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Tikuna Perceptions of Extreme Weather Events: A Case Study on an Indigenous Lands in the Upper Solimões River, Brazil

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ABSTRACT

The synergistic effects of extreme weather events and socioecological vulnerability are still poorly documented for Amazonian indigenous peoples. Herein, we investigated the impacts of recent extreme weather events on Tikuna villages. Tikuna are ancient people of the Amazon, with an estimated population of approximately 53 thousand people widely distributed along the upper Solimões River in the western Brazilian Amazon. The fieldwork was carried out between October 10 and December 10, 2018, using participatory research, including focus group interviews and free-listing exercises. Four extreme weather events were recalled, namely, the extreme floods of 2009, the subsequent extreme drought of 2010, and the extreme floods of 2012 and 2015. The results indicated that Tikuna from some villages are adopting migration from floodplain habitats to nonflooded lands as a coping strategy to increase the frequency and intensity of extreme weather events. This process was characterized by famine periods, internal divisions, and increased vulnerability. The three villages have rich traditional knowledge and live on a large diversity of biological resources, base for a fishing economy and for an agroforestry system, the original indigenous subsistence agriculture with a high level of self-sufficiency in terms of food. Until our study, Tikunas had not received any information about the global climate emergency. Our findings can contribute to formulating public policies to provide support for adapting to climate change. These policies must ensure the participation of the Tikuna and other indigenous peoples in local and national discussions on climate change, strengthening their capacity to develop adaptation strategies based on their ancestral knowledge.

Keywords: Migration, Adaptative strategies, Free list, Environmental change, Amazon.

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SIGNIFICANCE STATEMENT

Extreme weather events increased the socioecological vulnerability of the Tikuna people, an indigenous group widely distributed along the upper Solimões River, in the western Brazilian Amazon. Some of them are migrating from floodplains to nonflooded habitats as a coping strategy in a process characterized by famine periods, internal divisions, vulnerability, and no information about global climate change.

INTRODUCTION

Extreme weather events (EWEs) have a substantial impact on people's life hoods worldwide, and there is evidence that a succession of EWEs increases the magnitude of these impacts (Berlemann and Steinhardt 2017). In Amazonia, where extreme river floods and extreme droughts have increased in frequency and intensity in the last two decades (Marengo et al. 2013; Cai et al. 2014; Nobre 2014; Marengo and Spinoza 2016), there is growing concern about the effects of EWEs and their impacts on the livelihoods of people who depend on forests and agrobiodiversity (Kronik and Vener 2010; Oliveira et al. 2012; Pires et al. 2016; Parry et al. 2017; Funatsu et al. 2019; Ávila et al. 2021). In combination with other effects of climate change, EWEs may affect food security through impacts on access, availability, cultivation and harvesting strategies and the ability to store, process, and use foods in traditional ways (Pinho et al. 2015). Extreme floods mainly impact lowland areas along rivers, causing losses and decreasing the quality of agricultural production (Pinho et al. 2015; Funatsu et al. 2019; Ávila et al. 2022). Extreme droughts not only affect river dynamics but also nonflooded areas. These droughts can dry out stretches of rivers and lakes, affect fish reproduction, and reduce access to fishing sites by boat, reducing fish production; fish are the most important protein source for Amazonian people (Echeverri 2009; Pinho et al. 2015; Funatsu et al. 2019; Avila et al. 2021).

The impacts of EWEs are in addition to those of social vulnerability, putting the resilience and adaptive capacity of traditional Amazon communities at risk (Pinho et al. 2015). The most vulnerable populations in the upper Solimões River, western Brazilian Amazon, are indigenous people, with the Tikuna people among them.

Earlier Tikunas (self-named *Magüta*) were known as nomadic hunters and gatherers who specialized in nonflooded (*terra firme*) forests. They occupy forests from tributary streams on the left bank of the Solimões River, from the section where they enter Brazilian lands to the Içá/Putumayo River (Almeida 2005). In 1600, they began to expand their territories toward the floodplain habitats (*várzea*) of the Solimões River as a consequence of the extermination of Omáguas, an enemy indigenous group that occupied this area, from diseases and wars against Portuguese and Spanish people (Nimuendajú 1952). In 1768, the Tikunas were recognized as excellent hunters and fishermen (Nimuendajú 1952). Currently, Tikunas are widely distributed within the *várzea* and *terra firme* forests of the upper Solimões River and constitute the most numerous indigenous people in Brazil, with an estimated population of approximately 53 thousand people also inhabiting Peru and Colombia in relatively smaller numbers (Soares 2021). However, their long history of contact is characterized by violence, exploration, and efforts to integrate into the surrounding national society (Soares 2021). Communication and exchange are constant regardless of the border between the three countries because formal frontiers are less important than are the factors that unify them, such as cultural and linguistic identity (Catachunga et al. 2021).

The upper Solimões River region in Brazil includes municipalities with a low or very low human development index (HDI), in which between 28% and 56% of the population is in extreme poverty and between 78 and 94% of the population is vulnerable to poverty (Amazonas 2016). The Tikunas in these municipalities correspond to approximately 44% of the rural population, and in some cases, this percentage can reach 74% (Almeida 2005; Rebêlo et al. 2020). Despite the long history of contact, most of the Tikuna people are still fluent speakers of the Tikuna language, which is considered a genetically isolated language (Soares 2021). The Tikuna language is the basis for the cultural reproduction of Tikunas, which enabled them to claim their territories from the 1980s onwards. The upper Solimões River region currently has 46 Tikuna indigenous lands.

Due to the long adaptation history of the strong environmental contrasts driven by the annual flood pulse of the Solimões River, Tikunas has accumulated a rich amount of information in the form of traditional ecological knowledge. In fact, Tikunas are dependent on the biodiversity of their surroundings for fishing, hunting, agriculture, and collection of medicinal, aromatic, and edible plants (Almeida 2005; Noda et al. 2012; Rebêlo et al. 2020).

Cooperation among the Tikuna people and researchers from the National Institute for Amazon Research (INPA) started in 2003 after they reported on the scarcity of fish and the occurrence of invasions by nonindigenous fishermen in their territories. From 2005 to 2017, we developed participatory action research that resulted in the establishment of the Éware Tchoni Management (Sacred Land's Fishes, in Tikuna) in bilingual workshops (Portuguese-Tikuna) in which the Tikunas and other indigenous leaders and fishermen decided on rules and practices to guarantee food and territory. In 2017, two of us (MCL and GHR), during a follow-up workshop on fisheries management activities, realized that at least three participants, Tikuna villages, had moved from lowlands to uplands (*várzea* to *terra firme*) due to major floods in recent years. Migration is not uncommon in indigenous Amazonian societies (Alexiades 2009) and was identified as a human response to cope with the pressure of climate change (Black et al. 2011; Black

et al. 2013). However, this approach contrasts with the strategies observed in the middle Solimões River, where local nonindigenous communities are developing adaptation strategies to remain on their traditional lands in the floodplain in the face of EWEs (Ávila et al. 2021).

Considering their socioecological vulnerability, in this study, we investigated the relationships of recent EWEs with the motivations that led these three Tikuna villages to move their locations from *várzea* to *terra firme*. More specifically, we asked the following questions: 1) How did the recent EWEs remain in the memory of these indigenous villages? 2) Were recent EWEs the main cause of the migration of these three villages? 3) What are the consequences of these migrations for their livelihood activities (fishing and agriculture)? 4) How do the perceptions of EWEs differ between genders and villages? We also sought to identify coping and adaptive strategies developed by the Tikuna people during the migration process to support the design of future policies aimed at mitigating the impacts of EWEs and increasing their socioecological resilience to climate change.

MATERIAL AND METHODS

Study area

This study was conducted on two Tikuna indigenous lands of the upper Solimões River in the state of the Brazilian Amazonas State, the Éware I Indigenous Land (EIL I), with an area of 548.177,59 ha located on the left bank of the Solimões River in the municipalities of Tabatinga and São Paulo de Olivença, and the Éware II Indigenous Land (EIL II), with an area of 176,205.71 ha located on the right bank of the Solimões River in the municipality of São Paulo de Olivença (Figure 1). The demarcation process of these indigenous lands was completed in 1996 by the Brazilian Federal Government (Oliveira 1998). Both indigenous lands are covered by *várzea* (floodplain habitats) and *terra firme* forests (nonflooded), and the population is estimated to include 23,000 inhabitants, mostly Tikuna, and some Kokama in Éware I (Rebêlo et al. 2020).

The region has an Amazonian equatorial climate, without a dry season; an Af climate type according to the Köppen climate classification, with records of an average annual temperature of 25.7°C, seasonal differences of ±1°C, and annual rainfall between 2,800 mm and 3,600 mm; and an annual rainfall peak occurring between December and May (Alvares et al. 2014). In normal years, the Solimões River reaches its peak in June and its lowest level in November, but the flood and drought periods may vary depending on the rainfall in the headwaters of the Solimões River in the Andes (Lima 2005).

The floodplain lands in the upper Solimões River are covered by Holocene Quaternary sediments over large swaths of land, forming a complex system of channels, lakes, islands, and marginal dikes (Sioli 1990). Due to their recent sedimentary nature, the soils of these floodplains are closely related to the source material and sediments from the Andean and Sub-Andean regions that were transported by rivers and deposited in the alluvial plain (Lima 2005). Unstable formations are carved by rivers and often result in "fallen lands", whose sediments form beaches and islands (Bandeira et al. 2018). The *terra firme* (which does not suffer flooding) was formed from the tertiary sediments of the Solimões Formation and Quaternary sediments of the Içá Formation (Lima 2005).

The three villages that participated in this study and moved their housing from *várzea* to *terra firme* were (Figure 1): 1) *Ütapü*, or "Red Mountain" in the Tikuna language, located on the right bank of the Camatiã River (EIL II), settled in the area in 2013 and were composed of 45 families (201 inhabitants). The village infrastructure includes a school, the only place with electricity and the internet, and a church. In the past, the people of this village lived in the floodplain on the right bank of the Solimões River in the extinct *Paranapara* village (localized at EIL II and founded in 1944); 2) *Novo Paranapara*, located on the right bank of the Camatiã River (EIL II), settled in 2016 and currently has 68 families (397 inhabitants). The infrastructure includes a school with electricity and the internet and a neopentecostal church (under construction). Villagers also arrived from the extinct village of Paranapara. 3) *Nupune*, or "Lowland" in the Tikuna language, located in EIL I on the left bank of the Solimões River, settled in the area in 2015 and was composed of 13 families (76 inhabitants). There is a Catholic church and electricity services in the village, but the residents use schools in neighboring communities (Vendaval or Novo Paraíso, far from one kilometer). The Tikuna of this village lived in the floodplain on the right bank in *Paraná do Ribeiro* village (localized at EIL II and founded in 1970), where 20 families still live (98 inhabitants).

Data collection and analysis

This study was conducted under full approval from the Human Research Ethics Committee of the National Institute for Amazonian Research (CEP) (CAAE number 85962618.6.0000.0006) and was authorized by the National Council on Ethics in Research (Conselho Nacional de Ética em Pesquisa–CONEP) (authorization number 2.968.040). We additionally obtained authorization from the Brazilian National Indian Foundation (Fundação Na-

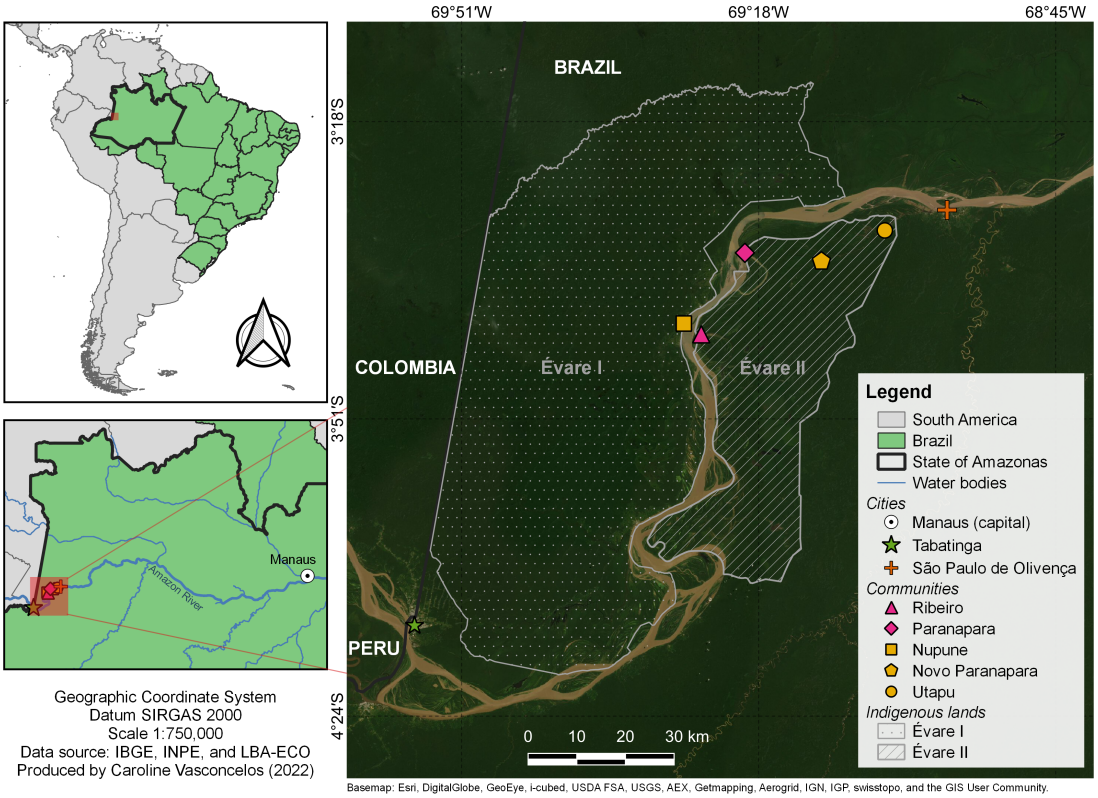

Figure 1. Map of the study area in western Brazilian Amazonia showing the villages where this study was conducted on Évare Indigenous Lands I and II, upper Solimões River. São Paulo de Olivença and Tabatinga are nearest urban centers.

cional do Índio – FUNAI) to enter Éware I and Éware II Indigenous Lands (authorization number 08620.011542/2018-50) and free, prior, and informed consent from the village representatives.

Fieldwork was conducted by one of the authors (M.C.L.) from October 10 to December 10, 2018. The data collection methods included interviews conducted in focus groups with open-ended questions, participatory historical ecoME exercises (free listing), village mapping (resource map), and guided tours (Albuquerque et al. 2014). A total of 21 focus groups were interviewed. The group size varied between 51 and 3 participants. The interviews were audio-recorded with the permission of the interviewees, and because most participants speak only the Tikuna language, questions and answers were translated by Tiago Berezinho Anastacio, native Tikuna from Ütapü village, who acted as an interpreter between the researcher and those interviewed in the three villages. More details about the interviews are available in Additional File 1.

The fieldwork was separated into three steps (Additional File 2). The first step involved an interview about the village migration process. The climate change subject was not addressed because we wanted to verify if it would come spontaneously. The guiding questions were as follows: How did the village change process occur for the new place? How was the new place chosen? What drives the change? How did the change affect peoples' lives in the village? How is the adaptation to the new place going? What has changed in agriculture or fisheries after migration? Would you say the change was caused by extreme weather events? After the interviews, the participants were encouraged to draw pictures and illustrations that expressed what was talked about, and the drawings were photographed to show other villages that went through a similar process (see Chaudhury et al. 2012).

This step was completed with participatory historical-ecological matrices exercise and resource mapping of the swidden and fishing areas. The first exercise included scoring exercises to determine *local ethnospecies relative importance perceptions* in the past, in the present and in the future. The term "ethnospecies" is used in the present study to indicate the common or vernacular names given to the cited plants and fishes. First, lists for each type of resource were constructed in a participatory way by separate groups of small farmers and fishermen, who always started with the list of ethnospecies that they

used before the extreme drought of 2009-2010, when they still lived in the floodplain; then, the list of ethnospecies that were being collected or captured at the time of the interview; and finally, a list of ethnospecies thought that would be used in the future, when they would already be completely established on *terra firme*. With the lists ready, the researcher asked them to be scored into 4 levels of importance using seed beans: 1 = unimportant, 2 = not very important, 3 = important, and 4 = very important. The historical-ecological matrices exercises were performed by 71 participants (Novo Paranapara – 51, Ütapü -15, Nupune - 5). The resource maps were drawn on copies of satellite images of the areas, printed in A3 and covered with transparent cellophane paper, on which environments and species were drawn by indigenous atomic brushes. At least 35 people participated in the resource mapping exercise (Novo Paranapara - 15, Ütapü -15, Nupune - 5). The resource maps drawn were georeferenced and photographed, and the originals were left in the villages. The second step of the fieldwork involved a dialog on the occurrence of EWEs from 1999 to 2017, in which conclusions from a review of both scientific information and daily news published in the media of the upper Rio Solimoes region were shared (see Supplementary Information). The purpose was to facilitate the understanding and identification of the level of access to weather information and the climate change debate. After that, interviews were carried out with focus groups separated by gender. The guiding questions were as follows: What was the most recent EWE? How did this happen? How did the village (or you) determine? How (or who) perceives that there will be an EWE? What climate and weather information are currently available in the village? What is the main source of this information (radio, internet, relatives, missionaries, other)? What weather information would you like to receive to protect yourself from an extreme weather event? How would this information be used? What is the most efficient way to share this information within the village and between villages?

The third part of the fieldwork consisted of describing agricultural practices and assessing whether they could be considered "climate smart" in the FAO (2013) sense. The interviews were carried out with three focus groups of self-declared farmers. The historical-ecological matrices and the following questions guided the interviews: Is there (or was there before the migration) any crop rotation? Is there livestock (on what scale?) or raising small animals (chickens or pigs, for example)? Is there any integration between agriculture and livestock (or raising small animals)? What are the practices used to improve soil quality? Are chemical fertilizers and pesticides used? If so, are there practices available to prevent or reduce its seepage into rivers? Are there any practices in use to adapt agriculture to EWEs, whether for extreme droughts or extreme floods? What are the practices used to avoid water pollution (springs) or water scarcity in an EWE case? How did EWEs affect fisheries? Are there species favored or disadvantaged by extreme floods or droughts? What are the effects of an EWE on populations of arapaima (*Arapaima gigas*), tambaqui (*Colossoma macropomum*), freshwater turtles (Podocnemididae) and caimans (Alligatoridae)?

This stage was completed with guided tours into cultivation sites selected by mutual agreement. The observations were recorded in a field diary, and the site was photographed with a Canon/T1i/EF-S 18-55 mm camera and mapped with a Sonar Garmin Striker/4CV Plus 010-01871-03 GPS receiver.

The data analysis consisted of qualitative analyses through the transcription of interviews and elaboration of the collective discourse. Next, we identified perceptions and coping and adaptation strategies during and after the migration events, comparing responses between villages and between genders.

We calculated the *salience indices* of each fish and cultivated plant ethnospecies following Chaves et al. (2019) using the formula $S = \Sigma(\frac{L-Rj+1}{\frac{L}{N}})$, where L is the length of a list, Rj is the rank of item j in the list, and N is the number of lists in the sample. Pearson's correlation analyses were run to show associations between the *Salience index* for fish and the mean production observed in commercial fish landings carried out by indigenous fishermen from São Paulo de Olivença from 2008 to 2012 (Éware Tchoni Management Database) and with the *local relative importance perceptions* reported in our participatory exercises. Kruskal–Wallis tests were run to determine the relationships between the *Salience index* and the life form plants used for local consumption and sale and the *local relative importance perceptions* reported in our participatory exercises. We performed a principal component analysis (PCA) using our matrices of focus group vs. resource use with the *local relative importance perceptions* to explore the level of cultural consensus in resource use. We compared times (2008, 2018, and 2028), places (*várzea* and *terra firme*), and villages (Ütapü, Novo Paranapara, Nupune).

RESULTS

Migration from Várzea to Terra firme

Based on the memories of the three Tikuna villages, we estimate a period of two to four years for the migration decision-making process. The main moti-

vations were "fallen lands" events and extreme floods. In this case, an extreme flood occurred in 2012 in Ütapü, and an extreme flood occurred in 2015 in Novo Paranapara and Nupune (Additional File 3). The "fallen lands" events caused severe damage to several houses and threatened others. Extreme floods cause total loss of swiddens and a scarcity of food and supplies.

Leadership action was the key decision-making element only in Ütapü, as reported by participants of both genders. The final decision was made in the three villages only by the men, although a woman in Nupune was mentioned by the men as being responsible for initiating the discussions and choosing the new place.

The perception that the new areas on *terra firme* would be less productive than the old areas located in *várzea* was the main cause of resistance to migration. Some families remained in the same places, while others decided to live in São Paulo de Olivença, returning to the Éware Indigenous Lands only to take care of their swidden or fish and hunt. After the extreme flood of 2015, the deterioration of community and reciprocity networks started, and the households that remained in the former village of Paranapara began to migrate from *várzea* to *terra firme*, but they founded a new village, Novo Paranapara village.

The Nupune village was also founded by a splitting process. We visited the families that remained in the floodplain in Ribeiro village on November 07, 2018, and the splitting process was remembered by some families, the new chief and the health agent. The participants stated that the floods caused considerable damage to the swiddens, but they decided not to move because their lakes had many fish. They reported that two other fisheries management participant villages in the ILE II floodplain, Otawari and Umaitê, also moved after the extreme floods of 2012 and 2015.

The migration process was considered difficult by all 21 focus groups. They did not receive help from any government or neighboring villages and dealt with the scarcity of food on their own. In addition, at the beginning of the migration process to create Ütapü, the other villages of the Camatiã River did not accept the new migrant villagers due to issues that already existed in the old community (Paranapara), making the adaptation process to the new place even more difficult.

Despite the difficulties faced in establishing these three villages before and two to five years after migration, the perception of women and men is that the change was good because they no longer have to worry about extreme floods. However, they also lack the large number of fishes in their ancient *várzea* lakes.

Fishing and agriculture

The participants prepared four maps of fishing areas and identified 34 water bodies located in EIL II currently used by the three villages, including 26 lakes, one stream, one *paraná* (the Nheengatú word for the lateral natural river channels) and two rivers (Figure 2, Additional File 4).

Only Nupune declared that they continue to use the same lakes. Fishing in the Camatiã and Solimões Rivers is considered open access, but access to lakes, streams and *paranás* is restricted to specific villages. Novo Paranapara and Ütapü, which are close to each other, share two lakes for fishing, Arapaima (*Arapaima gigas*) and Tambaqui (*Colossoma macropomum*), indicating a low overlap between previous and current use areas.

A reduction in the size and quantity of fish in the lakes was mentioned in the three villages. This perception was related to the invasion of indigenous and nonindigenous people who do not respect informal fishing agreements and invade lakes. In Nupune, fish spawning is impaired by the anticipation of the ebb period. In Novo Paranapara and Ütapü, there is a perception that the ancient fishing areas were more productive than their current ones were. However, the increase in fuel consumption for displacement and the need to transport canoes by land due to the decreased water connectivity of the lakes in the dry season force them to fish close to the villages.

A total of 60 ethnospecies were free-listed for lakes and fishing areas, among which 39 (65%) were identified at the species level, 18 (30%) at the genus level, two (3%) at the family level and one remaining unidentified. These ethnospecies correspond to more than 90 Linnaean species, including seven freshwater turtles, three caimans, one mammal, and two crustaceans (Table 1, Additional File 5). The average number of ethnospecies per village was 24.22 (± 8.5 SD), with a minimum of 14 recorded in Novo Paranapara and a maximum of 39 recorded in Nupune. Our interviews indicated that fishing was mainly for subsistence consumption, with surpluses occasionally being sold. However, the Salience index was positively correlated with the mean production observed in commercial fish landings carried out by indigenous fishermen from São Paulo de Olivença from 2008 to 2012 (Pearson's $R = 0.47$, $p = 0.0005$) (Figure 3A). Additionally, the *local relative importance perception* reported in our participatory exercises was positively correlated with the salience index (Pearson's $R = 0.53$, $p < 0.0001$) (Figure 3B). During the flood season, when fishing becomes more difficult, the villagers mentioned that fish be replaced by industrialized food such as frozen chicken and canned food purchased in São Paulo de Olivença.

