to smell it, look for sap and observe the inner color and hardness of the trunk. Occasionally, fruits or flowers fallen on the ground also aided in identification. The sorts of formal interview questions that I asked encouraged informants to describe their ideal image of a tree that would include all the most salient features. However, an informant may not actually need to see all of the most salient features of any given tree in order to identify it. Through years of observation, they would have a clear image of which features go together, so that, in some cases at least, simply observing one or two of these features (e.g., the trunk or leaves) would be enough to bring to mind any important features that are not actually present (e.g., fruit) (Glenn Shepard, written communication 2005). Clearly more studies are needed, both cross-culturally, and on different folk taxonomic life forms (e.g., vines and herbs) to better understand how people identify plants. It seems probable that with herbs and shrubs, leaves and fruit would play an even greater role in the actual process of identification, since they would be much easier to observe than they are for large trees. This is a prediction that future research could address.

NOTES

[1] The orthography used in this article for Aguaruna words is borrowed from Uwarai Yagkug et al. (1998). Underlined vowels indicate nasalization. Single vowels indicate short vowel sounds, while doubled vowels indicate long vowel sounds. The letter ***e*** represents a sound similar to the Spanish *u*, but is made without rounding the lips. The consonant ***g*** is pronounced like 'ng' in the English word 'running'. ***Nd*** represents a prenasalized 'd', while ***mb*** represents a prenasalized 'b'. ***Ts*** is pronounced like the 'ts' in the English word 'cats'. The consonants ***w*** and ***k*** are pronounced as in English. All other letters are pronounced as in Spanish.

[2] Although all trees selected were known to all eight key informants, some of the trees only occur in very particular kinds of habitat and were not easily accessible from all five study communities. Furthermore, a few of the study trees are highly valued timber species that have been made rare by selective logging. It would not be possible to find an actual example of all 63 trees near any single one of the five study communities. Even if it had been possible to find all of the trees near one community, it would still have been necessary to transport key informants from the four other study communities in order to make it possible for every informant to respond to the same stimuli.

[3] Voucher specimens of the trees collected were deposited in the herbarium of the Universidad Nacional Mayor de San Marcos (UNMSM) in Lima.

[4] These voucher specimens are deposited at the Missouri Botanical Garden in St. Louis, Missouri. Data for these collections has been compiled in an unpublished report by Brent Berlin, Cathy M. Crandall, and Walter H. Lewis, entitled: Taxonomic checklist of plants collected in the department of Amazonas, Peru 1972–1980. The report lists the Aguaruna name and corresponding scientific name of over 3500 specimens collected by Berlin and collaborators.

[5] A more thorough treatment of this subject will appear in the author's dissertation (in prep.).

ACKNOWLEDGMENTS

Generous support for this research was provided by a grant from the National Science Foundation (no. 0314289) and the Wenner-Gren Foundation for Anthropological Research. I would also like to thank Glenn Shepard and Brent Berlin for many helpful comments and much encouragement. Additionally, three anonymous reviewers of this manuscript provided valuable suggestions for its improvement. Various people in the herbarium of the Universidad Nacional Mayor de San Marcos (UNMSM) in Lima kindly helped me identify botanical specimens. These included Joaquina Albán, Hamilton Beltrán, Severo Baldeón, Franco Mellado, Mirbel Epiquien and Irayda Salinas. Most of all, I would like to thank the people of the communities of Bajo Cachiaco, Kayamas, Tayunts, Alto Pagki and Atash Shinukbau, where this research took place. In particular, Martín Reategui, Nestor Reategui and Gregorio Reategui were very helpful in their assistance with coordinating this research.

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