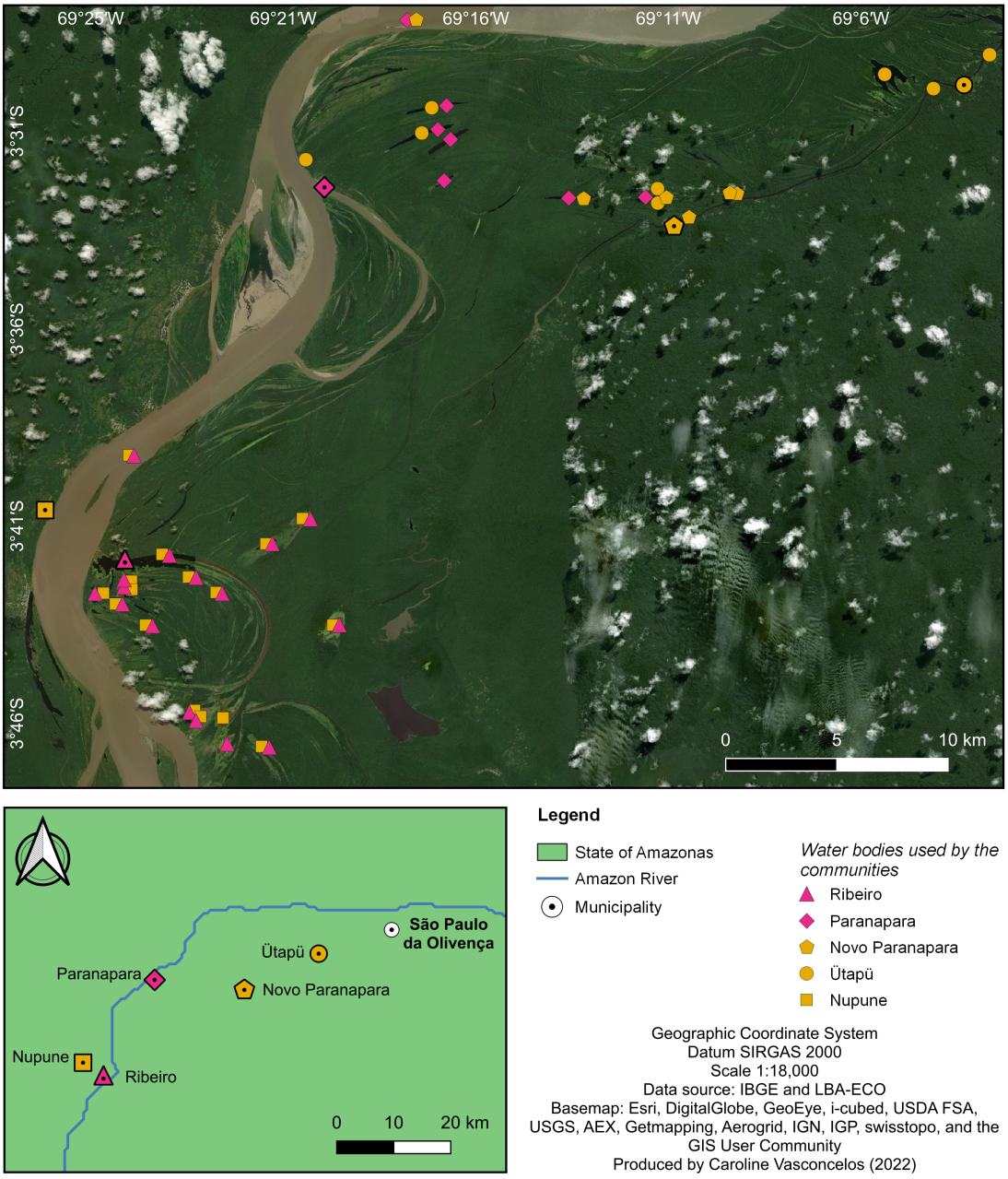

Figure 2. Water bodies used for fishing by five Tikuna villages on Évare Indigenous Land I, upper Solimões River reported in focus group interviews.

PCA ordination revealed a first factor-to-second factor eigenvalue ratio of 1.247, while the variations explained by the first two axes were 29.4% and 23.6%, respectively (Figure 4). The first component has negative loadings (see Additional File 6). These results indicate little structure among and within focus groups. However, the number of fishes cited correlated positively with the first component, indicating that the lists for the "present time" had high richness in comparison with the "past" and "future" time lists for the three villages. Additionally, five ethnospecies that exhibited the highest positive scores for the first component (*Prochilodus nigricans*, *Hoplias malabaricus*, *Serrasalmus* spp. and *Pygocentrus nattereri*) or the highest negative scores for the second component (*Pelona flavipinnis, Pimelodus blochii*) were among the list of the 20 most salient fish species (Table 1, Additional File 6).

A total of 62 plants were used for local con-

Table 1. Top 20 highest Salience Index values for fish species free-listed by three Tikuna villages of Éware Indigenous Lands I and II, upper Solimões River.

Order and Species	Tikuna Name	Frequency	Salience[1]	Landing (kg)[2]
OSTEOGLOSSIFORMES				
Arapaima gigas	Détchi	7	0,58 (02)	221
Osteoglossum bicirrhosum	Orowana	4	0,40 (08)	737
Clupeiformes				
Pelona flavipinnis	Onacatchi	5	0,28 (14)	1595
CHARACIFORMES				
Mylossoma spp.; *Myleus* spp.	Pacu, Ü'ta	7	0,51 (03)	5760
Triportheus spp.	Arawiri	7	0,49 (04)	3400
Cynodon gibbus; Rhaphiodon vulpinus	Yorewa, Wainayu	7	0,47 (05)	1233
Prochilodus nigricans	Caweya	6	0,42 (06)	13420
Piaractus brachypomus	Po'cu	5	0,41 (07)	523
Colossoma macropomum	Tomacatchi	6	0,32 (11)	254
Hoplias malabaricus	Dé	4	0,29 (13)	1736
S*errasalmus* spp.; *Pygocentrus nattereri*	Utchuma	4	0,28 (14)	499
SILURIFORMES				
Pseudoplatystoma punctifer	Yuta	7	0,64 (01)	2393
Pterygoplichthys spp.	Owaru	7	0,58 (02)	6120
Brachyplatystoma vaillantii	Müta, Cotchi	5	0,39 (09)	1015
Pimelodus blochii	Mo'ni	4	0,34 (10)	373
Lithodoras dorsalis; Pterodoras lentiginosus	Wocu, Tchumi	5	0,32 (11)	1807
Leiarius marmoratus	Taunü	5	0,29 (13)	450
Hypophthalmus spp.	Mapará	4	0,28 (14)	632
PERCIFORMES				
Cichla spp.	Tucunari	5	0,39 (09)	332,4
Cichlidae	Tchuná, Ma'nieru,	5	0,32 (11)	916,6
Astronatus ocellatus; Astronatus crassipinis	Ocara	4	0,31 (12)	0
Lithodoras dorsalis; Pterodoras lentiginosus	Wocu, Tchumi	5	0,32 (11)	1807

Legend: 1 The numbers in parentheses indicate salience index order; 2 The annual mean of the landing records collected from 2008 to 2012 in São Paulo de Olivença, upper Solimões River (Éware Tchoni Management Database).

sumption and sale; 53 (85.5%) were identified at the species level, 9 (14.5%) at the genus level, and one was unidentified (Additional File 5). Most of the species were native (77%). The average number of ethnospecies listed by focus group was 30.1 (± 12.8 SD), with a minimum of 13 for Novo Paranapara and a maximum of 46 for Nupune. Only 13 ethnospecies were found in five

Table 2. Top 20 highest Salience Index values for cultivated plant species free listed by three Tikuna villages of Éware Indigenous Lands I and II, upper Solimões River.

Life Form and Species	Tikuna Name	Site	Frequency	Salience[1]
HERBS				
Musa spp.	Poi', Iru i pumara r¨naitupara, Po´i y nge´e, Iru	swidden, garden, and yard	9*	0.90 (1)
Ananas sp.	Tchinü	swidden and yard	5	0.46 (8)
Peperomia pellucida	Tütchi	yard	6	0.43 (11)
Dioscorea alata	Uí,U'í	swidden	6	0.39 (15)
Acmella oleracea	Yabu, Yâbu	yard	5	0.29 (20)
PERENNIAL GRASS				
Saccharum officinarum	Dene	swidden and yard	8	0.62 (4)
Zea mays	Tchawü	swidden and cultivation	6	0.42 (13)
SHRUB				
Manihot esculenta	Tü'e, Tüe ya tchoüne, Awa, Tüe ya De´ene, Owa, Vará	swidden	8*	0.72 (2)
Carica papaya	Popaya	yard	5	0.31 (19)
Ipomoea batatas	Core, Co´re	swidden	6	0.29 (20)
PALM TREE				
Euterpe precatoria	Waira	swidden and yard	8	0.62 (4)
Mauritia flexuosa	Tema', Tema	yard	7	0.52 (6)
Cocos nucifera	Cucu	swidden and yard	8	0.35 (16)
TREE				
Inga spp.	Pama, Tchiatchiui, Ünapewa	swidden and yard	7*	0.63 (3)
Mangifera indica	Ma´ga	swidden and yard	6	0.48 (7)
Pouteria caimito	Taü, Tao	yard	6	0.46 (8)
Theobroma grandiflorum	Cupu	swidden and yard	7	0.45 (10)
Citrus sinensis	Naranha	yard	6	0.43 (11)
Pourouma sp.	Ichiã, Tchia, Tchinhã, Tchiãtchicii, Tchi´ã	swidden	7*	0.42 (13)
Anacardium occidentale	Coü'	swidden and yard	6	0.33 (17)

Legend: 1 Numbers in parentheses indicate the Salience Index order; * Species represented by more than one ethnospecies in the same list. In these cases, the salience index was calculated considering the position of the first ethnospecies cited.

or more lists. In addition, 8 ethnospecies were mentioned only once, and seven of them were mentioned only in the list for the past in the *várzea* (the trees *Ambelania acida*, *Artocarpus altilis*, *Pouteria venosa* and *Spondias mombin*, and the herbs *Cymbopogon citratus* and *Solanum lycopersicum*).

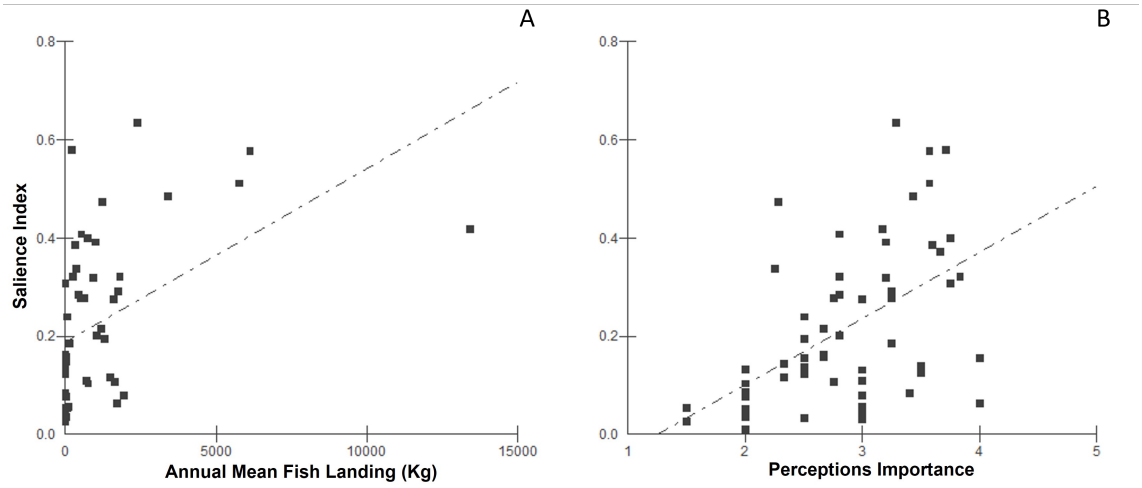

Figure 3. Correlation between the annual mean of landing fish records collected from 2008 to 2012 in São Paulo de Olivença, upper Solimões River, and the composite salience indices for fish of three Tikuna villages of Éware Indigenous Lands I and II.

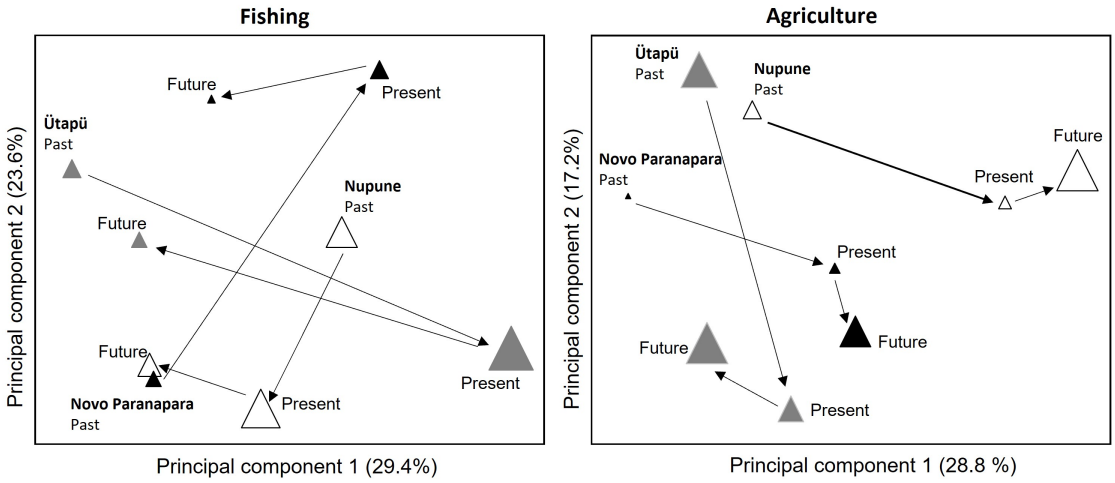

Figure 4. Projection of nine free lists in the space defined by the first and second principal components in the resource use of fish and cultivated plants considering the perceptions of importance in the past, present, and future of three Tikuna villages of the Éware Indigenous Lands I and II, upper Solimões River.

The 20 highest Salience indices (≥0.29) were obtained for five life forms (Table 2). The ethnospecies salience was independent of life form (Kruskal–Wallis test, H = 8.49, p<0.075) (Figure 5), and the *local relative importance perception* reported in our participatory exercises was not correlated with the salience index (Pearson's R = 0.0185, p = 0.886) (Figure 5).

PCA ordination returned a first factor-to-second factor eigenvalue ratio of 1.674, while the variations explained by the first two axes were 28.8% and 17.2%, respectively (Figure 4). The first component has negative loadings (see Additional File 6). These results also indicate little structure among and within focus groups. However, the number of cultivated plant species cited for "future time" was greater than that for "present" or "past" time for the three villages. Novo Paranapara and Ütapü were more dissimilar from each other in the "past time" than in the "present" and "future".

Several differences between floodplain and *terra firme* agriculture were identified by the Tikuna in the interviews; for example, they stated that there was a change in the quality of bananas and cassava, with *terra firme* swiddens producing smaller roots and banana trees with borers. Cassava plants were considered highly resistant to heat and drought. Varieties cultivated on *terra firme* were collected from the

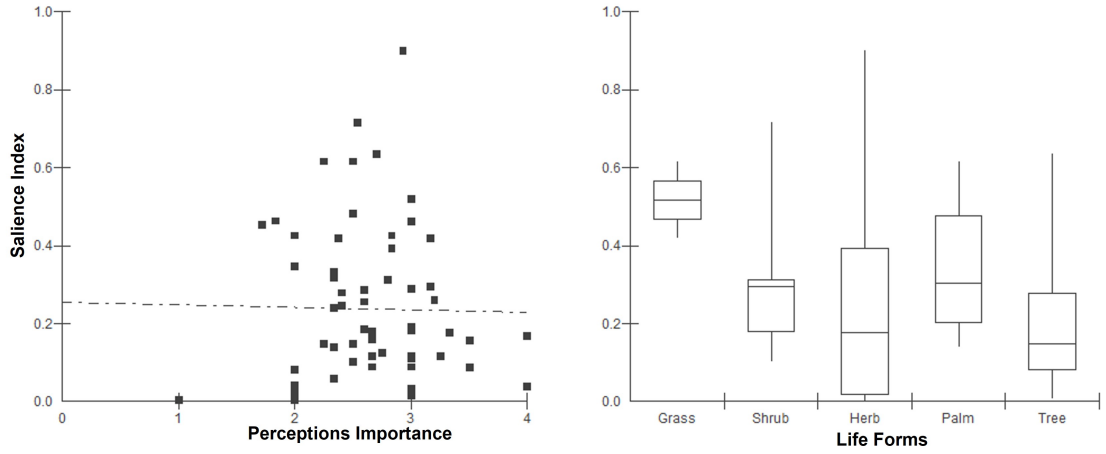

Figure 5. Correlation between the *local relative importance perceptions* and the composite salience indices for cultivated plants mentioned by three Tikuna villages of Éware Indigenous Lands I and II.

floodplain. The names of the cultivated varieties were not provided, but cassava and banana were the most common planted varieties. Variety exchanges within and between villages were mentioned. Women were responsible for storing the seeds for future planting.

Perceptions of climate change and extreme weather events

The phenomenon of global climate change and its connection with EWEs was not spontaneously invoked in the interviews on migration from *Várzea* to *Terra firme*, indicating that this debate was not yet present in Tikuna villages. After our presentation on the occurrence of EWEs from 1999 to 2017 and their relationship with global climate change, the collective discourse demonstrated a consensus that the weather was becoming less predictable, affecting fishing, hunting and agricultural activities. Several changes in their territory were related to climate change, even though this was their first contact with this topic (Table 3, Additional File 7). They also declared that extreme floods caused much damage to plantations and cultivated species in floodplains, and many trees died after being submerged for a long time during the extreme floods of 2012 and 2015.

Villagers in Novo Paranapara and Nupune declared that they did not receive any external information about weather. People from Ütapü have television access and receive meteorological information from the *Jornal Nacional* from Globo network news. However, such information was not considered useful. The three villages have very limited internet access at schools, but weather information is not sought by villagers, including students or teachers. The weather information shared in villages is exclusively derived from daily conversations and traditional knowledge. Without daily or seasonal weather information, villagers responded about the type of climate information they would like to receive and what the most efficient ways to share this information within the village or between villages were (Table 4).

Agricultural strategies to address social-eco changes

Amazonian indigenous agriculture was identified across the Tikuna villages as slash-and-burn agriculture where the crops are not rotated but rather as planting sites where the soil is exhausted or becomes unproductive. This agricultural approach is largely based on local knowledge and can also be considered climatically sustainable for the following reasons: not using external inputs, the high variety of cultivated species, the practice of leaving residues in the ground after harvest, and the management of fallow areas with the planting of species that accelerate soil recovery (for example, *Inga* sp.). In our focus group interviews, Tikunas from the three villages stated that they do not rotate crops in either the *várzea* or on *terra firme*; their animal husbandry is limited to ducks and chickens, which are free of range; and people do not intentionally use the manure from these animals as organic fertilizer (Additional File 8). When asked about practices in use to adapt agriculture to periods of long floods or long droughts, they answered that they did not use any practices for this specific purpose. Novo Paranapara and Ütapü reported collecting rainwater, which was not reported in Nupune. When asked about the possible effects of EWEs on populations of pirarucu, tambaqui, turtle and caimans and nonvolant terrestrial game species

in general (tapirs, agouti and monkeys), Tikunas from Novo Paranapara and Ütapü stated that it is difficult to fish during extreme floods, that there are no more freshwater turtles and that there is almost no more hunting. In Nupune, they said that the lakes become so dry during extreme droughts and that the water becomes so hot that the fish die.

The three villages demanded technical support for agriculture, but there are no projects to improve agroecological practices in Novo Paranapara and Nupune, and there is a lack of effective technical support. However, two projects are being developed in Ütapü, namely, the Swidden Without Burning Project (*Projeto Roça Sem Queima* in Portuguese), developed by CIMI Norte, and the "Life Project" (*Projeto Vida*, in Portuguese), which is the implementation of a collective garden at school using waste as fertilizer. Both projects are coordinated by teachers from the village.

DISCUSSION

Our results suggest that Tikunas villages from the upper Solimões River are adopting migration from lowlands to uplands (*várzea* to *terra firme movement*) as a coping strategy to increase the frequency and intensity of EWEs, droughts (2005 and 2010) and floods (2012 and 2015). In a short period of time, five new villages were created in *terra firme* areas; three were identified during a follow-up workshop of the Éware Tchoni Management, and two were mentioned by indigenous leaders in interviews during our field work. These findings agree that the impact of a succession of EWEs can be greater than the impact of a single disaster (Berlemann and Steinhardt 2017) and contrast with what was observed elsewhere in the Amazonia floodplain, where traditional riverine community dwellers do not abandon their *várzea* lands, despite the difficulties suffered by EWEs (Oliveira et al. 2012; Ávila et al. 2021). In fact, these studies indicate that traditional riverine communities use strategies to overcome the adverse effects of climate change on the basis of their ever-evolving knowledge (Ávila et al. 2021). Despite important continuities in the spatial histories of many Amazonian societies, historical records point to a long history of movements in the spatial organization of indigenous Amazonian societies (see Alexiades 2009). Our results also stress that climatic push events are just one of several factors influencing migration decisions (Black et al. 2011; Black et al. 2013). Thus, there are still significant gaps in our understanding of the complex relationship between climate change and Tikuna migration from *várzea* to *terra firme* as a coping strategy against global climate change. The livelihood activities of the Tikunas in the upper Solimões River region continue to be planned based on their local knowledge. However, recent EWEs remained in their memories as substantial famine periods, and all five new villages were created by splitting the ancient villages that were founded more than 40 years ago, indicating internal divisions, loss of reciprocity networks and increased vulnerability.

Migration implications for Tikuna socioecological strategies

The Tikuna have a long history of contact characterized by exploration and efforts to integrate into the surrounding national society (Almeida 2005; Catachunga et al. 2021). Even so, according to Almeida (2005), Tikuna society can be characterized as a domestic agricultural community because it a) practices self-subsistence agriculture; b) produces and consumes in common, common territories whose access is subordinated to that community; and c) is linked by unequal relationships of personal dependence.

Our studies revealed that the three Tikuna villages know well about and use or depend on a large diversity of biological resources, as described in other studies (Hammond et al. 1995; Almeida 2005; Noda et al. 2012; Dácio et al. 2018; Rebêlo et al. 2020; Faria Jr. et al. 2021). We found a positive relationship between both *local relative importance perception* and the salience index and between commercial fish landing records collected from 2008 to 2012 in São Paulo de Olivença (Figure 3). This result reveals the connections of small villages to the Tikuna fishing economy and indicates the importance of fishing resources not only as a source of subsistence but also as an economic activity (Almeida 2005; Noda et al. 2012; Faria Jr. et al. 2021). On the other hand, the *local relative importance perception* of cultivated plants was not correlated with the salience index, suggesting that Tikuna agrobiodiversity does not have different importance levels for species or varieties cultivated intentionally in swiddens or for noncyclical perennial plants, especially trees and palm trees, cultivated through the management of multiple spaces (gardens, yards, and fallow areas or *capoeiras* in different successional stages) (Figure 5). This agricultural system maintains the same characteristics as indigenous subsistence agriculture, pointed to as having a high level of self-sufficiency in terms of food studied in several Kokama and Tikuna communities in the upper Solimões River region and in Colombia, in which studies stress *várzea* centrality and the complementarity of *terra firme* for this high level of self-sufficiency (Hammond et al. 1995; Noda et al. 2012; Dácio et al. 2018).

Our interviews indicate that Novo Paranapara and Ütapü currently manage primarily *terra firme* areas

on the Camatiã River right (southern) bank, although they maintain small stretches of beach in *várzea* near rivers with short-cycle crops, such as watermelon and beans, while Nupune only develops agriculture on the *terra firme* on the Solimões River northern bank.

The consequences of this adaptative migration process can be the reduction in agricultural productivity caused by the continued use of acidic clay and poor nutrient levels in the soils of *terra firme* and the use of varieties adapted for cultivation in v*árzea* in *terra firme*. This process may result in overexploitation and a decrease in soil fertility around villages, impoverishment of diet, risks for food security, and conflicts with neighboring villages, which can be exacerbated by climate change (see Athayde and Silva-Lugo 2018). On the other hand, the high variety of cultivated species and the practice of leaving crop residues on the ground after harvest can increase the capacity to produce and minimize the effects of EWEs. The poorer soil quality in the *terra firme* region appears to be a major reason for the retention of crop residues after harvesting and managing swiddens and fallow areas during different recovery stages. This traditional agricultural practice also helps to reduce pests and protect soil moisture. In the same way, fisheries management over a wide diversity of species and lakes also increases the adaptive capacity and resilience of Tikuna villages. Taken together, these findings suggest that management practices are complementary and have enhanced food production and food security (Hammond et al. 1995; Noda et al. 2012; Dácio et al. 2018).

The main perception of Tikuna about the weather is that it is becoming less predictable, corroborating the findings of other studies (Pinho et al. 2015; Funatsu et al. 2019; Harris 2019; Ávila et al. 2021). Thus, although the intensity of the EWEs drew the attention of the focus groups interviewed, the duration of the EWEs was the factor of greatest concern. Apparently, for the Tikuna, it does not matter if the flood is a record but if the flood period starts or finishes much earlier than expected by local knowledge or if the ebb period takes longer to start or finish. This understanding is supported by statements of the effects of climate change that emerged from the collective discourse centered on the daily activities of these three villages, mainly those related to planting. For men, the river is shallower, the water is warmer, there are fewer fish, there is a delay in the planting season, there is a lot of smoke, and the soil is too hot. For women, the flooding and ebb periods are unregulated, the temperature is hotter, the sun kills the plants, and the fruits ripen out of season and are smaller (Table 3).

Thus, biocultural resilience is imprinted on the knowledge of indigenous people about seasonal regimes related to flood pulses in floodplains and the management of new *terra firme* settlements, and new or complementary knowledge is needed to address the complexity of global change. We highlight that these three villages demand technical support for agriculture, and there is a need to intensify lake monitoring to support and develop sustainable fisheries management, considering the constant threats from sectors with commercial interests in their natural resources and lands (e.g., fish merchants, farmers, loggers, and drug traffickers). Tikuna communities may also have to adopt new strategies to store food (see Ávila et al. 2022).

Only effective lake management guarantees the well-being and food security of indigenous people (Rebêlo et al. 2020). Although most fisheries occur in rivers, mainly in the Solimões River (sites with free access), lake systems are essential for the sustainability of fishing resources and the basis for the successful sustainable management of pirarucu (Gonçalves et al. 2018). In this context, it is essential that Tikuna people receive more information on the local effects of global change. With more knowledge about climate change, they may be better able to understand and innovate strategies to cope with this new complexity. However, although the debate on an international scale is growing, our results confirm that Tikuna people are on the margins of this process in the upper Solimões River, especially Tikuna women, who are central for several traditional practices, for example, seed storage (Arboleda and Barros 2016). If Tikuna women had the same access to communication technologies (i.e., cell phones) as men did, they could share information and learn cultivation techniques adapted to climate change, as was observed in traditional communities in India (Arora-Jonsson 2011; Chaudhury et al. 2012). Tikuna women have a strong connection with subsistence systems and with the production of traditional medicines, food, handicrafts, and utensils, as well as conservation and cultural transmission (Montero and Moreno 2014).

Future directions

Our results indicate that the debate on global climate change is not yet present or is very incipient among the Tikuna of the upper Solimões, even though they maintain active contact with other indigenous groups, such as the Yagua, Kokama, Huitoto, Kambeba and Culina, and with the "whites" and "caboclos" who make up the rural and urban population of this frontier region (López-Garcés 2002; Almeida 2005). This situation further weakens the resilience of these social groups and stresses the need for dialog between traditional and scientific knowledge about global climate change. This integration will provide

Table 3. Statements with weather perceptions in focus groups interviews about extreme weather events and global climate change across three Tikuna communities of Eware Indigenous Lands I and II, upper Solimões River.

Villages	***Women***	***Men***
Novo Paranapara	“Now we have to work much earlier, and we can only stay in our swiddens until 10:30 in the morning, when the sun still does not burn much” (41 years old).	"Currently, it is not possible to know if tomorrow it will be sunny or if it will rain, it is difficult to organize a fishing trip in the lakes" (46 years old).
	"In the past, great floods happened every 4 years. I remember the older ones asked for flood, to fertilize the land" (63 years old).	“In great floods is difficult to catch fish like tambaqui. There are no more turtles and there’s almost nothing for game either” (38 years old).
	“The very strong sun burns us and kills the plants” (48 years old).	“We experience a lot of losses in great floods or on severe droughts. On *terra firme*, when the drought is severe, the fish die, we run out of water to drink, and the creeks are very far from the houses” (42 years old).
Ütapü	“First I plant manioc, then I plant bananas to make better use of my garden and not run out of food to eat” (33 years old).	"Some floods are no longer occurring at the right time. Others come, but they no longer fill the river as before" (45 years old).
	“The time we spend in the swiddens decreased, because the heat became unbearable” (36 years old).	“In the dry season it is very difficult to fish, the lakes are far away and the very hot water in the lakes kills the fish” (57 years old).
	“The rains are irregular, which makes it more difficult to decide when to burn to make the swidden” (57 years old).	“The soil is getting hotter in our swiddens” (63 years old).
Nupune	"Great floods cause a lot of damage" (52 years old).	“We no longer know when summer or winter begins. The time when the river was supposed to be full, it is dry, the river is very different, the fish are getting more and more difficult” (63 years old).
	“During the dry season, the water in the river heats up, the fish die and the water becomes rotten without conditions for drinking”. (54 years old)	In the long drought, the lakes are very dry, the fish die with the water temperature (57 years old)
		“There is no fish in winter” (47 years old)
		“It is difficult to fish in the great floods” (28 years old)

information to the Tikuna people on the impacts of global climate change and, specifically, on how EWEs impact their ways of life. In this regard, they will be prepared to create or intensify their own strategies to overcome the adversities imposed by this new complexity. However, the way in which the topic of global climate change is often approached is far from the reality of indigenous groups. This fundamentally occurs because global and national debates still have not been fully articulated at other geographic scales. For many years, the consequences of climate change were foreseen for the future (and not for the present),

Table 4. Information on extreme weather events and global climate change and forms of communication suggested in interviews with focus groups in three Tikuna communities of the Eware Indigenous Lands I and II, upper Solimões River.

Villages	***Information***		***Communication***	
	Women	***Men***	***Women***	***Men***
Novo Paranapara	Change in everyday life	Which rainy months	Radio or someone in the community	Radio, School, and Church
Ütapü	Period of prolonged rain	Change of weather	Someone from the community or school	School, Church, and Community Leadership
Nupune	Change of weather and clime	Periods of prolonged rain and drought	Radio, school, and TV	Radio, School, and Church

but it is now evident how climate change is affecting everyone. In addition, although the causes are global, the adverse impacts of climate change are disproportionately burdening indigenous peoples, and they do not receive enough information to use their knowledge to cope with those impacts (Menezes and Bruno 2017).

Our experience in the upper Solimões River points to a challenge for the scientific community, which operates in the Amazon on at least three main fronts. First, it is necessary to move forward conservation planning approaches such as adaptive collaborative management, which provides a framework for integrating local and scientific knowledge, conducting joint analyses, and adjusting conservation and management strategies based on feedback from shared learning outcomes (Armitage et al. 2009). Our study is part of the Éware Tchoni Management effort started in 2003, which emphasized a participatory approach from the beginning (Rebêlo et al. 2011; Rebêlo et al. 2020). Tikuna increased their control over their territories, and 16 years after the first activity developed in collaboration, they carried out the first fishing of managed pirarucu in their lakes, a powerful initiative for both biodiversity conservation and the improvement of local livelihoods (Campos-Silva and Peres 2016; Campos-Silva et al. 2019). However, only in 2017 did we include the topic of global climate change in the Éware Tchoni Management effort. It is necessary to include such intercultural debate in all Amazonian initiatives for the conservation and management planning of common territories since the beginning, always in connection with local ecological knowledge and perceptions of indigenous peoples on this topic.

Second, it is necessary to create and implement a permanent public policy for adapting to climate change for the indigenous peoples of the Amazon, focusing on the practical and social effects of the initiatives to mitigate EWE risks (Menezes and Bruno 2017). The creation of the Ministry of Indigenous Peoples by the new presidential administration of Brazil may be an inflection point in this direction after the disastrous period of the Bolsonaro government (Ferrante and Fearnside 2021).

Third, media communication about climate change needs to go beyond reporting EWEs and addressing the impacts on indigenous people's daily lives, addressing not only risks and disaster news but also possible solutions. In other words, the news needs to stimulate a more qualified debate. The choice for more contextualized news, which offers consistent information and prevents the evident connections of the themes from being more explicit, is important for promoting a qualified debate and, perhaps, a way out for survival; furthermore, it can be fundamental for the involvement and mobilization of indigenous people to face climate risks. This is urgent, as in a rereading of news published in the media in the Alto Solimões region (Tabatinga and São Paulo de Olivença) between 1999 and 2017, we found that the highlights given by journalists to information on climate change were exclusively linked to the EWEs, but often, the news did not relate these events to global climate change (see Additional File 9). This mediation is extremely important for ensuring that scientific knowledge and sociopolitical decisions become public (Carvalho et al. 2011; CRED 2016). The media are central actors in the formulation, reproduction, and transformation of the meaning of this complex problem and are an arena for debate to legitimize and/or criticize political and economic options (Carvalho et al. 2011). In addition, the new media language based on smartphones and the Internet could be more attractive for better con-

textualizing the phenomenon and for discussing ways to address its risks. Almost all indigenous youths in the upper Solimões River region have smartphones and are connected, as are those in other places in the Amazon.

CONCLUSION

The migration from *Várzea* to *Terra firme* in three Tikuna villages was a coping strategy for the increase in the frequency and intensity of EWEs in the upper Solimões River in the western Brazilian Amazon. The people from the villages share memories of famine periods, internal divisions, loss of reciprocity networks and increased vulnerability.

The rapid inventory of Tikuna villages revealed rich traditional knowledge of the Éware Indigenous Land I and II and of resources, the basis for a fishing economy and an agricultural system, which maintain the same characteristics as indigenous subsistence agriculture and indicate a high level of self-sufficiency. These findings can contribute to formulating public policies to support indigenous people coping in the face of climate change.

The impacts of EWEs in the upper Solimões River are expected to increase sooner, particularly in habitats more exposed to flooding. Therefore, migration studies must be continued in the Éware territories, considering that this adaptation strategy is multifaceted and rooted in a complex historical context of violent integration into the surrounding Brazilian national society. We hope that a continuation of our studies reveals increased social organization across Éware territories and the capacity of Tikuna to create or intensify strategies to overcome the adversities imposed by climate change based on ancestral knowledge and social organization.

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DATA AVAILABILITY

The data used to support the findings of this study are available in the Supplementary Material and with the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

CONTRIBUTION STATEMENT

Conceptualization: MCL, GHR.
Investigation: MCL.
The MCL, GHR, and LMPH data were analyzed.
Wrote the first draft of the manuscript: MCL and LMPH.
Review and final writing of the manuscript: MCL, LMPH
Supervision: GHR, ACB.

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Additional Files

Add File 1. Participants.

Village	*Method*	*Age*	*Gender*	*Main livelihood*	*Clan*	*Type of Leadership*
Novo Paranapara	First group dialog and Free listing	30	M	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	30	M	family farmer	Acapu	
Novo Paranapara	First group dialog and Free listing	58	M	family farmer	?	
Novo Paranapara	First group dialog and Free listing	50	M	teacher	?	
Novo Paranapara	First group dialog and Free listing	38	M	family farmer	?	
Novo Paranapara	First group dialog and Free listing	30	M	family farmer	Arara	
Novo Paranapara	First group dialog and Free listing	50	M	family farmer	?	
Novo Paranapara	First group dialog and Free listing	43	M	family farmer	Maguari	
Novo Paranapara	First group dialog and Free listing	39	M	teacher	Mutum	
Novo Paranapara	First group dialog and Free listing	49	M	teacher	Avai	
Novo Paranapara	First group dialog and Free listing	46	M	family farmer	Jacó	
Novo Paranapara	First group dialog and Free listing	47	F	family farmer	Mutum	
Novo Paranapara	First group dialog and Free listing	60	F	family farmer	Jenipapo	
Novo Paranapara	First group dialog and Free listing	76	M	family farmer	Avai	
Novo Paranapara	First group dialog and Free listing	55	M	hunter	Maguari	
Novo Paranapara	First group dialog and Free listing	79	F	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	80	M	family farmer	Maguari	
Novo Paranapara	First group dialog and Free listing	68	M	family farmer	Maguari	
Novo Paranapara	First group dialog and Free listing	55	M	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	66	M	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	48	M	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	42	M	Indigenous health agent	Saúva	
Novo Paranapara	First group dialog and Free listing	46	M	family farmer	Avai	
Novo Paranapara	First group dialog and Free listing	56	M	teacher	Saúva	
Novo Paranapara	First group dialog and Free listing	38	F	family farmer	jacó	
Novo Paranapara	First group dialog and Free listing	34	F	family farmer	?	

Village	*Method*	*Age*	*Gender*	*Main livelihood*	*Clan*	*Type of Leadership*
Novo Paranapara	First group dialog and Free listing	39	M	family farmer	Avai	
Novo Paranapara	First group dialog and Free listing	49	F	family farmer	Mutum	
Novo Paranapara	First group dialog and Free listing	49	F	family farmer	Maguari	
Novo Paranapara	First group dialog and Free listing	39	F	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	29	M	family farmer	Mutum	
Novo Paranapara	First group dialog and Free listing	58	M	family farmer	Arara	
Novo Paranapara	First group dialog and Free listing	84	F	family farmer	Mutum	
Novo Paranapara	First group dialog and Free listing	60	F	family farmer	Onça	
Novo Paranapara	First group dialog and Free listing	49	M	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	68	F	family farmer	Jenipapo	
Novo Paranapara	First group dialog and Free listing	20	F	family farmer	Boi	
Novo Paranapara	First group dialog and Free listing	65	F	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	31	F	family farmer	Mutum	
Novo Paranapara	First group dialog and Free listing	87	M	fisherman	Japó	
Novo Paranapara	First group dialog and Free listing	48	F	family farmer	Japó	
Novo Paranapara	First group dialog and Free listing	50	M	fisherman	Mutum	
Novo Paranapara	First group dialog and Free listing	30	F	family farmer	Jacó	
Novo Paranapara	First group dialog and Free listing	22	F	family farmer	Onça	
Novo Paranapara	First group dialog and Free listing	52	F	family farmer	Maguari	
Novo Paranapara	First group dialog and Free listing	42	F	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	29	F	family farmer	Onça	
Novo Paranapara	First group dialog and Free listing	18	F	student	Saúva	
Novo Paranapara	First group dialog and Free listing	19	F	student	Saúva	
Novo Paranapara	First group dialog and Free listing	34	F	family farmer	Saúva	
Novo Paranapara	First group dialog and Free listing	31	F	family farmer	Maguari	
Novo Paranapara	Community mapping	52	M	teacher	Saúva	
Novo Paranapara	Community mapping	55	M	hunter	Maguari	
Novo Paranapara	Community mapping	46	M	family farmer	Japó	Chief
Novo Paranapara	Community mapping	66	M	family farmer	Avaí	
Novo Paranapara	Community mapping	87	M	fisherman	Japó	

Village	*Method*	*Age*	*Gender*	*Main livelihood*	*Clan*	*Type of Leadership*
Novo Paranapara	Community mapping	70	F	family farmer	Jenipapo	
Novo Paranapara	Community mapping	34	F	family farmer	Japó	
Novo Paranapara	Community mapping	50	M	teacher	Avai	
Novo Paranapara	Community mapping	38	M	family farmer	Saúva	
Novo Paranapara	Community mapping	50	M	fisherman	Mutum	
Novo Paranapara	Community mapping	30	M	family farmer	Avaí	
Novo Paranapara	Community mapping	55	M	family farmer	Mutum	
Novo Paranapara	Community mapping	57	F	family farmer	Japó	
Novo Paranapara	Community mapping	28	M	family farmer	Saúva	
Novo Paranapara	Community mapping	50	M	fisherman	Saúva	
Novo Paranapara	Focus group - Migration	42	M	Indigenous health agent	Saúva	
Novo Paranapara	Focus group - Migration	46	M	family farmer	Japó	Chief
Novo Paranapara	Focus group - Migration	39	M	family farmer	Avai	
Novo Paranapara	Focus group - Migration	48	M	family farmer	Sauva	
Novo Paranapara	Focus group - Migration	46	M	family farmer	Avai	
Novo Paranapara	Focus group - Migration	87	F	family farmer	Japó	
Novo Paranapara	Focus group - Migration	43	F	family farmer	Japó	
Novo Paranapara	Focus group - Migration	48	F	family farmer	Japó	
Novo Paranapara	Focus group - Migration	41	F	family farmer	Japó	
Novo Paranapara	Focus group - Climate change and EWEs	87	F	family farmer	Japó	
Novo Paranapara	Focus group - Climate change and EWEs	43	F	family farmer	Japó	
Novo Paranapara	Focus group - Climate change and EWEs	48	F	family farmer	Japó	
Novo Paranapara	Focus group - Climate change and EWEs	41	F	family farmer	Japó	
Novo Paranapara	Focus group - Climate change and EWEs	42	M	Indigenous health agent	Saúva	
Novo Paranapara	Focus group - Climate change and EWEs	49	M	teacher	Avai	
Novo Paranapara	Focus group - Climate change and EWEs	50	M	teacher	Saúva	
Novo Paranapara	Focus group - Climate change and EWEs	52	M	teacher	Saúva	

Village	*Method*	*Age*	*Gender*	*Main livelihood*	*Clan*	*Type of Leadership*
Novo Paranapara	Focus group - Adaptation and Climate Smart Agriculture	48	M	family farmer	Saúva	
Novo Paranapara	Focus group - Adaptation and Climate Smart Agriculture	48	F	family farmer	Japó	
Novo Paranapara	Focus group - Adaptation and Climate Smart Agriculture	43	F	family farmer	Japó	
Novo Paranapara	Focus group - Adaptation and Climate Smart Agriculture	26	M	family farmer	Saúva	
Novo Paranapara	Focus group - Adaptation and Climate Smart Agriculture	38	M	family farmer	Saúva	
Novo Paranapara	Focus group - Adaptation and Climate Smart Agriculture	42	M	Indigenous health agent	Saúva	
Novo Paranapara	Focus group - Adaptation and Climate Smart Agriculture	20	M	family farmer	Saúva	
Novo Paranapara	Guided Tour	38	M	family farmer	Saúva	
Novo Paranapara	Guided Tour	42	M	Indigenous health agent	Saúva	
Ütapü	First group dialog and Free listing	50	M	teacher	Mutum	
Ütapü	First group dialog and Free listing	50	M	family farmer	Japó	
Ütapü	First group dialog and Free listing	36	M	fisherman	Saúva	
Ütapü	First group dialog and Free listing	42	M	fisherman	Mutum	
Ütapü	First group dialog and Free listing	64	F	family farmer	Jaburu	
Ütapü	First group dialog and Free listing	56	F	family farmer	Saúva	
Ütapü	First group dialog and Free listing	55	M	family farmer	Maguari	
Ütapü	First group dialog and Free listing	?	F	family farmer	Onça	
Ütapü	First group dialog and Free listing	?	F	family farmer	Mutum	
Ütapü	First group dialog and Free listing	81	F	family farmer	Saúva	
Ütapü	First group dialog and Free listing	36	M	family farmer	Saúva	Pentecostal Pastor
Ütapü	First group dialog and Free listing	52	M	family farmer	?	
Ütapü	First group dialog and Free listing	18	M	student	Mutum	
Ütapü	First group dialog and Free listing	30	F	family farmer	Saúva	
Ütapü	First group dialog and Free listing	26	M	fisherman	Japó	

Village	*Method*	*Age*	*Gender*	*Main livelihood*	*Clan*	*Type of Leadership*
Ütapü	Community mapping	50	M	teacher	Mutum	
Ütapü	Community mapping	50	M	family farmer	Japó	
Ütapü	Community mapping	36	M	fisherman	Saúva	
Ütapü	Community mapping	42	M	fisherman	Mutum	
Ütapü	Community mapping	64	F	family farmer	Jaburu	
Ütapü	Community mapping	56	F	family farmer	Saúva	
Ütapü	Community mapping	55	M	family farmer	Maguari	
Ütapü	Community mapping	?	F	family farmer	Onça	
Ütapü	Community mapping	?	F	family farmer	Mutum	
Ütapü	Community mapping	81	F	family farmer	Saúva	
Ütapü	Community mapping	36	M	family farmer	Saúva	Pentecostal Pastor
Ütapü	Community mapping	52	M	family farmer	?	
Ütapü	Community mapping	18	M	student	Mutum	
Ütapü	Community mapping	30	F	family farmer	Saúva	
Ütapü	Community mapping	26	M	fisherman	Japó	
Ütapü	Focus group - Migration	40	M	fisherman	Onça	
Ütapü	Focus group - Migration	57	M	fisherman	Saúva	
Ütapü	Focus group - Migration	39	M	fisherman	Japó	
Ütapü	Focus group - Migration	63	M	family farmer	Saúva	
Ütapü	Focus group - Migration	28	F	family farmer	Maguari	
Ütapü	Focus group - Migration	36	F	family farmer	Mutum	
Ütapü	Focus group - Migration	57	F	family farmer	Mutum	
Ütapü	Focus group - Migration	33	F	teacher/family farmer	Avaí	
Ütapü	Focus group - Migration	42	F	family farmer	Japó	
Ütapü	Focus group - Climate change and EWEs	40	M	fisherman	Onça	
Ütapü	Focus group - Climate change and EWEs	57	M	fisherman	Saúva	
Ütapü	Focus group - Climate change and EWEs	39	M	fisherman	Japó	
Ütapü	Focus group - Climate change and EWEs	63	M	family farmer	Saúva	
Ütapü	Focus group - Climate change and EWEs	28	F	family farmer	Maguari	

Village	*Method*	*Age*	*Gender*	*Main livelihood*	*Clan*	*Type of Leadership*
Ütapü	Focus group - Climate change and EWEs	36	F	family farmer	Mutum	
Ütapü	Focus group - Climate change and EWEs	57	F	family farmer	Mutum	
Ütapü	Focus group - Climate change and EWEs	33	F	teacher/family farmer	Avaí	
Ütapü	Focus group - Climate change and EWEs	42	F	family farmer	Japó	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	50	M	family farmer	Japó	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	40	M	fisherman	Onça	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	28	F	family farmer	Maguari	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	36	F	family farmer	Mutum	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	57	F	family farmer	Mutum	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	36	M	family farmer	Saúva	Pentecostal Pastor
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	52	M	family farmer	?	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	26	M	fisherman	Japó	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	39	M	fisherman	Japó	
Ütapü	Focus group - Adaptation and Climate Smart Agriculture	50	M	teacher	Mutum	
Ütapü	Guided Tour	50	M	family farmer	Japó	
Ütapü	Guided Tour	55	M	family farmer	Maguari	
Nupume	First group dialog	57	M	family farmer	Mutum	Chief
Nupume	First group dialog	?	M	family farmer	Mutum	
Nupume	First group dialog	?	F	family farmer	Mutum	
Nupume	First group dialog	?	M	fisherman	Jenipapo	
Nupume	First group dialog	?	F	family farmer	Jenipapo	

Village	*Method*	*Age*	*Gender*	*Main livelihood*	*Clan*	*Type of Leadership*
Nupume	First group dialog	?	F	family farmer	Mutum	
Nupume	First group dialog	?	F	family farmer	Mutum	
Nupume	First group dialog	?	F	family farmer	Jenipapo	
Nupume	First group dialog	?	M	fisherman	Mutum	
Nupume	First group dialog	?	F	family farmer	?	
Nupume	First group dialog	?	M	family farmer	?	
Nupume	First group dialog	?	M	family farmer	Buriti	
Nupume	First group dialog	?	M	family farmer	Mutum	
Nupume	First group dialog	28	M	fisherman	Mutum	
Nupume	First group dialog	21	M	family farmer	Boi	
Nupume	First group dialog	18	M	student	Saúva	
Nupume	First group dialog	21	M	student	Saúva	
Nupume	First group dialog	57	M	family farmer	Mutum	Chief
Nupume	Community mapping	28	M	fisherman	Mutum	
Nupume	Community mapping	21	M	family farmer	Boi	
Nupume	Community mapping	18	M	student	Saúva	
Nupume	Community mapping	21	M	student	Saúva	
Nupume	Community mapping	57	M	family farmer	Mutum	Chief
Nupume	Focus group - Migration	52	F	family farmer	Saúva	
Nupume	Focus group - Migration	54	F	family farmer	Japó	
Nupume	Focus group - Migration	?	F	family farmer	Jenipapo	
Nupume	Focus group - Migration	?	F	family farmer	?	
Nupume	Focus group - Migration	57	M	family farmer	Mutum	Chief
Nupume	Focus group - Migration	47	M	family farmer	Boi	
Nupume	Focus group - Migration	?	M	family farmer	Mutum	
Nupume	Focus group - Climate change and EWEs	52	F	family farmer	Saúva	
Nupume	Focus group - Climate change and EWEs	54	F	family farmer	Japó	
Nupume	Focus group - Climate change and EWEs	?	F	family farmer	Jenipapo	
Nupume	Focus group - Climate change and EWEs	?	F	family farmer	?	
Nupume	Focus group - Climate change and EWEs	?	F	family farmer	Mutum	

Village	*Method*	*Age*	*Gender*	*Main livelihood*	*Clan*	*Type of Leadership*
Nupume	Focus group - Climate change and EWEs	?	F	family farmer	Jenipapo	
Nupume	Focus group - Climate change and EWEs	28	M	fisherman	Mutum	
Nupume	Focus group - Climate change and EWEs	?	M	family farmer	Mutum	
Nupume	Focus group - Climate change and EWEs	?	M	family farmer	Mutum	
Nupume	Focus group - Climate change and EWEs	47	M	family farmer	Boi	
Nupume	Focus group - Climate change and EWEs	57	M	family farmer	Mutum	Chief
Nupume	Focus group - Climate change and EWEs	18	M	student	Saúva	
Nupume	Focus group - Climate change and EWEs	21	M	student	Saúva	
Nupume	Focus group - Adaptation and Climate Smart Agriculture	57	M	family farmer	Mutum	Chief
Nupume	Focus group - Adaptation and Climate Smart Agriculture	?	M	family farmer	Mutum	
Nupume	Focus group - Adaptation and Climate Smart Agriculture	?	F	family farmer	?	
Nupume	Focus group - Adaptation and Climate Smart Agriculture	54	F	family farmer	Japó	
Nupume	Focus group - Adaptation and Climate Smart Agriculture	52	F	family farmer	Saúva	
Nupume	Focus group - Adaptation and Climate Smart Agriculture	18	M	student	Saúva	
Nupume	Focus group - Adaptation and Climate Smart Agriculture	21	M	student	Saúva	
Nupume	Guided Tour	57	M	family farmer	Mutum	Chief

Add File 2. Methods.

Fieldwork Steps	***Method***	***Purpose***
1 - Migration	Focus group	Explore local perceptions on motivations and migration process
1 - Migration	Resource map (community mapping)	Identify perceptions of relative importance of local fishing areas and cultive sites
1 - Migration	Historical-ecological matrix (free listing)	Understand how resources use has changed over time and between areas
2 - Climate change and extreme weather events	Focus group	Explore local perceptions of climate change and extreme weather events
3 – Adaptation and climate smart agriculture	Focus group	Explore local adaptation strategies
3 – Adaptation and climate smart agriculture	Guided Tour	Observe and reaffirm information and ideas gathered in interviews

Add File 3. Focus group – Migration to explore local perceptions of motivations and migration processes.

Fieldwork step	Village	Focus group	Como foi escolhido o lugar para onde s e mudaram?	O que levou a mudança?	Como a mudança afetou a vida das famílias das comunidades?	Como está sendo a adaptação ao novo lugar?	Como era a pescaria e o cultivo antes da mudança? E agora?	Você diria que a mudança foi causada pelos eventos extremo climáticos?
Focus group - Migration	Novo Paranapara	women	O lugar foi escolhido pelo Sr. João Belmiro Bilitão, que não havia gostado do lugar onde o cacique da comunidade Paranapará havia escolhido, então resolveu procurar um lugar que fosse melhor para plantar. O Sr. João construiu sua casa junto com sua família e permaneceu sozinho no local até 2016, quando os que permaneceram na comunidade Paranapará se mudaram aos poucos	Foi o desbarrancamento da comunidade que iniciou em 2010, as casas caíram todas.	No início foi difícil, pois não havia recursos para trazer nossas coisas da comunidade. Nós tivemos que montar um barraco para morar, aqui só tinha o peixe. Todo o resto precisava ser comprado na cidade. Hoje já está melhor.	Está sendo bom. Agora não temos mais medo de perder a casa, já estamos plantando, temos nossa igreja e escola.	Tinha muito peixe na várzea, para nossa alimentação e para venda. Plantávamos na ilha e no quintal, tinha bastante fruta. Mas, quando vinha a cheia, morria tudo e depois, quando secava, tinha que comprar farinha em outro lugar.	Sim, são coisas que não podemos controlar, é da natureza.
Focus group - Migration	Novo Paranapara	men	Alguns moradores da comunidade Paranapaná não gostaram do lugar que o cacique havia escolhido, gerando uma certa resistência de alguns que não queriam deixar suas casas. Já tinha caido metade da comunidade e os que ficaram estavam com medo de continuar no local, foi então que resolveram se mudar para o local onde o Sr. João estava com a família.	Foi o desbarrancamento de terra da comunidade.	Aos poucos estamos nos adaptando. Em questão de alimentação foi difícil, pois precisávamos comprar na cidade, na terra firme demora para dar frutos. Não tinha escola para nossos filhos. A várzea por muito tempo foi nosso local de moradia, tinhas nossos peixes, nossa plantação e nossas histórias. Foi difícil perder nossa casa, mas ninguém manda na natureza.	Na terra firme, a gente não se preocupa com as cheias não precisamos ficar mexendo nas nossas casas e nem retirar as mandiocas antes do tempo.	Tem muito peixe, na cheias eles se espalham fica mais difícil de pescar bodó, na seca os peixes morrem com a temperatura da água, na roça muitas vezes tinha que tirar antes do tempo porque apodrece as raízes as bananeiras morrem. E agora os peixes estão cada vez mais miúdos e na roça não precisamos tirar todas as mandiocas de uma vez como antes.	Sim, e tem outras comunidades se mudando pelo mesmo motivo, continua desbarrancando as terras.
Focus group - Migration	Ütapü	women	Quem escolheu o lugar foi o cacique Berezinho Lito Anastásio. Ele avisou para a comunidade. Alguns homens vieram conhecer o local, mas acharam o local ruim para plantar. O cacique e o agente de saúde foram os primeiros a montar suas casas. Depois disso, os que ficaram começaram aos poucos a se mudar para o Camatiã. Nós mulheres só acompanhamos nossas famílias.	Desbarrancamento de terra da comunidade	Foi difícil, pois morávamos a muito tempo na várzea e ninguém sabia como ia ser na terra firme. Tínhamos roça e muito peixe. Nossa vida na várzea era sofrida por causa das enchentes, tínhamos que mudar a casa e perdíamos tudo das nossas roças.	Está sendo boa. Aqui plantamos mais e não precisamos ficar mudando de casa.	A pescaria era boa, tem muito peixe na várzea. Na terra firme tem também bastante peixe. Na várzea, plantávamos menos, o período de colheita era mais estreito que na terra firme.	Sim, porque antes não tinham muitas cheias grandes.

Fieldwork step	**Village**	**Focus group**	**Como foi escolhido o lugar para onde s e mudaram?**	**O que levou a mudança?**	**Como a mudança afetou a vida das famílias das comunidades?**	**Como está sendo a adaptação ao novo lugar?**	**Como era a pescaria e o cultivo antes da mudança? E agora?**	**Você diria que a mudança foi causada pelos eventos extremo climáticos?**
Focus group - Migration	Ütapü	men	Andaram em canoas 15 pessoas e escolheram o Camatiã junto com o cacique Berezinho Lito Anastásio, viemos limpar o local, fizemos reunião com a comunidade, só que tinha família que não queria vir por causa da escola e da igreja e das nossas casas.	Foram as enchentes grande e o desbarrancamento	Foi difícil. Nós tivemos que desmanchar as nossas casas, algumas famílias construíram aos poucos sua casa na terra firme. Nós tínhamos tudo na várzea, só que o barranco já estava chegando próximo das nossas casas.	Estar sendo boa, já temos nossas plantações e temos energia 24 horas.	A pescaria era boa, tinha muito peixe. Agora, só tem peixes miúdo, as comunidades não estão preservando os lagos, tem algumas espécies que não encontramos mais na terra firme. Na terra firme estamos cultivando mais espécies que na várzea.	Sim, as enchentes grandes trazem muitos prejuízos.
Focus group - Migration	Nupume	women	O local foi escolhido pelos nossos maridos, que começaram a plantar e construir um barraco. Como já existia uma comunidade ao lado, não foi preciso cortar as árvores.	Durante quatro anos sofremos com as cheias, tivemos muitos prejuízos com as plantações.	Como fica ao lado da comunidade Novo Paraíso, já tinha escola para nossos filhos. Depois colocaram energia, não sentimos muitas dificuldades porque no início tivemos ajuda da defesa civil para construir nossas casas.	Estamos nos adaptando bem. Sentimos dificuldades em plantar laranja e a banana. Na pesca tem muito peixe.	A banana na terra firme só dá três vezes. Além disso, na várzea, a qualidade era melhor. Na várzea, pescávamos pirarucu e tambaqui para vender e comprar outros alimentos, agora só estamos pescando peixe miúdo.	Sim, pois as enchentes trazem muitos prejuízos na várzea.
Focus group - Migration	Nupune	men	Tinha uma moradora que já tinha uma capoeira na terra firme. Ela convidou o seu genro para se mudar para esse local, porque tudo que plantavam na várzea morria. Foi o genro dela que falou com cacique Celso para informar que iria se mudar para outro lado e que já havia feito uma casinha na terra firme de lá. Ele se mudou e o cacique Celso e sua família resolveram acompanhar. Eles primeiro construíram suas casas na terra firme alta, depois fizeram uma roça grande e no ano seguinte se mudaram juntamente com suas famílias. Mas, a maior parte da comunidade ainda continua na comunidade Ribeiro.	As cheias dos anos anteriores. Perdemos todo nosso roçado.	Tivemos que deixar nossas plantações e casas. No começo foi difícil, pois a comunidade ao lado não queria, depois fomos convivendo com eles. As comunidades são separadas.	Agora melhorou, já plantamos muitas coisas, construímos nossa igreja e nossas casas, não fica longe dos lagos.	Agora para caça tem que andar muito para encontra os bichos. Os lagos não são vigiados e os indígenas de Vendaval não respeitam os lagos.	Sim, pelas enchentes.

Add File 4. A resource map (community mapping) was used to identify perceptions of the relative importance of local fishing areas and culture sites.

Village	***Resource***	***Use***	***Site***
Paranapara	Fishing area	Before migration	Lago Piranha
Paranapara	Fishing area	Before migration	Lago Pacu Baixo
Paranapara	Fishing area	Before migration	Lago Pacu Fundo
Paranapara	Fishing area	Before migration	Lago Chibuizinho
Paranapara	Fishing area	Before migration	Lago do Gago
Paranapara	Fishing area	Before migration	Rio Solimões
Novo Paranapara	Fishing area	After migration	Lago Cacau
Novo Paranapara	Fishing area	After migration	Lago do Gago
Novo Paranapara	Fishing area	After migration	Igarapé Itaboca
Novo Paranapara	Fishing area	After migration	Lago Chibuizinho
Novo Paranapara	Fishing area	After migration	Rio Camatiã
Novo Paranapara	Fishing area	After migration	Rio Solimões
Paranapara	Fishing area	Before migration	Lago Chibuizinho
Paranapara	Fishing area	Before migration	Lago Remanso
Paranapara	Fishing area	Before migration	Lago do Piranha
Paranapara	Fishing area	Before migration	Lago Pacu Baixo
Paranapara	Fishing area	Before migration	Rio Solimões
Paranapara	Fishing area	Before migration	Lago Chibui
Paranapara	Fishing area	Before migration	Lago do Cara
Ütapü	Fishing area	After migration	Lago Sacabo
Ütapü	Fishing area	After migration	Lago Chibuizinho
Ütapü	Fishing area	After migration	Lago do Piranha
Ütapü	Fishing area	After migration	Lago Pacu Baixo
Ütapü	Fishing area	After migration	Lago do Cacau
Ütapü	Fishing area	After migration	Rio Camatiã
Ütapü	Fishing area	After migration	Rio Solimões
Ütapü	Fishing area	After migration	Lago Uraxira
Ütapü	Fishing area	After migration	Igarapé Garcua
Ribeiro	Fishing area	Before migration	Lago Carnapia
Ribeiro	Fishing area	Before migration	Lago Cipó

Village	***Resource***	***Use***	***Site***
Ribeiro	Fishing area	Before migration	Lago Coendo
Ribeiro	Fishing area	Before migration	Lago Comprido
Ribeiro	Fishing area	Before migration	Lago Corral
Ribeiro	Fishing area	Before migration	Lago Macapuama
Ribeiro	Fishing area	Before migration	Lago Maguari
Ribeiro	Fishing area	Before migration	Lago do Maité
Ribeiro	Fishing area	Before migration	Lago Marajá
Ribeiro	Fishing area	Before migration	Lago Mirituba
Ribeiro	Fishing area	Before migration	lago Mungubal
Ribeiro	Fishing area	Before migration	Lago Preto
Ribeiro	Fishing area	Before migration	Lago do Redondo
Ribeiro	Fishing area	Before migration	lago do Remuja
Ribeiro	Fishing area	Before migration	Lago do Ribeirinho
Ribeiro	Fishing area	Before migration	Rio Solimões
Ribeiro	Fishing area	Before migration	Paraná do Ribeiro
Nupune	Fishing area	After migration	Lago Carnapia
Nupune	Fishing area	After migration	Lago Cipó
Nupune	Fishing area	After migration	Lago Coendo
Nupune	Fishing area	After migration	Lago Comprido
Nupune	Fishing area	After migration	Lago corral
Nupune	Fishing area	After migration	Lago Macapuama
Nupune	Fishing area	After migration	Lago Maguari
Nupune	Fishing area	After migration	Lago do Maité
Nupune	Fishing area	After migration	Lago Marajá
Nupune	Fishing area	After migration	Lago Mirituba
Nupune	Fishing area	After migration	lago mungubal
Nupune	Fishing area	After migration	Lago Preto
Nupune	Fishing area	After migration	Lago do Redondo
Nupune	Fishing area	After migration	lago do Remuja
Nupune	Fishing area	After migration	Lago do Ribeirinho
Nupune	Fishing area	After migration	Rio Solimões
Nupune	Fishing area	After migration	Paraná do Ribeiro

Add File 5. A historical-eco-matrix (free listing) was used to determine how resource use has changed over time and between areas.

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
1_A	Novo Parana-para	2008	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira	Tü'e, Tüe ya tchoüne	2	shrub	native	swidden
1_A	Novo Parana-para	2008	Malpiphigiales	Euphorbiaceae	*Manihot esculenta*	Mandioca	Awa, Tüe ya De´ene	3	shrub	native	swidden
1_A	Novo Parana-para	2008	Zingiberales	Musaceae	*Musasssss* spp.	Banana	Poi'	4	herb	exotic	swidden
1_A	Novo Parana-para	2008	Poales	Poaceae	*Zea mays*	Milho	Tchawü	2	perennial grass	exotic	swidden
1_A	Novo Parana-para	2008	Poales	Poaceae	*Saccharum officinarum*	Cana	Dene	1	perennial grass	native	swidden
1_A	Novo Parana-para	2008	Cucurbitales	Cucurbitaceae	*Citrullus lanatus*	Melancia	Woratchia	2	herb/climber	exotic	swidden
1_A	Novo Parana-para	2008	Fabales	Fabaceae	*Vigna unguiculata*	Feijão	Peyaü	3	herb	exotic	"sitio" or "quintal"
1_A	Novo Parana-para	2008	?	?	?	Madeira	Ünapewa	3	tree	native	forest
1_A	Novo Parana-para	2008	Solanales	Convolvulaceas	*Ipomoea batatas*	Batata-doce	Core, Co´re	2	shrub	native	swidden
1_A	Novo Parana-para	2008	Arecales	Arecaceae	*Cocos nucifera*	Coco	Cucu	2	palm tree	exotic	"sitio" or "quintal"
1_A	Novo Parana-para	2008	Brassicales	Caricaceae	*Carica papaya*	Mamão	Popaya	2	shrub	exotic	"sitio" or "quintal"
1_A	Novo Parana-para	2008	Arecales	Arecaceae	*Euterpe oleracea*	Açaí	Waira	1	palm tree	native	swidden
1_A	Novo Parana-para	2008	Malpighiales	Clusiaceae	*Platonia insignis*	Bacuri	Cowi	3	tree	native	"sitio" or "quintal"
1_F	Novo Parana-para	2008	Siluriformes	Pimelodidae	*Brachyplatystoma vaillantii*	Piramutaba, Pirabutão	Müta, Cotchi	4	catfish		
1_F	Novo Parana-para	2008	Siluriformes	Pimelodidae	*Pseudoplatystoma punctifer*	Surubim	Yuta	4	catfish		
1_F	Novo Parana-para	2008	Siluriformes	Doradidae	*Lithodoras dorsalis; Pterodoras lentiginosus*	Bacu, Bacu-onça	Wocu	4	catfish		
1_F	Novo Parana-para	2008	Siluriformes	Pimelodidae	*Pimelodus blochii*	Mandi, Mandii	Mo'ni	3	catfish		
1_F	Novo Parana-para	2008	Siluriformes	Pimelodidae	*Leiarius marmoratus*	Jandiá	Taunü	3	catfish		
1_F	Novo Parana-para	2008	Characiformes	Cynodontidae	*Cynodon gibbus; Rhaphiodon vulpinus*	Peixe-cachorro, Peixe-mucura	Yorewa	1	scale fish		
1_F	Novo Parana-para	2008	Siluriformes	Pimelodidae	*Hypophthalmus* spp.	Mapará	Mapará	4	catfish		
1_F	Novo Parana-para	2008	Clupeiformes	Pristigasteridae	*Pelona flavipinnis*	Arenga, Apapá-branco	Onacatchi	3	scale fish		
1_F	Novo Parana-para	2008	Characiformes	Characidae	*Colossoma macropomum*	Tambaqui	Tomacatchi	3	scale fish		

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
1_F	Novo Parana-para	2008	Siluriformes	Pimelodidae	*Pinirampus pirinampu*	Barba-chata, Barbado	Dútchinagü	3	catfish		
1_F	Novo Parana-para	2008	Siluriformes	Pimelodidae	*Phractocephalus hemiliopterus*	Pirarara	Pué, Ôê	4	catfish		
1_F	Novo Parana-para	2008	Testudines	Podocnemididae	*Podocnemis unifilis*	Tracajá	To'ri	4	turtle		
1_F	Novo Parana-para	2008	Characiformes	Characidae	*Triportheus* spp.	Sardinha	Arawiri	2	scale fish		
1_F	Novo Parana-para	2008	Characiformes	Curimatidae	*Potamorhina* spp.	Branquinha, Chorão	Tchuraũ, Tchuraü	2	scale fish		
1_F	Novo Parana-para	2008	Characiformes	Prochilodontidae	*Prochilodus nigricans*	Curimatã	Caweya	1	scale fish		
1_F	Novo Parana-para	2008	Siluriformes	Auchenipteridae	*Ageneiosus* spp.	Mandubé	Doma	1	catfish		
1_F	Novo Parana-para	2008	Siluriformes	Callichthyidae	*Hoplosternum litoralle*	Tamoatá	Tchuru	4	catfish		
1_F	Novo Parana-para	2008	Perciforme	Cichlidae	*Cichla* spp.	Tucunaré	Tucunari	4	scale fish		
2_A	Novo Parana-para	2018	Zingiberales	Musaceae	*Musa* spp.	Banana	Poi'	4	herb	exotic	swidden
2_A	Novo Parana-para	2018	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira	Tüe ya tchoüné	1	shrub	native	swidden
2_A	Novo Parana-para	2018	Poales	Bromeliaceae	*Ananas* sp.	Abacaxi	Tchinü	4	herb	native	swidden
2_A	Novo Parana-para	2018	Poales	Poaceae	*Saccharum officinarum*	Cana	Dene	3	perennial grass	native	swidden
2_A	Novo Parana-para	2018	Ericales	Sapotaceae	*Pouteria caimito*	Abiu	Taü, Tao	3	tree	native	"sitio" or "quintal"
2_A	Novo Parana-para	2018	Fabales	Fabaceae	*Inga edulis*	Ingá	Pama	3	tree	native	"sitio" or "quintal"
2_A	Novo Parana-para	2018	Dioscoreales	Dioscoreaceae	*Dioscorea alata*	Cará	Uí	4	perenniall herb	native	swidden
2_A	Novo Parana-para	2018	Solanales	Convolvulaceas	*Ipomoea batatas*	Batata-doce	Core, Co´re	4	shrub	native	swidden
2_A	Novo Parana-para	2018	Solanales	Solanaceae	*Capsicum* sp.	Pimenta-de-cheiro	Me' ya üeüwe-muruũ	2	shrub	native	"sitio" or "quintal"
2_A	Novo Parana-para	2018	Poales	Poaceae	*Zea mays*	Milho	Tchawü	4	perennial grass	exotic	swidden
2_A	Novo Parana-para	2018	Rosales	Urticaceae	*Pourouma* sp.	Mapatí	Ichiã	2	tree	native	"sitio" or "quintal"
2_A	Novo Parana-para	2018	Malpiphigiales	Euphorbiaceae	*Manihot esculenta*	Mandioca	Tü'e ya De´ene, Owa	1	shrub	native	swidden
2_A	Novo Parana-para	2018	Zingiberales	Musaceae	*Musa* spp.	Banana-maçã	Iru i pumara r¨naitupara	3	herb	exotic	swidden
2_A	Novo Parana-para	2018	Zingiberales	Musaceae	*Musa* spp.	Banana-quarilo	Po´i y nge´e	3	herb	exotic	swidden

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
2_A	Novo Paranapara	2018	Malvales	Malvaceae	*Theobroma grandiflorum*	Cupuaçu	Cupu	2	tree	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Sapindales	Anacardiaceae	*Mangifera indica*	Manga	Ma´ga	2	tree	exotic	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Sapindales	Anacardiaceae	*Anacardium occidentale*	Caju	Coü'	1	tree	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Cucurbitales	Cucurbitaceae	*Citrullus lanatus*	Melancia	Woratchia	2	herb/climber	exotic	swidden
2_A	Novo Paranapara	2018	Arecales	Arecaceae	*Euterpe oleracea*	Açaí	Waira	2	palm tree	native	swidden
2_A	Novo Paranapara	2018	Piperales	Piperaceae	*Peperomia pellucida*	Pé-de-jabuti, erva-de-jabuti	Tütchi	2	herb	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Arecales	Arecaceae	*Cocos nucifera*	Coco	Cucu	2	palm tree	exotic	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Sapindales	Rutaceae	*Citrus sinensis*	Laranja	Naranha	1	tree	exotic	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Laurales	Lauraceae	*Persea americana*	Abacate	Nhüma, Ngüma. Ngu´na, Nguma	3	tree	exotic	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Arecales	Arecaceae	*Mauritia flexuosa*	Buriti	Tema', Tema	3	palm tree	native	forest
2_A	Novo Paranapara	2018	Malvales	Malvaceae	*Matisia cordata*	Sapota	Otere	3	tree	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Sapindales	Rutaceae	*Citrus reticulata*	Tangerina	Tayirima	3	tree	exotic	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Asterales	Asteraceae	*Acmella oleracea*	Jambu	Yabu	3	herb	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Malpighiales	Clusiaceae	*Platonia insignis*	Bacuri	Cowi	4	tree	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Gentianales	Rubiaceae	*Alibertia sorbilis*	Apuruí	Puruí	2	tree	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Myrtales	Myrtaceae	*Psidium* sp.	Araçá	Mitchuru	2	tree	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Magnoliales	Annonaceae	*Rollinia mucosa*	Biriba	Wiriwa	2	tree	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Cucurbitales	Cucurbitaceae	*Cucurbita* spp.	Jerimum	Yuruma	1	herb	native	swidden
2_A	Novo Paranapara	2018	Apiales	Apiaceae	*Eryngium foetidum*	Chicória	Tchicuria	2	herb	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Brassicales	Caricaceae	*Carica papaya*	Mamão	Popaya	3	shrub	exotic	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Sapindales	Rutaceae	*Citrus limonia*	Limão	Irimawa	1	tree	exotic	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Malvales	Bixaceae	*Bixa orellana*	Urucum	Ü'ta	2	tree	native	"sitio" or "quintal"
2_A	Novo Paranapara	2018	Arecales	Arecaceae	*Bactris gasipaes*	Pupunha	Itü	2	palm tree	native	swidden

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
2_A	Novo Parana-para	2018	Malvales	Malvaceae	*Theobroma cacao*	Cacau	Tchapere	2	tree	native	"sitio" or "quintal"
2_A	Novo Parana-para	2018	Arecales	Arecaceae	*Oenocarpus bacaba*	Bacaba	Boruá	2	palm tree	native	"sitio" or "quintal"
2_A	Novo Parana-para	2018	Oxalidales	Oxalidaceae	*Averrhoa carambola*	Carambola	Nhoõ	2	tree	exotic	"sitio" or "quintal"
2_F	Novo Parana-para	2018	Osteoglossidae	Osteoglossidae	*Osteoglossum bicirrhosum*	Aruanã, Sulamba	Orowana	4	scale fish		
2_F	Novo Parana-para	2018	Characiformes	Characidae	*Piaractus brachypomus*	Pirapitinga	Po'cu	4	scale fish		
2_F	Novo Parana-para	2018	Siluriformes	Loricariidae	*Pterygoplichthys* spp.	Bodó, Acarí-bodó	Owaru	4	catfish		
2_F	Novo Parana-para	2018	Characiformes	Characidae	*Serrasalmus* spp.; *Pygocentrus nattereri*	Piranha	Utchuma	3	scale fish		
2_F	Novo Parana-para	2018	Characiformes	Cynodontidae	*Cynodon gibbus; Rhaphiodon vulpinus*	Peixe-mucura	Yorewa	2	scale fish		
2_F	Novo Parana-para	2018	Perciforme	Cichlidae	*Cichla* spp.	Tucunaré	Tucunari	3	scale fish		
2_F	Novo Parana-para	2018	Siluriformes	Pimelodidae	*Pseudoplatystoma punctifer*	Surubim	Yuta	4	catfish		
2_F	Novo Parana-para	2018	Siluriformes	Doradidae	*Oxydoras niger*	Cuiu, Cuiu-cuiu, Cujuba	Cuyu	3	catfish		
2_F	Novo Parana-para	2018	Characiformes	Erythrinidae	*Hoplias malabaricus*	Traíra	Dé	3	scale fish		
2_F	Novo Parana-para	2018	Characiformes	Prochilodontidae	*Prochilodus nigricans*	Curimatã	Caweya	4	scale fish		
2_F	Novo Parana-para	2018	Perciforme	Cichlidae	*Astronatus ocellatus; Astronatus crassipinis*	Carauaçu	Ocara	4	scale fish		
2_F	Novo Parana-para	2018	Characiformes	Characidae	*Mylossoma* spp.; *Myleus* spp.	Pacu	Pacu, Ü'ta	3	scale fish		
2_F	Novo Parana-para	2018	Characiformes	Anostomidae	*Leporinus* spp.; *Schizodon* spp.	Aracu	Waracu	3	scale fish		
2_F	Novo Parana-para	2018	Crocodylia	Alligatoridae	*Caiman crocodilus*	Jacaré	Coya	3	alligator		
2_F	Novo Parana-para	2018	Osteoglossidae	Arapaimatidae	*Arapaima gigas*	Pirarucu	Détchi	4	scale fish		
2_F	Novo Parana-para	2018	Characiformes	Characidae	*Colossoma macropomum*	Tambaqui	Tomacatchi	4	scale fish		
2_F	Novo Parana-para	2018	Characiformes	Characidae	*Brycon amazonicus*	Matrinchã	Nge'tchi	3	scale fish		
2_F	Novo Parana-para	2018	Perciforme	Cichlidae	*Cichlidae*	Cará, Acará	Tchuná	4	scale fish		
2_F	Novo Parana-para	2018	Perciforme	Cichlidae	*Crenicichla* spp.	Jacundá, Peixe-sabão, Jacuná	Yacuna, Cuetchagü, Cawatchure	4	scale fish		

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
2_F	Novo Parana-para	2018	Perciforme	Sciaenidae	*Plagioscion squamosissimus*	Pescada	Tücüena	3	scale fish		
3_A	Novo Parana-para	2028	Arecales	Arecaceae	*Euterpe oleracea*	Açaí	Waira	4	palm tree	native	swidden
3_A	Novo Parana-para	2028	Arecales	Arecaceae	*Mauritia flexuosa*	Buriti	Tema', Tema	4	palm tree	native	forest
3_A	Novo Parana-para	2028	Malvales	Malvaceae	*Theobroma grandiflorum*	Cupuaçu	Cupu	3	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Icacinales	Icacinaceae	*Poraqueiba sericea*	Umarí	Te'tchi	3	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Piperales	Piperaceae	*Peperomia pellucida*	Pé-de-jabuti, erva-de-jabuti	Tütchi	2	herb	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Sapindales	Anacardiaceae	*Mangifera indica*	Manga	Ma´ga	3	tree	exotic	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Arecales	Arecaceae	*Oenocarpus bacaba*	Bacaba	Boruá	3	palm tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Malvales	Malvaceae	*Theobroma cacao*	Cacau	Tchapere	4	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira	Tü'e	2	shrub	native	swidden
3_A	Novo Parana-para	2028	Myrtales	Melastomataceae	*Mouriri trunciflora*	Muruari	Muruari	3	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Zingiberales	Musaceae	*Musa* spp.	Banana	Poi'	2	herb	exotic	swidden
3_A	Novo Parana-para	2028	Zingiberales	Musaceae	*Musa* spp.	Banana-maçã	Iru	2	herb	exotic	swidden
3_A	Novo Parana-para	2028	Dioscoreales	Dioscoreaceae	*Dioscorea alata*	Cará	U'í	4	perenniall herb	native	swidden
3_A	Novo Parana-para	2028	Solanales	Convolvulaceas	*Ipomoea batatas*	Batata-doce	Core, Co´re	4	shrub	native	swidden
3_A	Novo Parana-para	2028	Poales	Poaceae	*Saccharum officinarum*	Cana	Dene	1	perennial grass	native	swidden
3_A	Novo Parana-para	2028	Sapindales	Rutaceae	*Citrus limonia*	Limão	Irimawa	2	tree	exotic	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Sapindales	Rutaceae	*Citrus sinensis*	Laranja	Naranha	2	tree	exotic	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Rosales	Urticaceae	*Pourouma* sp.	Mapatí	Tchia	2	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Ericales	Sapotaceae	*Pouteria caimito*	Abiu	Taü, Tao	2	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Myrtales	Myrtaceae	*Psidium guajava*	Goiaba	Oratcha	2	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Malpighiales	Clusiaceae	*Platonia insignis*	Bacuri	Cowi	2	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Laurales	Lauraceae	*Persea americana*	Abacate	Nhüma, Ngüma. Ngu´na, Nguma	2	tree	exotic	"sitio" or "quintal"

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
3_A	Novo Parana-para	2028	Malpighiales	Euphorbiaceae	*Mabea* sp.	Tacuarí	Tu´a	2	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Gentianales	Apocynaceae	*Couma* sp.	Sorva	Nge'tchi	2	tree	native	"sitio" or "quintal"
3_A	Novo Parana-para	2028	Malvales	Bixaceae	*Bixa orellana*	Urucum	Ü´ta	2	tree	native	"sitio" or "quintal"
3_F	Novo Parana-para	2028	Osteoglossidae	Arapaimatidae	*Arapaima gigas*	Pirarucu	Détchi	4	scale fish		
3_F	Novo Parana-para	2028	Perciforme	Cichlidae	*Cichla* spp.	Tucunaré	Tucunari	4	scale fish		
3_F	Novo Parana-para	2028	Characiformes	Characidae	*Piaractus brachypomus*	Pirapitinga	Po'cu	4	scale fish		
3_F	Novo Parana-para	2028	Osteoglossidae	Osteoglossidae	*Osteoglossum bicirrhosum*	Aruanã, Sulamba	Orowana	4	scale fish		
3_F	Novo Parana-para	2028	Characiformes	Prochilodontidae	*Prochilodus nigricans*	Curimatã	Caweya	3	scale fish		
3_F	Novo Parana-para	2028	Perciforme	Cichlidae	*Astronatus ocellatus; Astronatus crassipinis*	Carauaçu	Ocara	4	scale fish		
3_F	Novo Parana-para	2028	Siluriformes	Loricariidae	*Pterygoplichthys* spp.	Bodó, Acarí-bodó	Owaru	4	catfish		
3_F	Novo Parana-para	2028	Siluriformes	Doradidae	*Oxydoras niger*	Cuiu, Cuiu-cuiu, Cujuba	Cuyu	2	catfish		
3_F	Novo Parana-para	2028	Characiformes	Characidae	*Triportheus spp*	Sardinha	Arawiri	4	scale fish		
3_F	Novo Parana-para	2028	Characiformes	Characidae	*Mylossoma* spp.; *Myleus* spp.	Pacu	Pacu, Ü'ta	3	scale fish		
3_F	Novo Parana-para	2028	Characiformes	Characidae	*Ctenobrycon hauxwellianus*	Matupiri		3	scale fish		
3_F	Novo Parana-para	2028	Testudines	Podocnemididae	*Podocnemis unifilis*	Tracajá	To'ri	2	turtle		
3_F	Novo Parana-para	2028	Testudines	Podocnemididae	*Podocnemis expansa*	Tartaruga	Bawe'	4	turtle		
3_F	Novo Parana-para	2028	Crocodylia	Alligatoridae	*Caiman crocodilus*	Jacaré	Coya	4	alligator		
4_A	Ütapü	2008	Malvales	Malvaceae	*Matisia cordata*	Sapota	Otere	4	tree	native	"sitio" or "quintal"
4_A	Ütapü	2008	Brassicales	Caricaceae	*Carica papaya*	Mamão	Popaya	4	shrub	exotic	"sitio" or "quintal"
4_A	Ütapü	2008				Banana maça	Iru	2	herb	native	"sitio" or "quintal"
4_A	Ütapü	2008	Sapindales	Rutaceae	*Citrus sinensis*	Laranja	Naranha	4	tree	exotic	"sitio" or "quintal"
4_A	Ütapü	2008	Dioscoreales	Dioscoreaceae	*Dioscorea alata*	Cará	Uí	2	perenniall herb	native	swidden
4_A	Ütapü	2008	Fabales	Fabaceae	*Inga edulis*	Ingá	Pama	4	tree	native	"sitio" or "quintal"
4_A	Ütapü	2008	Zingiberales	Musaceae	*Musa* spp.	Banana	Poi'	2	herb	exotic	swidden
4_A	Ütapü	2008	Myrtales	Myrtaceae	*Eugenia stipitata*	Araçá-boi	Tawe	3	tree	native	"sitio" or "quintal"
4_A	Ütapü	2008	Asterales	Asteraceae	*Acmella oleracea*	Jambu	Yabu	1	herb	native	"sitio" or "quintal"
4_A	Ütapü	2008	Apiales	Apiaceae	*Eryngium foetidum*	Chicória	Tchicuria	4	herb	native	"sitio" or "quintal"
4_A	Ütapü	2008	Poales	Poaceae	*Saccharum officinarum*	Cana	Dene	2	perennial grass	native	swidden
4_A	Ütapü	2008	Malvales	Malvaceae	*Theobroma cacao*	Cacau	Tchapere	2	tree	native	"sitio" or "quintal"
4_A	Ütapü	2008	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira	Tü'e	4	shrub	native	swidden
4_A	Ütapü	2008	Malpiphigiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira-amarela, Mandioca	Owa	1	shrub	native	swidden

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4_A	Ütapü	2008	Arecales	Arecaceae	*Cocos nucifera*	Coco	Cucu	2	palm tree	exotic	"sitio" or "quintal"
4_A	Ütapü	2008	Malvales	Malvaceae	*Theobroma grandiflorum*	Cupuaçu	Cupu	1	tree	native	"sitio" or "quintal"
4_A	Ütapü	2008	Laurales	Lauraceae	*Persea americana*	Abacate	Nhüma, Ngüma. Ngu´na, Nguma	1	tree	exotic	"sitio" or "quintal"
4_A	Ütapü	2008	Icacinales	Icacinaceae	*Poraqueiba sericea*	Umarí	Te'tchi	2	tree	native	"sitio" or "quintal"
4_A	Ütapü	2008	Gentianales	Rubiaceae	*Genipa americana*	Jenipapo	E'	3	tree	native	"sitio" or "quintal"
4_F	Ütapü	2008	Testudines	Podocnemididae	*Podocnemis unifilis*	Tracajá	To'ri	4	turtle		
4_F	Ütapü	2008	Testudines	Podocnemididae	*Podocnemis expansa*	Tartaruga	Bawe'	4	turtle		
4_F	Ütapü	2008	Testudines	Podocnemididae	*Podocnemis sexturbeculata*	Copeçu	Cupetchu	4	turtle		
4_F	Ütapü	2008	Testudines	Chelidae	*Chelus fimbriatus*	Mata-matá	Ngaiyare	3	turtle		
4_F	Ütapü	2008	Testudines	Podocnemididae	*Peltocephalus dumerilianus*	Cabeçudo	Tcharaeru	2	turtle		
4_F	Ütapü	2008	Testudines	Geoemydidae	*Rhinoclemmys punctularia*	Perema	Do'tchi	3	turtle		
4_F	Ütapü	2008	Siluriformes	Pimelodidae	*Brachyplatystoma filamentosum*	Piraiba ou Filhote	Piraíba, Yu-turi	2	catfish		
4_F	Ütapü	2008	Characiformes	Ctenoluciidae	*Boulengerella maculata*	Peixe-agulha, Zé-prego	Copi	3	scale fish		
4_F	Ütapü	2008	Perciforme	Cichlidae	*Cichlidae*	Peixe-bandeira, Acará-bandeira	Ma'nieru	3	scale fish		
4_F	Ütapü	2008	Characiformes	Characidae	*Brycon melanopterus*	Jatuarana	Eruma	3	scale fish		
4_F	Ütapü	2008	Decapoda	Palaemonidae	*Macrobrachium* sp.	Camarão	E'nü	2	crustacean		
4_F	Ütapü	2008	Siluriformes	Callichthyidae	*Megalodoras uranoscopos*	Bacu-uruá, Peixe-uruá, Uruá, Juruá	Meru, Meru-ana	2	catfish		
4_F	Ütapü	2008	Decapoda	Thrichodactylidae	*Thrichodactylidae*	Caranguejo	Owe	2	crustacean		
4_F	Ütapü	2008	Characiformes	Hemiodontidae	*Hemiodus* spp.	Charuto	Tcharutu	2	scale fish		
4_F	Ütapü	2008	Characiformes	Curimatidae	*Potamorhina* spp.	Branquinha, Chorão	Tchuraû, Tchuraü	1	scale fish		
4_F	Ütapü	2008	Characiformes	Anostomidae	*Leporinus* spp.	Piau, Aracu-piau	O'ta	2	scale fish		
4_F	Ütapü	2008	Perciforme	Cichlidae	*Cichlidae*	Cará-disco	Tchuna bo-tatchinü'ü	1	scale fish		
4_F	Ütapü	2008	Perciforme	Cichlidae	*Cichlidae*	Cará, Acará	Tchuná	1	scale fish		
4_F	Ütapü	2008	Perciforme	Cichlidae	*Uaru amphiocanthoides*	Cará-bararuá, Bararua	Bararuá, Ngo´oo	1	scale fish		
5_A	Ütapü	2018	Zingiberales	Musaceae	*Musa* spp.	Banana	Poi'	4	herb	exotic	swidden
5_A	Ütapü	2018	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira	Tu´e	4	shrub	native	swidden
5_A	Ütapü	2018	Poales	Bromeliaceae	*Ananas* sp.	Abacaxi	Tchinü	4	herb	native	swidden
5_A	Ütapü	2018	Poales	Poaceae	*Saccharum officinarum*	Cana	Dene	3	perennial grass	native	swidden
5_A	Ütapü	2018	Dioscoreales	Dioscoreaceae	*Dioscorea alata*	Cará	Uí	1	perenniall herb	native	swidden
5_A	Ütapü	2018	Fabales	Fabaceae	*Inga edulis*	Ingá	Pama	1	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Rosales	Urticaceae	*Pourouma* sp.	Mapatí	Tchinhã	3	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Ericales	Sapotaceae	*Pouteria caimito*	Abiu	Taü, Tao	1	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Sapindales	Rutaceae	*Citrus sinensis*	Laranja	Naranha	2	tree	exotic	"sitio" or "quintal"
5_A	Ütapü	2018	Arecales	Arecaceae	*Mauritia flexuosa*	Buriti	Tema', Tema	4	palm tree	native	forest
5_A	Ütapü	2018	Arecales	Arecaceae	*Euterpe oleracea*	Açaí	Waira	4	palm tree	native	swidden
5_A	Ütapü	2018	Sapindales	Anacardiaceae	*Mangifera indica*	Manga	Ma´ga	4	tree	exotic	"sitio" or "quintal"
5_A	Ütapü	2018	Arecales	Arecaceae	*Cocos nucifera*	Coco	Cucu	3	palm tree	exotic	"sitio" or "quintal"
5_A	Ütapü	2018	Malvales	Malvaceae	*Theobroma grandiflorum*	Cupuaçu	Cupu	2	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Sapindales	Anacardiaceae	*Anacardium occidentale*	Caju	Coü'	3	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Solanales	Convolvulaceas	*Ipomoea batatas*	Batata-doce	Core, Co´re	3	shrub	native	swidden
5_A	Ütapü	2018	Piperales	Piperaceae	*Peperomia pellucida*	Pé-de-jabuti, erva-de-jabuti	Tütchi	2	herb	native	"sitio" or "quintal"
5_A	Ütapü	2018	Icacinales	Icacinaceae	*Poraqueiba sericea*	Umarí	Te'tchi	1	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Malpighiales	Clusiaceae	*Platonia insignis*	Bacuri	Cowi	2	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Arecales	Arecaceae	*Oenocarpus bacaba*	Bacaba	Boruá	3	palm tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Myrtales	Melastomataceae	*Mouriri trunciflora*	Muruari	Muruari	4	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Sapindales	Rutaceae	*Citrus limonia*	Limão	Irimawa	2	tree	exotic	"sitio" or "quintal"
5_A	Ütapü	2018	Sapindales	Rutaceae	*Citrus reticulata*	Tangerina	Tayirima	3	tree	exotic	"sitio" or "quintal"
5_A	Ütapü	2018	Poales	Poaceae	*Zea mays*	Milho	Tchawü	4	perennial grass	exotic	swidden

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5_A	Ütapü	2018	Solanales	Solanaceae	*Solanum sessiliflorum*	Cubiu	Bere'	2	shrub	native	"sitio" or "quintal"
5_A	Ütapü	2018	Fabales	Fabaceae	*Vigna unguiculata*	Feijão	Pewa	4	herb	exotic	"sitio" or "quintal"
5_A	Ütapü	2018	Arecales	Arecaceae	*Bactris gasipaes*	Pupunha	Itü	3	palm tree	native	swidden
5_A	Ütapü	2018	Arecales	Arecaceae	*Astrocaryum aculeatum*	Tucumã	Itcha	3	palm tree	native	swidden
5_A	Ütapü	2018	Malpighiales	Clusiaceae	*Symphonia globulifera*	Anani	Ãwü	2	tree	native	"sitio" or "quintal"
5_A	Ütapü	2018	Myrtales	Myrtaceae	*Eugenia stipitata*	Araçá-boi	Tawe	3	tree	native	"sitio" or "quintal"
5_F	Ütapü	2018	Osteoglossidae	Arapaimatidae	*Arapaima gigas*	Pirarucu	Détchi	4	scale fish		
5_F	Ütapü	2018	Characiformes	Characidae	*Colossoma macropomum*	Tambaqui	Tomacatchi	4	scale fish		
5_F	Ütapü	2018	Osteoglossidae	Osteoglossidae	*Osteoglossum bicirrhosum*	Aruanã, Sulamba	Orowana	3	scale fish		
5_F	Ütapü	2018	Perciforme	Cichlidae	*Astronatus ocellatus; Astronatus crassipinis*	Carauaçu	Ocara	3	scale fish		
5_F	Ütapü	2018	Perciforme	Cichlidae	*Cichlidae*	Cará, Acará	Tchuná	3	scale fish		
5_F	Ütapü	2018	Siluriformes	Pimelodidae	*Pseudoplatystoma punctifer*	Surubim	Yuta	3	catfish		
5_F	Ütapü	2018	Perciforme	Cichlidae	*Cichla* spp.	Tucunaré	Tucunari	3	scale fish		
5_F	Ütapü	2018	Characiformes	Characidae	*Piaractus brachypomus*	Pirapitinga	Po'cu	2	scale fish		
5_F	Ütapü	2018	Characiformes	Characidae	*Brycon amazonicus*	Matrinchã	Nge'tchi	3	scale fish		
5_F	Ütapü	2018	Characiformes	Erythrinidae	*Hoplias malabaricus*	Traíra	Dé	3	scale fish		
5_F	Ütapü	2018	Siluriformes	Loricariidae	*Pterygoplichthys* spp.	Bodó, Acarí-bodó	Owaru	4	catfish		
5_F	Ütapü	2018	Characiformes	Prochilodontidae	*Prochilodus nigricans*	Curimatã	Caweya	4	scale fish		
5_F	Ütapü	2018	Perciforme	Sciaenidae	*Plagioscion squamosissimus*	Pescada	Tücüena	3	scale fish		
5_F	Ütapü	2018	Siluriformes	Pimelodidae	*Brachyplatystoma vaillantii*	Piramutaba, Pirabutão	Müta, Cotchi	4	catfish		
5_F	Ütapü	2018	Characiformes	Anostomidae	*Leporinus* spp.; *Schizodon* spp.	Aracu	Waracu	3	scale fish		
5_F	Ütapü	2018	Characiformes	Characidae	*Triportheus* spp.	Sardinha	Arawiri	4	scale fish		
5_F	Ütapü	2018	Characiformes	Characidae	*Mylossoma* spp.; *Myleus* spp.	Pacu	Pacu, Ü'ta	4	scale fish		
5_F	Ütapü	2018	Siluriformes	Pimelodidae	*Zungaro zungaro*	Pacamu, Pacamon, Jau	Pacamú	4	catfish		
5_F	Ütapü	2018	Characiformes	Prochilodontidae	*Semaprochilodus* spp.	Jaraqui	Waire	4	scale fish		
5_F	Ütapü	2018	Characiformes	Cynodontidae	*Cynodon gibbus; Rhaphiodon vulpinus*	Peixe-cachorro, Peixe-mucura	Yorewa, Wainayu	2	scale fish		
5_F	Ütapü	2018	Siluriformes	Doradidae	*Lithodoras dorsalis; Pterodoras lentiginosus*	Bacu	Wocu, Tchumi	2	catfish		
5_F	Ütapü	2018	Siluriformes	Doradidae	*Oxydoras niger*	Cuiu, Cuiu-cuiu, Cujuba	Cuyu	3	catfish		
5_F	Ütapü	2018	Siluriformes	Pimelodidae	*Phractocephalus hemiliopterus*	Pirarara	Pué, Ôê	4	catfish		
5_F	Ütapü	2018	Siluriformes	Pimelodidae	*Leiarius marmoratus*	Jandiá	Taunü	3	catfish		
5_F	Ütapü	2018	Siluriformes	Pimelodidae	*Sorubim lima*	Chiripira	De´ne tchma´â, Tchiripira	3	catfish		
5_F	Ütapü	2018	Siluriformes	Loricariidae	*Pseudorinelepis* sp.	Bodó-sem-costela	O´wa	3	catfish		
5_F	Ütapü	2018	Siluriformes	Auchenipteridae	*Ageneiosus* spp.	Mandubé	Doma	3	catfish		
5_F	Ütapü	2018	Siluriformes	Auchenipteridae	*Trachelyopterus galeatus*	Cangati	Uperu	2	catfish		
5_F	Ütapü	2018	Siluriformes	Pimelodidae	*Pimelodus blochii*	Mandi, Mandii	Mo'ni	2	catfish		
5_F	Ütapü	2018	Characiformes	Characidae	*Serrasalmus* spp.; *Pygocentrus nattereri*	Piranha	Utchuma	3	scale fish		
5_F	Ütapü	2018	Characiformes	Characidae	*Mylossoma* spp.; *Myleus* spp.	Pacutinga	Üacü	4	scale fish		
5_F	Ütapü	2018	Characiformes	Erythrinidae	*Hoplerythrinus unitaeniatus*	Jiju	O'ü	3	scale fish		
5_F	Ütapü	2018	Perciforme	Cichlidae	*Uaru amphiocanthoides*	Cará-bararuá, Bararua	Bararuá, Ngo´oo	2	scale fish		
5_F	Ütapü	2018	Siluriformes	Callichthyidae	*Hoplosternum litoralle*	Tamoatá	Tchuru	4	catfish		
5_F	Ütapü	2018	Crocodylia	Alligatoridae	*Caiman crocodilus*	Jacaré	Coya	3	alligator		
5_F	Ütapü	2018	Crocodylia	Alligatoridae	*Paleosuchus trigonatus*	Jacaré-curuá	Curuá	2	alligator		
5_F	Ütapü	2018	Crocodylia	Alligatoridae	*Melanosuchus niger*	Jacaré-preto	Coya waüü	2	alligator		
5_F	Ütapü	2018	Clupeiformes	Pristigasteridae	*Pelona flavipinnis*	Arenga, Apapá-branco	Onacatchi	3	scale fish		

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
5_F	Ütapü	2018	Siluriformes	Doradidae	*Lithodoras dorsalis*; *Pterodoras lentiginosus*	Bacu, Bacu-pedra	Wocu	2	catfish		
6_A	Ütapü	2028	Sapindales	Anacardiaceae	*Mangifera indica*	Manga	Ma´ga	4	tree	exotic	"sitio" or "quintal"
6_A	Ütapü	2028	Fabales	Fabaceae	*Inga edulis*	Ingá	Pama	1	tree	native	"sitio" or "quintal"
6_A	Ütapü	2028	Arecales	Arecaceae	*Bactris gasipaes*	Pupunha	Itü	3	palm tree	native	swidden
6_A	Ütapü	2028	Sapindales	Rutaceae	*Citrus limonia*	Limão	Irimawa	3	tree	exotic	"sitio" or "quintal"
6_A	Ütapü	2028	Zingiberales	Musaceae	*Musa* spp.	Banana	Poi'	3	herb	exotic	swidden
6_A	Ütapü	2028	Arecales	Arecaceae	*Mauritia flexuosa*	Buriti	Tema', Tema	2	palm tree	native	forest
6_A	Ütapü	2028	Poales	Bromeliaceae	*Ananas* sp.	Abacaxi	Tchinü	2	herb	native	swidden
6_A	Ütapü	2028	Poales	Poaceae	*Zea mays*	Milho	Tchawü	4	perennial grass	exotic	swidden
6_A	Ütapü	2028	Rosales	Urticaceae	*Pourouma* sp.	Mapatí	Tchinhã	3	tree	native	"sitio" or "quintal"
6_A	Ütapü	2028	Arecales	Arecaceae	*Astrocaryum aculeatum*	Tucumã	Itcha	2	palm tree	native	swidden
6_A	Ütapü	2028	Arecales	Arecaceae	*Euterpe oleracea*	Açaí	Waira	2	palm tree	native	swidden
6_A	Ütapü	2028	Myrtales	Myrtaceae	*Psidium guajava*	Goiaba	Oratcha	4	tree	native	"sitio" or "quintal"
6_A	Ütapü	2028	Sapindales	Anacardiaceae	*Anacardium occidentale*	Caju	Coü'	3	tree	native	"sitio" or "quintal"
6_A	Ütapü	2028	Ericales	Sapotaceae	*Pouteria caimito*	Abiu	Taü, Tao	1	tree	native	"sitio" or "quintal"
6_A	Ütapü	2028	Arecales	Arecaceae	*Cocos nucifera*	Coco	Cucu	3	palm tree	exotic	"sitio" or "quintal"
6_A	Ütapü	2028	Gentianales	Rubiaceae	*Genipa americana*	Jenipapo	E'	2	tree	native	"sitio" or "quintal"
6_A	Ütapü	2028	Magnoliales	Annonaceae	*Annona muricata*	Graviola	Wíriwa	2	tree	exotic	"sitio" or "quintal"
6_A	Ütapü	2028	Myrtales	Myrtaceae	*Psidium* sp.	Araçá	Mitchuru	2	tree	native	"sitio" or "quintal"
6_A	Ütapü	2028	Malvales	Malvaceae	*Theobroma grandiflorum*	Cupuaçu	Cupu	1	tree	native	"sitio" or "quintal"
6_F	Ütapü	2028	Osteoglossidae	Arapaimatidae	*Arapaima gigas*	Pirarucu	Détchi	4	scale fish		
6_F	Ütapü	2028	Testudines	Podocnemididae	*Podocnemis unifilis*	Tracajá	To'ri	4	turtle		
6_F	Ütapü	2028	Siluriformes	Pimelodidae	*Leiarius marmoratus*	Jandiá	Taunü	3	catfish		
6_F	Ütapü	2028	Siluriformes	Pimelodidae	*Pseudoplatystoma punctifer*	Surubim	Yuta	3	catfish		
6_F	Ütapü	2028	Characiformes	Characidae	*Piaractus brachypomus*	Pirapitinga	Po'cu	2	scale fish		
6_F	Ütapü	2028	Perciforme	Cichlidae	*Crenicichla* spp.	Jacundá, Peixe-sabão, Jacuná	Yacuna, Cuetchagü, Cawatchure	2	scale fish		
6_F	Ütapü	2028	Characiformes	Characidae	*Triportheus* spp.	Sardinha	Arawiri	4	scale fish		
6_F	Ütapü	2028	Characiformes	Characidae	*Mylossoma* spp.; *Myleus* spp.	Pacu	Pacu, Ü'ta	4	scale fish		
6_F	Ütapü	2028	Characiformes	Curimatidae	*Potamorhina* spp.	Branquinha, Chorão	Tchuraû, Tchuraü	3	scale fish		
6_F	Ütapü	2028	Siluriformes	Loricariidae	*Pterygoplichthys* spp.	Bodó, Acarí-bodó	Owaru	4	catfish		
6_F	Ütapü	2028	Testudines	Geoemydidae	*Rhinoclemmys punctularia*	Perema	Do'tchi	3	turtle		
6_F	Ütapü	2028	Testudines	Chelidae	*Chelus fimbriatus*	Mata-matá	Ngaiyare	2	turtle		
6_F	Ütapü	2028	Siluriformes	Pimelodidae	*Brachyplatystoma vaillantii*	Piramutaba, Pirabutão	Müta, Cotchi	3	catfish		
6_F	Ütapü	2028	Characiformes	Cynodontidae	*Cynodon gibbus*; *Rhaphiodon vulpinus*	Peixe-cachorro, Peixe-mucura	Wainayu	2	scale fish		
6_F	Ütapü	2028	Siluriformes	Pimelodidae	*Hypophthalmus* spp.	Mapará	Mapará	4	catfish		
6_F	Ütapü	2028	Characiformes	Prochilodontidae	*Semaprochilodus* spp.	Jaraqui	Waire	3	scale fish		
6_F	Ütapü	2028	Decapoda	Thrichodactylidae	*Thrichodactylidae*	Caranguejo	Owe	1	crustacean		
6_F	Ütapü	2028	Characiformes	Characidae	*Brycon melanopterus*	Jatuarana	Eruma	3	scale fish		
7_A	Nupune	2008	Zingiberales	Musaceae	*Musa* spp.	Banana	Poi'	3	herb	exotic	swidden
7_A	Nupune	2008	Cucurbitales	Cucurbitaceae	*Citrullus lanatus*	Melancia	Woratchia	3	herb/climber	exotic	swidden
7_A	Nupune	2008	Poales	Poaceae	*Zea mays*	Milho	Tchawü	3	perennial grass	exotic	swidden
7_A	Nupune	2008	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira	Tü'e	2	shrub	native	swidden
7_A	Nupune	2008	Fabales	Fabaceae	*Vigna unguiculata*	Feijão	Peyae	3	herb	exotic	"sitio" or "quintal"
7_A	Nupune	2008	Arecales	Arecaceae	*Euterpe oleracea*	Açaí	Waira	3	palm tree	native	swidden
7_A	Nupune	2008	Fabales	Fabaceae	*Inga edulis*	Ingá	Pama	2	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Rosales	Moraceae	*Artocarpus altilis*	Fruta-pão	Poütchire	3	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Brassicales	Caricaceae	*Carica papaya*	Mamão	Popaya	3	shrub	exotic	"sitio" or "quintal"
7_A	Nupune	2008	Ericales	Sapotaceae	*Pouteria venosa*	Abiorana	Taütchicü	2	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Solanales	Solanaceae	*Solanum sessiliflorum*	Cubiu	Bere'	3	shrub	native	"sitio" or "quintal"
7_A	Nupune	2008	Piperales	Piperaceae	*Peperomia pellucida*	Pé-de-jabuti, erva-de-jabuti	Tütchi	2	herb	native	"sitio" or "quintal"
7_A	Nupune	2008	Gentianales	Rubiaceae	*Alibertia sorbilis*	Apuruí	Puruí	3	tree	native	"sitio" or "quintal"

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
7_A	Nupune	2008	Sapindales	Anacardiaceae	*Anacardium occidentale*	Caju	Coü'	3	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Arecales	Arecaceae	*Cocos nucifera*	Coco	Cucu	1	palm tree	exotic	"sitio" or "quintal"
7_A	Nupune	2008	Myrtales	Melastomataceae	*Mouriri trunciflora*	Muruari	Mururi	2	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Gentianales	Rubiaceae	*Genipa americana*	Jenipapo	E'	3	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Asterales	Asteraceae	*Acmella oleracea*	Jambu	Yabu	4	herb	native	"sitio" or "quintal"
7_A	Nupune	2008	Oxalidales	Oxalidaceae	*Averrhoa carambola*	Carambola	Nhoõ	2	tree	exotic	"sitio" or "quintal"
7_A	Nupune	2008	Arecales	Arecaceae	*Mauritia flexuosa*	Buriti	Tema', Tema	2	palm tree	native	forest
7_A	Nupune	2008	Solanales	Solanaceae	*Capsicum* sp.	Pimentão	Me'ê	3	shrub	native	"sitio" or "quintal"
7_A	Nupune	2008	Poales	Poaceae	*Saccharum officinarum*	Cana	Dene	3	perennial grass	native	swidden
7_A	Nupune	2008	Myrtales	Myrtaceae	*Psidium guajava*	Goiaba	Oratcha	1	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Sapindales	Anacardiaceae	*Spondias mombin*	Taperebá	Yomeru	4	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Sapindales	Meliaceae	*Cedrela odorata*	Cedro	Ocayiwa	3	tree	native	forest
7_A	Nupune	2008	Fabales	Fabaceae	*Inga* sp.	Ingá-corrente	Tchiatchiui	3	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Fabales	Fabaceae	*Inga edulis*	Ingá-rabo-de-macaco	Pama	3	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Rosales	Urticaceae	*Pourouma* sp.	Mapatirana	Tchiãtchicii	2	tree	native	forest
7_A	Nupune	2008	Arecales	Arecaceae	*Oenocarpus bacaba*	Bacaba	Boruá	3	palm tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Solanales	Solanaceae	*Solanum lycopersicum*	Tomate	Tumate	3	herb	native	"sitio" or "quintal"
7_A	Nupune	2008	Gentianales	Apocynaceae	*Ambelania acida*	Pepino-do-mato	Pipino	3	tree	native	"sitio" or "quintal"
7_A	Nupune	2008	Apiales	Apiaceae	*Eryngium foetidum*	Chicória	Tchicuria	3	herb	native	"sitio" or "quintal"
7_A	Nupune	2008	Cucurbitales	Cucurbitaceae	*Cucumis anguria*	Maxixe	Matchitchi	3	herb/climber	native	"sitio" or "quintal"
7_A	Nupune	2008	Cucurbitales	Cucurbitaceae	*Cucurbita* spp.	Jerimum	Yuruma	2	herb	native	swidden
7_A	Nupune	2008	Poales	Poaceae	*Cymbopogon citratus*	Capim-santo		1	herb	exotic	"sitio" or "quintal"
7_F	Nupune	2008	Siluriformes	Loricariidae	*Pterygoplichthys* spp.	Bodó, Acarí-bodó	Owaru	4	catfish		
7_F	Nupune	2008	Characiformes	Erythrinidae	*Hoplias malabaricus*	Traíra	Dé	4	scale fish		
7_F	Nupune	2008	Characiformes	Prochilodontidae	*Prochilodus nigricans*	Curimatã	Caweya	4	scale fish		
7_F	Nupune	2008	Perciforme	Cichlidae	*Cichla* spp.	Tucunaré	Tucunari	4	scale fish		
7_F	Nupune	2008	Osteoglossidae	Osteoglossidae	*Osteoglossum bicirrhosum*	Aruanã, Sulamba	Orowana	4	scale fish		
7_F	Nupune	2008	Characiformes	Characidae	*Colossoma macropomum*	Tambaqui	Tomacatchi	4	scale fish		
7_F	Nupune	2008	Osteoglossidae	Arapaimatidae	*Arapaima gigas*	Pirarucu	Détchi	3	scale fish		
7_F	Nupune	2008	Characiformes	Ctenoluciidae	*Boulengerella maculata*	Peixe-agulha, Zé-prego	Copi	2	scale fish		
7_F	Nupune	2008	Characiformes	Characidae	*Serrasalmus* spp.; *Pygocentrus nattereri*	Piranha	Utchuma	3	scale fish		
7_F	Nupune	2008	Perciforme	Cichlidae	*Astronatus ocellatus; Astronatus crassipinis*	Carauaçu	Ocara	4	scale fish		
7_F	Nupune	2008	Perciforme	Cichlidae	*Cichlidae*	Cará, Acará	Tchuná	2	scale fish		
7_F	Nupune	2008	Characiformes	Erythrinidae	*Hoplerythrinus unitaeniatus*	Jiju	O'ü	2	scale fish		
7_F	Nupune	2008	Perciforme	Cichlidae	*Crenicichla* spp.	Jacundá, Peixe-sabão, Jacuná	Yacuna, Cuetchagü, Cawatchure	2	scale fish		
7_F	Nupune	2008	Characiformes	Characidae	*Triportheus* spp.	Sardinha	Arawiri	4	scale fish		
7_F	Nupune	2008	Characiformes	Characidae	*Mylossoma* spp.; *Myleus* spp.	Pacu	Pacu, Ü'ta	3	scale fish		
7_F	Nupune	2008	Characiformes	Anostomidae	*Leporinus* spp.; *Schizodon* spp.	Aracu	Waracu	2	scale fish		
7_F	Nupune	2008	Sirenia	Trichechidae	*Trichechus inunguis*	Peixe-boi	Airume	2	mammal		
7_F	Nupune	2008	Clupeiformes	Pristigasteridae	*Pelona flavipinnis*	Arenga, Apapá-branco	Onacatchi	3	scale fish		
7_F	Nupune	2008	Characiformes	Cynodontidae	*Cynodon gibbus; Rhaphiodon vulpinus*	Peixe-mucura	Yorewa	3	scale fish		
7_F	Nupune	2008	Siluriformes	Pimelodidae	*Pseudoplatystoma punctifer*	Surubim	Yuta	4	catfish		
7_F	Nupune	2008	Siluriformes	Pimelodidae	*Pseudoplatystoma tigrinum*	Caparari	Coparari	2	catfish		
7_F	Nupune	2008	Characiformes	Cynodontidae	*Cynodon gibbus; Rhaphiodon vulpinus*	Peixe-terçado	Wainayu	2	scale fish		
7_F	Nupune	2008	Characiformes	Characidae	*Piaractus brachypomus*	Pirapitinga	Po'cu	2	scale fish		
7_F	Nupune	2008	Siluriformes	Callichthyidae	*Hoplosternum litoralle*	Tamoatá	Tchuru	3	catfish		
7_F	Nupune	2008	Characiformes	Curimatidae	*Potamorhina* spp.	Branquinha, Chorão	Tchuraû, Tchuraü	4	scale fish		

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
7_F	Nupune	2008	Testudines	Podocnemididae	*Podocnemis expansa*	Tartaruga	Bawe'	4	turtle		
7_F	Nupune	2008	Siluriformes	Doradidae	*Lithodoras dorsalis; Pterodoras lentiginosus*	Bacu, Bacu-pedra	Wocu	2	catfish		
7_F	Nupune	2008	Siluriformes	Auchenipteridae	*Trachelyopterus galeatus*	Cangati	Uperu	2	catfish		
7_F	Nupune	2008	Siluriformes	Callichthyidae	*Megalodoras uranoscopos*	Peixe-uruá, Uruá, Juruá	Meru, Meru-ana	2	catfish		
7_F	Nupune	2008	Siluriformes	Pimelodidae	*Leiarius marmoratus*	Jandiá	Taunü	3	catfish		
8_A	Nupune	2018	Poales	Bromeliaceae	*Ananas* sp.	Abacaxi	Tchinü	2	herb	native	swidden
8_A	Nupune	2018	Zingiberales	Musaceae	*Musa* spp.	Banana	Poi'	3	herb	exotic	swidden
8_A	Nupune	2018	Ericales	Sapotaceae	*Pouteria caimito*	Abiu	Taü, Tao	2	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Arecales	Arecaceae	*Bactris gasipaes*	Pupunha	Itü	4	palm tree	native	swidden
8_A	Nupune	2018	Ericales	Lecythidaceae	*Bertholletia excelsa*	Castanha	Nho´ô, Nhoí	4	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Malpighiales	Euphorbiaceae	*Mabea* sp.	Tacuarí	Tu´a	3	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Arecales	Arecaceae	*Euterpe oleracea*	Açaí	Waira	2	palm tree	native	swidden
8_A	Nupune	2018	Fabales	Fabaceae	*Inga edulis*	Ingá	Pama	2	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Sapindales	Anacardiaceae	*Mangifera indica*	Manga	Ma´ga	1	tree	exotic	"sitio" or "quintal"
8_A	Nupune	2018	Malvales	Malvaceae	*Theobroma grandiflorum*	Cupuaçu	Cupu	1	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Poales	Poaceae	*Saccharum officinarum*	Cana	Dene	3	perennial grass	native	swidden
8_A	Nupune	2018	Asterales	Asteraceae	*Acmella oleracea*	Jambu	Yâbu	4	herb	native	"sitio" or "quintal"
8_A	Nupune	2018	Rosales	Urticaceae	*Pourouma* sp.	Mapatí	Tchinhã	2	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Malpighiales	Clusiaceae	*Platonia insignis*	Bacuri	Cowi	4	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Brassicales	Caricaceae	*Carica papaya*	Mamão	Popaya	2	shrub	exotic	"sitio" or "quintal"
8_A	Nupune	2018	Malpiphigiales	Euphorbiaceae	*Manihot esculenta*	Mandioca	Owa	3	shrub	native	swidden
8_A	Nupune	2018	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira	Tü'e	3	shrub	native	swidden
8_A	Nupune	2018	Myrtales	Myrtaceae	*Psidium guajava*	Goiaba	Oratcha	3	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Arecales	Arecaceae	*Mauritia flexuosa*	Buriti	Tema', Tema	3	palm tree	native	forest
8_A	Nupune	2018	Sapindales	Rutaceae	*Citrus sinensis*	Laranja	Naranha	4	tree	exotic	"sitio" or "quintal"
8_A	Nupune	2018	Piperales	Piperaceae	*Peperomia pellucida*	Pé-de-jabuti, erva-de-jabuti	Tütchi	2	herb	native	"sitio" or "quintal"
8_A	Nupune	2018	Sapindales	Anacardiaceae	*Anacardium occidentale*	Caju	Coü'	2	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Malvales	Malvaceae	*Theobroma cacao*	Cacau	Tchapere	2	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Myrtales	Myrtaceae	*Psidium acutangulum*	Araçapeva	Oratchapewa	3	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Ericales	Lecythidaceae	*Lecythis zabucajo*	Castanha-cabeça-de-macaco	Âüne	2	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Sapindales	Rutaceae	*Citrus limonia*	Limão	Irimawa	3	tree	exotic	"sitio" or "quintal"
8_A	Nupune	2018	Poales	Poaceae	*Zea mays*	Milho	Tchawü	2	perennial grass	exotic	swidden
8_A	Nupune	2018	Sapindales	Rutaceae	*Citrus reticulata*	Tangerina	Tayirima	3	tree	exotic	"sitio" or "quintal"
8_A	Nupune	2018	Oxalidales	Oxalidaceae	*Averrhoa carambola*	Carambola	Nhoõ	4	tree	exotic	"sitio" or "quintal"
8_A	Nupune	2018	Malvales	Bixaceae	*Bixa orellana*	Urucum	Ü'ta	3	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Gentianales	Rubiaceae	*Genipa americana*	Jenipapo	E'	3	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Icacinales	Icacinaceae	*Poraqueiba sericea*	Umarí	te'tchi	3	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Arecales	Arecaceae	*Oenocarpus bacaba*	Bacaba	Boruá	2	palm tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Dioscoreales	Dioscoreaceae	*Dioscorea alata*	Cará	U'í	3	perenniall herb	native	swidden
8_A	Nupune	2018	Solanales	Convolvulaceas	*Ipomoea batatas*	Batata-doce	Core, Co´re	3	shrub	native	swidden
8_A	Nupune	2018	Solanales	Solanaceae	*Capsicum* sp.	Pimentão	Ü´ewemiiraii	3	shrub	native	"sitio" or "quintal"
8_A	Nupune	2018	Solanales	Solanaceae	*Capsicum* sp.	Pimenta-ardosa	Üewemiirai	3	shrub	native	"sitio" or "quintal"
8_A	Nupune	2018	Zingiberales	Musaceae	*Musa* spp.	Banana-maçã	Iru	3	herb	exotic	swidden
8_A	Nupune	2018	Myrtales	Myrtaceae	*Myrciaria dubia*	Camu-camu	Camu camu	3	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Fabales	Fabaceae	*Inga* sp.	Ingá-roxo	Ünapewa	4	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Gentianales	Rubiaceae	*Alibertia sorbilis*	Apuruí	Puruí	3	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Arecales	Arecaceae	*Cocos nucifera*	Coco	Cucu	1	palm tree	exotic	"sitio" or "quintal"
8_A	Nupune	2018	Myrtales	Melastomataceae	*Mouriri trunciflora*	Muruari	Mururi	2	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Gentianales	Apocynaceae	*Couma* sp.	Sorva	Nge'tchi	2	tree	native	"sitio" or "quintal"
8_A	Nupune	2018	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Vará	Vará	3	shrub	native	swidden
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Pseudoplatystoma punctifer*	Surubim	Yuta	3	catfish		
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Pimelodus blochii*	Mandi, Mandii	Mo'ni	2	catfish		
8_F	Nupune	2018	Characiformes	Characidae	*Brycon amazonicus*	Matrinchã	Nge'tchi	2	scale fish		

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
8_F	Nupune	2018	Characiformes	Characidae	*Mylossoma* spp.; *Myleus* spp.	Pacu	Pacu, Ü'ta	2	scale fish		
8_F	Nupune	2018	Characiformes	Characidae	*Triportheus* spp.	Sardinha	Arawiri	3	scale fish		
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Brachyplatystoma vaillantii*	Piramutaba, Pirabutão	Müta, Cotchi	2	catfish		
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Sorubim lima*	Chiripira, Bico-de-pato	De´ne tchma´â, Tchiripira	2	catfish		
8_F	Nupune	2018	Clupeiformes	Pristigasteridae	*Pelona flavipinnis*	Arenga, Apapá-branco	Onacatchi	3	scale fish		
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Hypophthalmus* spp.	Mapará	Mapará	3	catfish		
8_F	Nupune	2018	Characiformes	Cynodontidae	*Cynodon gibbus; Rhaphiodon vulpinus*	Peixe-terçado	Wainayu	2	scale fish		
8_F	Nupune	2018	Perciforme	Sciaenidae	*Plagioscion squamosissimus*	Pescada	Tücüena	2	scale fish		
8_F	Nupune	2018	Siluriformes	Loricariidae	*Pterygoplichthys* spp.	Bodó, Acarí-bodó	Owaru	3	catfish		
8_F	Nupune	2018	Characiformes	Characidae	*Serrasalmus* spp.; *Pygocentrus nattereri*	Piranha	Utchuma	2	scale fish		
8_F	Nupune	2018	Characiformes	Prochilodontidae	*Prochilodus nigricans*	Curimatã	Caweya	3	scale fish		
8_F	Nupune	2018	Siluriformes	Doradidae	*Lithodoras dorsalis; Pterodoras lentiginosus*	Bacu	Wocu	2	catfish		
8_F	Nupune	2018	Siluriformes	Callichthyidae	*Megalodoras uranoscopos*	Peixe-uruá, Uruá, Juruá	Meru, Meru-ana	3	catfish		
8_F	Nupune	2018	Siluriformes	Doradidae	*Oxydoras niger*	Cuiu, Cuiu-cuiu, Cujuba	Cuyu	2	catfish		
8_F	Nupune	2018	Characiformes	Curimatidae	*Potamorhina* spp.	Branquinha, Chorão	Tchuraû, Tchuraü	4	scale fish		
8_F	Nupune	2018	Osteoglossidae	Arapaimatidae	*Arapaima gigas*	Pirarucu	Détchi	3	scale fish		
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Leiarius marmoratus*	Jandiá	Taunü	2	catfish		
8_F	Nupune	2018	Siluriformes	Auchenipteridae	*Ageneiosus spp*	Mandubé	Doma	2	catfish		
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Pseudoplatystoma tigrinum*	Caparari	Coparari	2	catfish		
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Phractocephalus hemiliopterus*	Pirarara	Pué, Ôê	3	catfish		
8_F	Nupune	2018	Siluriformes	Pimelodidae	*Brachyplatystoma rousseauxii*	Dourada	Dui	3	catfish		
8_F	Nupune	2018	Perciforme	Cichlidae	*Cichlidae*	Cará, Acará	Tchuná	2	scale fish		
8_F	Nupune	2018	Characiformes	Erythrinidae	*Hoplias malabaricus*	Traíra	Dé	3	scale fish		
8_F	Nupune	2018	Testudines	Podocnemididae	*Podocnemis unifilis*	Tracajá	To'ri	4	turtle		
8_F	Nupune	2018	Testudines	Podocnemididae	*Podocnemis sexturbeculata*	Copeçu	Cupetchu	3	turtle		
8_F	Nupune	2018	Characiformes	Erythrinidae	*Hoplerythrinus unitaeniatus*	Jiju	O'ü	2	scale fish		
8_F	Nupune	2018	Testudines	Testudinidae	*Chelonoidis*	Jabuti	Ngóbü	3	turtle		
8_F	Nupune	2018	Testudines	Podocnemididae	*Podocnemis expansa*	Tartaruga	Bawe'	4	turtle		
8_F	Nupune	2018	Characiformes	Characidae	*Brycon melanopterus*	Jatuarana	Eruma	3	scale fish		
8_F	Nupune	2018	Characiformes	Prochilodontidae	*Semaprochilodus* spp.	Jaraqui	Waire	2	scale fish		
8_F	Nupune	2018	Siluriformes	Callichthyidae	*Hoplosternum litoralle*	Tamoatá	Tchuru	3	catfish		
8_F	Nupune	2018	Characiformes	Characidae	*Colossoma macropomum*	Tambaqui	Tomacatchi	4	scale fish		
9_A	Nupune	2028	Zingiberales	Musaceae	*Musa* spp.	Banana	Poi'	3	herb	exotic	swidden
9_A	Nupune	2028	Arecales	Arecaceae	*Euterpe oleracea*	Açaí	Waira	2	palm tree	native	swidden
9_A	Nupune	2028	Ericales	Sapotaceae	*Pouteria caimito*	Abiu	Taü, Tao	2	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Poales	Poaceae	*Saccharum officinarum*	Cana	Dene	2	perennial grass	native	swidden
9_A	Nupune	2028	Myrtales	Myrtaceae	*Psidium guajava*	Goiaba	Oratcha	3	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Malvales	Malvaceae	*Theobroma grandiflorum*	Cupuaçu	Cupu	2	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Malpiphigiales	Euphorbiaceae	*Manihot esculenta*	Mandioca	Owa	4	shrub	native	swidden
9_A	Nupune	2028	Sapindales	Rutaceae	*Citrus sinensis*	Laranja	Naranha	4	tree	exotic	"sitio" or "quintal"
9_A	Nupune	2028	Sapindales	Rutaceae	*Citrus reticulata*	Tangerina	Tayirima	3	tree	exotic	"sitio" or "quintal"
9_A	Nupune	2028	Arecales	Arecaceae	*Mauritia flexuosa*	Buriti	Tema', Tema	3	palm tree	native	forest
9_A	Nupune	2028	Malvales	Malvaceae	*Theobroma cacao*	Cacau	Tchapere	2	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Piperales	Piperaceae	*Peperomia pellucida*	Pé-de-jabuti, erva-de-jabuti	Tütchi	2	herb	native	"sitio" or "quintal"
9_A	Nupune	2028	Sapindales	Meliaceae	*Cedrela odorata*	Cedro	Ocayiwa	3	tree	native	forest
9_A	Nupune	2028	Sapindales	Rutaceae	*Citrus limonia*	Limão	Irimawa	3	tree	exotic	"sitio" or "quintal"
9_A	Nupune	2028	Myrtales	Melastomataceae	*Mouriri trunciflora Ducke*	Muruari	Mururi	2	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Gentianales	Apocynaceae	*Couma* sp.	Sorva	Nge'tchi	4	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Fabales	Fabaceae	*Inga edulis*	Ingá	Pama	4	tree	native	"sitio" or "quintal"

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
9_A	Nupune	2028	Arecales	Arecaceae	*Astrocaryum aculeatum*	Tucumã	Itcha	2	palm tree	native	swidden
9_A	Nupune	2028	Ericales	Lecythidaceae	*Berthollethia excelsa*	Castanha	Nho´ô, Nhoí	4	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Poales	Bromeliaceae	*Ananas* sp.	Abacaxi	Tchinü	3	herb	native	swidden
9_A	Nupune	2028	Laurales	Lauraceae	*Persea americana*	Abacate	Nhüma, Ngüma. Ngu´na, Nguma	3	tree	exotic	"sitio" or "quintal"
9_A	Nupune	2028	Ericales	Lecythidaceae	*Lecythis zabucajo*	Castanha-cabeça-de-macaco	Âüne	4	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Vará	Vará	3	shrub	native	swidden
9_A	Nupune	2028	Arecales	Arecaceae	*Cocos nucifera*	Coco	Cucu	2	palm tree	exotic	"sitio" or "quintal"
9_A	Nupune	2028	Icacinales	Icacinaceae	*Poraqueiba sericea*	Umarí	Te'tchi	3	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Sapindales	Anacardiaceae	*Mangifera indica*	Manga	Ma´ga	1	tree	exotic	"sitio" or "quintal"
9_A	Nupune	2028	Malpighiales	Euphorbiaceae	*Mabea* sp.	Tacuarí	Tu´a	3	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Asterales	Asteraceae	*Acmella oleracea*	Jambu	Yâbu	3	herb	native	"sitio" or "quintal"
9_A	Nupune	2028	Myrtales	Myrtaceae	*Eugenia stipitata*	Araçá-boi	Tawe	2	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Rosales	Urticaceae	*Pourouma* sp.	Mapatí	Tchi´ã	2	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Malpighiales	Euphorbiaceae	*Manihot esculenta*	Macaxeira	Tü'e	2	shrub	native	swidden
9_A	Nupune	2028	Sapindales	Anacardiaceae	*Anacardium occidentale*	Caju	Coü'	2	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Myrtales	Myrtaceae	*Psidium acutangulum*	Araçapeva	Oratchapewa	4	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Arecales	Arecaceae	*Bactris gasipaes*	Pupunha	Itü	4	palm tree	native	swidden
9_A	Nupune	2028	Gentianales	Rubiaceae	*Alibertia sorbilis*	Apuruí	Puruí	2	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Dioscoreales	Dioscoreaceae	*Dioscorea alata*	Cará	U'í	3	perenniall herb	native	swidden
9_A	Nupune	2028	Solanales	Convolvulaceas	*Ipomoea batatas*	Batata-doce	Core, Co´re	3	shrub	native	swidden
9_A	Nupune	2028	Apiales	Apiaceae	*Eryngium foetidum*	Chicória	Tchicuria	4	herb	native	"sitio" or "quintal"
9_A	Nupune	2028	Solanales	Solanaceae	*Capsicum* sp.	Pimenta-ardosa	Me'ê	3	shrub	native	"sitio" or "quintal"
9_A	Nupune	2028	Solanales	Solanaceae	*Capsicum* sp.	Pimentão	Ü´ewemiiraii	2	shrub	native	"sitio" or "quintal"
9_A	Nupune	2028	Myrtales	Myrtaceae	*Myrciaria dubia*	Camu-camu	Camu camu	3	tree	native	"sitio" or "quintal"
9_A	Nupune	2028	Oxalidales	Oxalidaceae	*Averrhoa carambola*	Carambola	Nhoõ	4	tree	exotic	"sitio" or "quintal"
9_A	Nupune	2028	Cucurbitales	Cucurbitaceae	*Cucurbita* spp.	Jerimum	Yuruma	3	herb	native	swidden
9_A	Nupune	2028	Cucurbitales	Cucurbitaceae	*Cucumis anguria*	Maxixe	Matchitchi	3	herb/climber	native	"sitio" or "quintal"
9_A	Nupune	2028	Rosales	Urticaceae	*Pourouma* sp.	Mapatirana	Tchiãtchicii	3	tree	native	forest
9_A	Nupune	2028	Malpighiales	Passifloraceae	*Passiflora edulis*	Maracujá	Bora'	2	climbers	native	"sitio" or "quintal"
9_F	Nupune	2028	Siluriformes	Pimelodidae	*Pseudoplatystoma punctifer*	Surubim	Yuta	2	catfish		
9_F	Nupune	2028	Siluriformes	Pimelodidae	*Pimelodus blochii*	Mandi, Mandii	Mo'ni	2	catfish		
9_F	Nupune	2028	Characiformes	Characidae	*Mylossoma* spp.; *Myleus* spp.	Pacu	Pacu, Ü'ta	2	scale fish		
9_F	Nupune	2028	Characiformes	Characidae	*Triportheus* spp.	Sardinha	Arawiri	3	scale fish		
9_F	Nupune	2028	Siluriformes	Pimelodidae	*Hypophthalmus* spp.	Mapará	Mapará	2	catfish		
9_F	Nupune	2028	Siluriformes	Loricariidae	*Pterygoplichthys* spp.	Bodó, Acarí-bodó	Owaru	2	catfish		
9_F	Nupune	2028	Siluriformes	Doradidae	*Lithodoras dorsalis; Pterodoras lentiginosus*	Bacu	Wocu	2	catfish		
9_F	Nupune	2028	Crocodylia	Alligatoridae	*Caiman crocodilus*	Jacaré	Coya	4	alligator		
9_F	Nupune	2028	Siluriformes	Pimelodidae	*Brachyplatystoma vaillantii*	Piramutaba, Pirabutão	Müta, Cotchi	3	catfish		
9_F	Nupune	2028	Osteoglossidae	Arapaimatidae	*Arapaima gigas*	Pirarucu	Détchi	4	scale fish		
9_F	Nupune	2028	Clupeiformes	Pristigasteridae	*Pelona flavipinnis*	Arenga, Apapá-branco	Onacatchi	3	scale fish		
9_F	Nupune	2028	Testudines	Podocnemididae	*Podocnemis unifilis*	Tracajá	To'ri	4	turtle		
9_F	Nupune	2028	Characiformes	Cynodontidae	*Cynodon gibbus; Rhaphiodon vulpinus*	Peixe-terçado	Wainayu	2	scale fish		
9_F	Nupune	2028	Siluriformes	Pimelodidae	*Pseudoplatystoma tigrinum*	Caparari	Coparari	2	catfish		
9_F	Nupune	2028	Siluriformes	Pimelodidae	*Phractocephalus hemilioplerus*	Pirarara	Pué, Ôê	2	catfish		
9_F	Nupune	2028	Siluriformes	Pimelodidae	*Brachyplatystoma rousseauxii*	Dourada	Dui	3	catfish		
9_F	Nupune	2028	?	?	?	Peixe-leão	Tcho´e	2	?		
9_F	Nupune	2028	Characiformes	Characidae	*Brycon melanopterus*	Jatuarana	Eruma	3	scale fish		
9_F	Nupune	2028	Characiformes	Characidae	*Colossoma macropomum*	Tambaqui	Tomacatchi	4	scale fish		
9_F	Nupune	2028	Siluriformes	Callichthyidae	*Hoplosternum litoralle*	Tamoatá	Tchuru	3	catfish		

Free Listing	Village	Time	Ordem	Family	Scientific name	Portuguese name	Tikuna name	Importance	Category	Origin	Site
9_F	Nupune	2028	Characiformes	Prochilodontidae	*Semaprochilodus* spp.	Jaraqui	Waire	2	scale fish		
9_F	Nupune	2028	Testudines	Testudinidae	*Chelonoidis*	Jabuti	Ngóbü	2	turtle		
9_F	Nupune	2028	Siluriformes	Pimelodidae	*Sorubim lima*	Chiripira, Bico-de-pato	De´ne tchma´â, Tchiripira	2	catfish		
9_F	Nupune	2028	Siluriformes	Callichthyidae	*Megalodoras uranoscopos*	Peixe-uruá, Uruá, Juruá	Meru, Meru-ana	3	catfish		

Add File 6. PCA results.

PC-ORD, 7.08
Plots in Species space

Randomization test requested. 999 runs.

5280 = Seed for random number generator.

Fishing_PCA_Correlation_Localimportance

Cross-products matrix contains CORRELATION COEFFICIENTS among Species

VARIANCE EXTRACTED, FIRST 10 AXES

AXIS	Eigenvalue	% of Variance	Cum.% of Var.	Broken-stick Eigenvalue
1	12.363	29.435	29.435	4.327
2	9.917	23.612	53.047	3.327
3	4.952	11.791	64.839	2.827
4	4.216	10.038	74.877	2.493
5	3.837	9.135	84.012	2.243
6	2.769	6.593	90.605	2.043
7	2.704	6.438	97.042	1.877
8	1.242	2.958	100.000	1.734
9	0.000	0.000	100.000	1.609
10	0.000	0.000	100.000	1.498

Sum of eigenvalues: 42.

FIRST 6 EIGENVECTORS, scaled to unit length.
These can be used as coordinates in a distance-based biplot,
where the distances among objects approximate their Euclidean
distances.

Species	Eigenvector 1	2	3	4	5	6
Age spp	0.1651	-0.1975	0.1495	0.0814	-0.0538	-0.0901
Ara gig	0.1435	0.0494	0.0492	-0.2838	0.3009	-0.0473
Ast oce	0.1979	0.1897	-0.0731	-0.0852	-0.0461	0.0322
Bou mac	-0.0747	0.0872	-0.2021	0.3275	-0.0542	-0.2286
Bra rou	-0.0476	-0.1864	0.0031	0.0067	0.3644	0.1802
Bra vai	0.0146	-0.2528	0.1730	-0.1227	-0.1151	-0.0372
Bry ama	0.2262	-0.0039	0.1438	0.1212	0.1027	0.1192
Bry mel	-0.1751	-0.0932	0.0301	0.0912	0.3102	-0.1527
Cic spp	0.1388	0.0858	-0.0732	-0.1201	-0.3349	0.1484
Cichli	0.0881	0.1081	0.0033	0.4204	0.0433	-0.0557
Col mac	0.1769	-0.1508	-0.1084	0.0669	0.0780	0.2963
Cre spp	0.0881	0.1801	-0.1548	-0.0564	0.0537	0.1406
Cyn gib	0.1359	-0.0634	-0.3450	-0.0678	0.0772	-0.0325
Hop uni	0.2130	-0.1390	-0.0888	0.0789	0.0324	-0.2104
Hop mal	0.2346	-0.0131	-0.2087	0.1003	0.0859	0.0329
Hop lit	0.0999	-0.2689	-0.0638	0.0188	-0.1170	0.0822

Hyp spp -0.1329 -0.1908 0.0009 -0.1850 -0.0483 0.0785
Lei mar 0.0851 -0.1717 -0.1513 -0.1196 -0.2276 -0.2128
Lep spp 0.1914 0.1184 -0.0058 0.2682 -0.0503 -0.0666
Lit dor 0.1081 -0.2510 0.0100 0.0209 -0.2147 0.0629
Meg ura -0.0757 -0.1289 -0.1747 0.1859 0.3150 0.0320
Myl spp 0.2226 -0.0100 0.1182 -0.1400 0.0587 -0.2707
Ost bic 0.1979 0.1897 -0.0731 -0.0852 -0.0461 0.0322
Oxy nig 0.2133 0.0692 0.1983 0.0112 0.0920 0.1116
Pel fla 0.0883 -0.2692 -0.1189 0.0163 -0.0337 0.0932
Phr hem 0.0749 -0.2660 0.1478 0.0349 -0.1355 0.1114
Pia bra 0.1360 0.2421 0.0349 -0.2063 -0.0039 0.0124
Pim blo 0.0177 -0.2756 0.1213 0.0109 -0.1099 0.2044
Pla squ 0.2262 -0.0039 0.1438 0.1212 0.1027 0.1192
Pot spp -0.0356 -0.1121 -0.3408 -0.0351 0.0019 -0.1151
Pro nig 0.2504 0.0645 -0.0925 -0.0111 -0.0063 0.0879
Pse pun 0.1369 -0.1073 -0.1848 -0.0784 -0.1020 0.2036
Pse tig 0.0061 -0.1492 -0.2674 -0.0005 0.2869 0.0916
Pte spp 0.1841 0.0930 -0.0540 -0.2594 0.1904 -0.1246
Sem spp 0.0923 -0.1685 0.1749 -0.1018 0.1573 -0.2914
Ser spp 0.2570 0.0118 -0.1410 0.1051 0.0597 0.0416
Sor lim 0.1321 -0.2085 0.1699 0.0525 0.1983 -0.0710
Tra gal 0.2062 -0.0479 -0.1539 0.0359 -0.1018 -0.2611
Tri spp 0.0665 -0.1132 -0.0653 -0.3438 0.0321 -0.2765
Uar amp 0.1268 -0.0420 0.2096 0.2315 -0.0909 -0.3204
Tes tud -0.2279 -0.0686 -0.1772 -0.0917 0.0123 -0.0785
Cro cod 0.0894 0.0816 0.2475 -0.1358 0.1514 0.1509
———————————————————————————

FIRST 6 EIGENVECTORS, each scaled to its standard deviation. These are sometimes called V vectors and, when applied to PCA of a correlation matrix, are the same as the correlation coefficient between scores for rows in the main matrix and the column variables.
———————————————————————————
Eigenvector
Species 1 2 3 4 5 6
———————————————————————————
Age spp 0.5804 -0.6218 0.3327 0.1671 -0.1053 -0.1499
Ara gig 0.5045 0.1555 0.1096 -0.5827 0.5894 -0.0787
Ast oce 0.6960 0.5974 -0.1626 -0.1748 -0.0903 0.0536
Bou mac -0.2628 0.2745 -0.4497 0.6725 -0.1062 -0.3805
Bra rou -0.1673 -0.5870 0.0068 0.0138 0.7138 0.2999
Bra vai 0.0513 -0.7961 0.3851 -0.2519 -0.2254 -0.0619
Bry ama 0.7954 -0.0122 0.3200 0.2488 0.2012 0.1984
Bry mel -0.6157 -0.2934 0.0671 0.1872 0.6077 -0.2541
Cic spp 0.4879 0.2703 -0.1628 -0.2467 -0.6560 0.2469
Cichli 0.3098 0.3405 0.0074 0.8632 0.0847 -0.0927
Col mac 0.6220 -0.4748 -0.2412 0.1373 0.1527 0.4930
Cre spp 0.3097 0.5673 -0.3445 -0.1158 0.1052 0.2339
Cyn gib 0.4780 -0.1995 -0.7677 -0.1393 0.1513 -0.0540
Hop uni 0.7489 -0.4376 -0.1977 0.1620 0.0635 -0.3501
Hop mal 0.8250 -0.0414 -0.4644 0.2059 0.1682 0.0548
Hop lit 0.3513 -0.8468 -0.1420 0.0387 -0.2291 0.1367
Hyp spp -0.4672 -0.6008 0.0020 -0.3798 -0.0946 0.1307
Lei mar 0.2991 -0.5408 -0.3366 -0.2456 -0.4459 -0.3541
Lep spp 0.6730 0.3728 -0.0129 0.5508 -0.0986 -0.1108
Lit dor 0.3800 -0.7905 0.0223 0.0428 -0.4206 0.1047
Meg ura -0.2661 -0.4059 -0.3887 0.3817 0.6170 0.0533
Myl spp 0.7826 -0.0315 0.2630 -0.2874 0.1151 -0.4505
Ost bic 0.6960 0.5974 -0.1626 -0.1748 -0.0903 0.0536

Oxy nig 0.7501 0.2179 0.4412 0.0230 0.1802 0.1858
Pel fla 0.3105 -0.8478 -0.2646 0.0334 -0.0659 0.1550
Phr hem 0.2635 -0.8376 0.3290 0.0717 -0.2653 0.1853
Pia bra 0.4782 0.7625 0.0776 -0.4236 -0.0077 0.0206
Pim blo 0.0622 -0.8679 0.2700 0.0223 -0.2152 0.3401
Pla squ 0.7954 -0.0122 0.3200 0.2488 0.2012 0.1984
Pot spp -0.1251 -0.3530 -0.7585 -0.0721 0.0037 -0.1915
Pro nig 0.8803 0.2032 -0.2059 -0.0229 -0.0122 0.1462
Pse pun 0.4814 -0.3379 -0.4113 -0.1610 -0.1998 0.3387
Pse tig 0.0213 -0.4698 -0.5950 -0.0010 0.5621 0.1523
Pte spp 0.6472 0.2927 -0.1202 -0.5327 0.3730 -0.2074
Sem spp 0.3244 -0.5306 0.3892 -0.2091 0.3082 -0.4849
Ser spp 0.9036 0.0373 -0.3139 0.2157 0.1170 0.0692
Sor lim 0.4645 -0.6566 0.3782 0.1079 0.3885 -0.1181
Tra gal 0.7251 -0.1510 -0.3424 0.0738 -0.1994 -0.4344
Tri spp 0.2337 -0.3565 -0.1454 -0.7059 0.0629 -0.4600
Uar amp 0.4458 -0.1323 0.4665 0.4753 -0.1781 -0.5331
Tes tud -0.8012 -0.2160 -0.3943 -0.1882 0.0242 -0.1307
Cro cod 0.3143 0.2570 0.5509 -0.2788 0.2965 0.2511
——————————————————————————

COORDINATES (SCORES) OF Plots
———————————————————————————————
Axis (Component)
Plots 1 2 3 4 5 6
———————————————————————————————
1 1_F -2.3145 -3.0591 0.1523 -0.3457 -4.0988 1.8774
2 2_F 3.3192 4.6795 0.4340 0.7203 0.6824 2.5709
3 3_F -0.8697 3.9530 1.4724 -2.5300 -0.2245 -0.1149
4 4_F -4.3687 2.2037 0.5497 4.2347 -0.2747 -1.4107
5 5_F 6.6180 -2.2800 2.6616 0.6430 -0.8494 -1.8037
6 6_F -2.6842 0.4208 0.0263 -2.7139 0.3613 -2.1329
7 7_F 2.3755 0.6027 -5.3498 -0.1086 -0.5284 -0.7465
8 8_F 0.3560 -3.8080 -0.7577 0.7427 2.4008 0.6512
9 9_F -2.4315 -2.7127 0.8112 -0.6426 2.5314 1.1093
———————————————————————————————

10.75 = inflation factor for biplot scores

BEGINNING RANDOMIZATIONS

RANDOMIZATION RESULTS
999 = N = number of randomizations
—————————————————————————
Eigenvalue Eigenvalues from randomizations
from ——————————————-
Axis real data Minimum Average Maximum p n
1 12.363 7.1692 8.9182 11.589 0.001000 0
2 9.9171 6.2621 7.4801 9.6576 0.001000 0
3 4.9524 5.1730 6.3524 7.4802 1.000000 999
4 4.2159 4.3105 5.4435 6.8096 1.000000 999
5 3.8368 3.5221 4.5884 5.9319 0.990000 989
6 2.7690 2.7901 3.8342 4.8196 1.000000 999
7 2.7038 1.9830 3.0807 4.1239 0.863000 862
8 1.2422 1.1012 2.3025 3.2846 0.996000 995
9 0.25426E-13 0.16338E-13 0.25094E-13 0.30552E-13 0.493000 492
10 0.62664E-15 0.40602E-15 0.56420E-15 0.81418E-15 0.171000 170
—————————————————————————

* p value for an axis is (n+1)/(N+1), where n is the number of randomizations
with an eigenvalue for that axis that is equal to or larger than the observed
eigenvalue for that axis. N is the total number of randomizations.

APPLICATION OF STOPPING RULES

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Last useful Rule
axis acronym Explanation (see Peres-Neto, Jackson & Somers 2005)

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2 Rnd-Lambda Observed eigenvalue as compared to randomizations
2 Rnd-F Observed pseudo-F-ratio compared to randomizations
2 Avg-Rnd Observed eigenvalue as compared to average eigenvalue from randomizations
7 BS Observed eigenvalue as compared to broken-stick eigenvalue

————————————————————————————

Notes: Rnd-Lambda is relatively robust to nonnormal data.
Rnd-F performs well with uncorrelated variables and multivariate normality.
Avg-Rnd performs well with multivariate normal data without uncorrelated variables.
BS performs well when variables are highly correlated.
For more information, see Peres-Neto et al. (2005 – Comp.Stat.Data Anal.)

PCA completed

PC-ORD, 7.08
Plots in Species space

Randomization test requested. 999 runs.

5804 = Seed for random number generator.

Agriculture_PCA_Correlation_localimportance

Cross-products matrix contains CORRELATION COEFFICIENTS among Species

VARIANCE EXTRACTED, FIRST 10 AXES

——————————————————

Broken-stick
AXIS Eigenvalue % of Variance Cum.% of Var. Eigenvalue

——————————————————

1 14.954 28.758 28.758 4.538
2 8.934 17.181 45.939 3.538
3 7.671 14.751 60.690 3.038
4 5.856 11.261 71.951 2.705
5 4.780 9.193 81.144 2.455
6 4.081 7.848 88.992 2.255
7 3.187 6.128 95.120 2.088
8 2.537 4.880 100.000 1.945
9 0.000 0.000 100.000 1.820
10 0.000 0.000 100.000 1.709

——————————————————

Sum of eigenvalues: 52.

FIRST 6 EIGENVECTORS, scaled to unit length.
These can be used as coordinates in a distance-based biplot,
where the distances among objects approximate their Euclidean
distances.

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Eigenvector

Species	1	2	3	4	5	6
Acm ole	0.1486	0.1776	0.1470	0.1612	0.0916	-0.0488
Ali sor	0.1503	0.1408	0.1734	0.1715	0.0787	-0.0983
Ana occ	0.0522	-0.0920	0.3012	-0.0997	0.0493	-0.0601
Ana sp.	0.1160	-0.1735	0.1105	0.0160	0.1958	0.2454
Ast acu	0.0412	-0.1907	0.1406	-0.2584	-0.0043	0.1551
Ave car	0.2171	0.1180	0.0996	0.0533	0.1067	-0.0395
Bac gas	0.1762	-0.1140	0.0912	-0.1290	0.1991	0.0610
Ber exc	0.2249	0.0788	0.0102	-0.0935	0.0650	-0.0298
Bix ore	0.1250	-0.0541	-0.1406	0.2600	0.0731	-0.1160
Cap sp.	0.1772	0.1455	0.1682	0.1144	0.0721	-0.0750
Car pap	-0.0844	0.2458	-0.0125	0.1924	0.0915	0.1026
Ced odo	0.0977	0.1570	0.2128	-0.0646	-0.1136	-0.0742
Cit lan	-0.0985	0.1158	0.1776	0.2409	0.0220	-0.0677
Cit lim	0.1759	-0.1749	-0.0120	-0.1575	0.0941	-0.1115
Cit ret	0.1851	-0.0822	0.0803	0.0703	0.1162	0.2488
Cit sin	0.1719	0.0936	-0.1429	-0.0942	-0.0556	0.1874
Coc nuc	-0.0765	-0.0924	0.1179	-0.2062	0.2196	0.2475
Cou sp.	0.2273	0.0299	-0.0705	-0.1058	-0.0779	-0.0734
Cuc ang	0.0977	0.1570	0.2128	-0.0646	-0.1136	-0.0742
Cuc spp.	0.1321	0.1331	0.1756	-0.0257	-0.0145	0.0050
Dio ala	0.1718	-0.0223	-0.2013	0.1693	0.0130	0.0769
Ery foe	0.0505	0.2468	0.0404	-0.0482	-0.0032	0.1601
Eug sti	0.0151	0.0244	-0.0067	-0.1935	-0.1285	0.3936
Eut ole	0.0651	-0.2243	0.1119	0.0984	-0.2408	-0.0916
Gen ame	-0.0297	0.1836	0.0525	-0.0358	0.0496	-0.1508
Ing spp.	0.1354	0.2178	0.0511	0.0084	0.1282	0.1251
Ipo bat	0.1464	-0.1542	-0.1020	0.1864	-0.0381	0.1056
Lec zab	0.2215	0.0822	0.0242	-0.1495	0.0396	0.0141
Mab sp.	0.2306	0.0230	-0.0903	-0.0485	-0.0610	-0.1217
Man ind	0.0080	-0.3152	-0.0028	-0.0628	0.0243	-0.0117
Man esc	0.0678	0.1103	-0.0220	-0.1065	-0.2261	0.3042
Mat cor	-0.0583	0.1297	-0.1439	0.0993	0.1469	0.2640
Mau fle	0.1627	-0.2200	0.0508	0.0969	-0.1023	-0.0159
Mou tru	0.1144	-0.1379	0.0885	0.0122	-0.3336	0.0382
Mus spp.	-0.0332	-0.1128	0.1897	0.1002	0.1612	0.1732
Myr dub	0.2249	0.0788	0.0102	-0.0935	0.0650	-0.0298
Oen bac	0.0401	-0.1196	0.0981	0.2689	-0.2321	-0.0315
Pep pel	0.1835	-0.0679	0.1104	0.2036	-0.1456	0.0241
Per ame	0.1329	0.0141	-0.1239	0.0843	0.0580	0.1164
Pla ins	0.0368	-0.0970	-0.0778	0.2810	0.1100	0.0567
Por ser	0.1880	0.0360	-0.1812	-0.0799	-0.1640	0.0011
Pou sp.	0.1393	-0.1980	0.1649	-0.0712	0.0256	-0.0683
Pou cai	0.1808	-0.1355	-0.0811	0.1550	0.1518	0.0118
Psi acu	0.2270	0.0816	0.0167	-0.1203	0.0546	-0.0105
Psi gua	0.1278	-0.0533	-0.0033	-0.1933	0.1079	-0.3267
Psi sp.	-0.0459	-0.1215	0.0119	0.0530	0.3643	-0.0601
Sac off	0.0960	0.0738	0.1538	0.2228	-0.0518	0.2407
Sol ses	-0.0481	0.0066	0.2894	0.0700	-0.2233	0.0223
The cac	0.1336	0.0132	-0.2679	0.1108	-0.0876	-0.0346
The gran	0.1290	-0.1873	-0.1563	0.0373	-0.0905	0.1016
Vig ung	-0.1127	-0.0477	0.2231	0.0265	-0.2058	0.1202
Zea may	-0.0830	-0.1623	0.2229	0.1058	0.1986	0.0168

FIRST 6 EIGENVECTORS, each scaled to its standard deviation.
These are sometimes called V vectors and, when applied to
PCA of a correlation matrix, are the same as the correlation

coefficient between scores for rows in the main matrix and the column variables.

	Eigenvector					
Species	1	2	3	4	5	6
Acm ole	0.5748	0.5307	0.4071	0.3900	0.2003	-0.0986
Ali sor	0.5810	0.4209	0.4802	0.4149	0.1721	-0.1987
Ana occ	0.2018	-0.2749	0.8341	-0.2412	0.1077	-0.1214
Ana sp.	0.4485	-0.5185	0.3059	0.0386	0.4281	0.4957
Ast acu	0.1593	-0.5700	0.3894	-0.6252	-0.0094	0.3133
Ave car	0.8394	0.3528	0.2758	0.1289	0.2334	-0.0798
Bac gas	0.6816	-0.3406	0.2526	-0.3122	0.4354	0.1232
Ber exc	0.8695	0.2355	0.0283	-0.2263	0.1421	-0.0603
Bix ore	0.4835	-0.1616	-0.3895	0.6292	0.1598	-0.2344
Cap sp.	0.6851	0.4349	0.4659	0.2768	0.1576	-0.1515
Car pap	-0.3265	0.7346	-0.0345	0.4655	0.2000	0.2072
Ced odo	0.3779	0.4692	0.5894	-0.1563	-0.2483	-0.1498
Cit lan	-0.3808	0.3461	0.4919	0.5829	0.0480	-0.1367
Cit lim	0.6803	-0.5227	-0.0332	-0.3812	0.2058	-0.2252
Cit ret	0.7159	-0.2458	0.2224	0.1701	0.2540	0.5026
Cit sin	0.6647	0.2796	-0.3959	-0.2280	-0.1216	0.3785
Coc nuc	-0.2958	-0.2763	0.3266	-0.4990	0.4801	0.4999
Cou sp.	0.8792	0.0894	-0.1952	-0.2561	-0.1702	-0.1482
Cuc ang	0.3779	0.4692	0.5894	-0.1563	-0.2483	-0.1498
Cuc spp.	0.5108	0.3977	0.4864	-0.0623	-0.0316	0.0102
Dio ala	0.6643	-0.0668	-0.5574	0.4096	0.0283	0.1554
Ery foe	0.1954	0.7377	0.1119	-0.1167	-0.0070	0.3234
Eug sti	0.0582	0.0729	-0.0186	-0.4683	-0.2810	0.7951
Eut ole	0.2519	-0.6703	0.3100	0.2380	-0.5264	-0.1851
Gen ame	-0.1149	0.5488	0.1454	-0.0867	0.1085	-0.3047
Ing spp.	0.5238	0.6509	0.1414	0.0204	0.2803	0.2527
Ipo bat	0.5661	-0.4610	-0.2825	0.4510	-0.0834	0.2133
Lec zab	0.8565	0.2458	0.0671	-0.3617	0.0867	0.0284
Mab sp.	0.8917	0.0688	-0.2501	-0.1173	-0.1334	-0.2458
Man ind	0.0311	-0.9420	-0.0076	-0.1519	0.0531	-0.0236
Man esc	0.2622	0.3298	-0.0610	-0.2578	-0.4944	0.6145
Mat cor	-0.2256	0.3875	-0.3985	0.2402	0.3212	0.5334
Mau fle	0.6291	-0.6576	0.1406	0.2344	-0.2237	-0.0320
Mou tru	0.4426	-0.4122	0.2450	0.0295	-0.7293	0.0771
Mus spp.	-0.1285	-0.3373	0.5255	0.2425	0.3523	0.3499
Myr dub	0.8695	0.2355	0.0283	-0.2263	0.1421	-0.0603
Oen bac	0.1552	-0.3574	0.2718	0.6506	-0.5074	-0.0636
Pep pel	0.7096	-0.2029	0.3057	0.4927	-0.3184	0.0487
Per ame	0.5138	0.0420	-0.3432	0.2040	0.1268	0.2351
Pla ins	0.1425	-0.2899	-0.2155	0.6800	0.2406	0.1146
Por ser	0.7269	0.1077	-0.5019	-0.1934	-0.3585	0.0023
Pou sp.	0.5387	-0.5917	0.4566	-0.1722	0.0561	-0.1381
Pou cai	0.6993	-0.4050	-0.2245	0.3751	0.3320	0.0239
Psi acu	0.8778	0.2440	0.0463	-0.2912	0.1193	-0.0211
Psi gua	0.4941	-0.1594	-0.0091	-0.4677	0.2359	-0.6601
Psi sp.	-0.1774	-0.3632	0.0328	0.1282	0.7966	-0.1213
Sac off	0.3714	0.2207	0.4260	0.5390	-0.1133	0.4863
Sol ses	-0.1859	0.0198	0.8016	0.1694	-0.4882	0.0450
The cac	0.5167	0.0394	-0.7419	0.2680	-0.1916	-0.0699
The gran	0.4989	-0.5598	-0.4329	0.0903	-0.1980	0.2052
Vig ung	-0.4357	-0.1426	0.6180	0.0642	-0.4499	0.2427
Zea may	-0.3211	-0.4851	0.6173	0.2560	0.4342	0.0339

COORDINATES (SCORES) OF Plots

Axis (Component) Plots	1	2	3	4	5	6
1	1_A	-4.9838	0.9963	-0.6812	-0.0862	0.1063	-0.1590
2	2_A	0.4831	-0.9350	-0.2430	4.3399	3.2351	1.5653
3	3_A	1.0236	-2.6028	-4.1937	1.3490	-3.2348	-2.0648
4	4_A	-3.0899	4.3235	-3.2688	-1.4372	-0.2305	2.1955
5	5_A	-0.6732	-4.6456	2.5639	-0.6729	-1.9891	3.1451
6	6_A	-2.9032	-2.8943	0.5637	-3.2453	2.9086	-2.4299
7	7_A	-1.7187	3.2751	4.9827	1.6845	-1.8912	-1.8225
8	8_A	4.9884	0.8106	-0.4992	1.0871	1.1193	-1.1843
9	9_A	6.8737	1.6723	0.7756	-3.0188	-0.0237	0.7547

14.74 = inflation factor for biplot scores

BEGINNING RANDOMIZATIONS

RANDOMIZATION RESULTS
999 = N = number of randomizations

Eigenvalue Eigenvalues from randomizations from ——————————- Axis	real data	Minimum	Average	Maximum	p	n
1	14.954	8.5709	10.585	13.278	0.001000	0
2	8.9342	7.5860	8.9396	11.825	0.469000	468
3	7.6707	6.0762	7.7348	8.9805	0.548000	547
4	5.8556	5.5617	6.7206	8.0532	0.987000	986
5	4.7802	4.6502	5.7990	6.9602	0.997000	996
6	4.0812	3.7792	4.9381	5.9553	0.992000	991
7	3.1866	2.6536	4.0953	5.5185	0.986000	985
8	2.5374	1.7545	3.1876	4.3771	0.932000	931
9	0.45586E-13	0.28132E-13	0.44574E-13	0.51486E-13	0.441000	440
10	0.68737E-15	0.48206E-15	0.65797E-15	0.95879E-15	0.298000	297

* p value for an axis is (n+1)/(N+1), where n is the number of randomizations with an eigenvalue for that axis that is equal to or larger than the observed eigenvalue for that axis. N is the total number of randomizations.

APPLICATION OF STOPPING RULES

Last useful Rule axis	acronym	Explanation (see Peres-Neto, Jackson & Somers 2005)
1	Rnd-Lambda	Observed eigenvalue as compared to randomizations
3	Rnd-F	Observed pseudo-F-ratio compared to randomizations
1	Avg-Rnd	Observed eigenvalue as compared to average eigenvalue from randomizations
8	BS	Observed eigenvalue as compared to broken-stick eigenvalue

Notes: Rnd-Lambda is relatively robust to nonnormal data.
Rnd-F performs well with uncorrelated variables and multivariate normality.
Avg-Rnd performs well with multivariate normal data without uncorrelated variables.
BS performs well when variables are highly correlated.
For more information, see Peres-Neto et al. (2005 – Comp.Stat.Data Anal.)

PCA completed

Add File 7. Focus group to explore local perceptions of climate change and extreme weather events.

Fieldwork step	Climate change and extreme weather events	Climate change and extreme weather events	Climate change and extreme weather events	Climate change and extreme weather events	Climate change and extreme weather events	Climate change and extreme weather events
Community	Novo Paranapara	Novo Paranapara	Ütapü	Ütapü	Nupune	Nupune
Focus group	women	men	women	men	women	men
Qual foi o EEC mais recente?	Em 2015	A cheia de 2015	Em 2012	A cheia grande de 2012	Em 2015 para 1016	2015 foi maior a cheia, teve outras também
Como aconteceu?	Algumas famílias já haviam saído da comunidade Paranapara, a cheia de 2015, trouxe muito prejuízo para nossa plantação, morreu tudo e nossos filhos ficam doentes.	Foi quando vimos que teríamos que se mudar para Terra Firme junto com outros, porque não tinha mais terra para mudar nossas casas e perdemos tudo que plantamos	Todas as casas foram para fundo, algumas pessoas tiveram que ficar na casa de outros, depois ficamos sem farinha e banana porque morreu tudo	Perdemos alguns animas, nossa plantação, a porta da igreja quebrou com a pressão da água e tivemos que mudar nossas casas.	Na terra firme a água subiu bastante ficou acima da marca dos outros anos	As plantas morreram tudo e a água ficou bem próximo do telhado.
Como a comunidade (ou você ficou sabendo)?	Não tem informações, a gente sabe que vai ser uma cheia grande, porque temos que mudar o assoalho das casas.	No dia a dia, vamos percebendo o quanto está enchendo, se está subindo rápido ou não a água	A gente fica sabendo pelos nossos conhecimentos. As mudanças no dia a dia	Antes da enchente não tivemos informações que em 2012 ia ter uma enchente grande, a gente só sabe por que o rio aumentou mais que no ano passado. Na várzea alta quando a enchente não é grande não alaga.	Através no nosso conhecimento	a gente percebe quando a cheia vai ser grande e quando vai ser pequena, a água sobe muito rápido.
Como (ou quem) percebe que vai haver um EEC?	Pela marca deixada pela enchente anterior, são os homens que percebe se vai ser preciso aumentar o assoalho da casa ou se temos que retirar toda mandioca para não apodrecer	Tanto homens como Mulheres, pois cada um percebe o que estar mudando em suas atividades, os homens saem para pesca então sabemos o quanto o rio enche no dia, as mulheres sabem por que lavam roupas e as vasilhas no geral que também é mudado conforme a cheia ou seca.	Percebemos que o tempo vai mudar, pelo período de chuvas, sabemos os meses que chove mais, se não chove esses meses é porque a seca vai ser longa	Todos nos indígenas percebemos quando vai ter uma cheia grande ou uma seca prolongada. Nosso conhecimento ajuda bastante, a gente planta de acordo com as chuvas	Quando a enchente é grande os papagaios vem comer as bananas e pupunhas.	nós percebemos se chove muito, se vai ser preciso tirar as mandiocas e aumentar nossas casas.
Quais as informações sobre clima e tempo estão disponíveis atualmente na comunidade?	Não tem	Somente pela TV no Jornal	Só informações do Jornal	Não tem	Não tem	Não tem
Qual a principal fonte destas informações (rádio, internet, parentes, missionários, outro-quais)?	Não tem	Tv	TV	Não tem	Não tem	Não tem
Se não há informações suficientes para se precaver de EEC catastróficos, quais informações gostariam de receber?	De quando vai chover, se as cheias vão ser grande no ano	sobre as cheias e secas grandes, pois temos muitos prejuízos. Na terra firma quando a seca e grande os peixes morrem, ficamos sem água para beber e os igarapés ficam muito distante das casas	Gostaríamos de informações sobre as práticas para plantar	Todos os tipos de informações sobre o clima, pois não tem esse tipo de informação na comunidade.	As informações de quando vai ter chuvas fortes, e quando vai ter secas longas	sobre as cheias e secas no ano pra se preparar, tirar as roças antes de ficar no fundo
Como são usadas as informações disponíveis?	Não tem informações,	Não temos outras informações, só nosso conhecimento do dia a dia de nossas atividades.	nossos conhecimentos são usados nas atividades de roça.	Não tem informações	Não tem informações	Não tem informações
Para que?	Não tem	Para prevenir	Para se iniciar a queima e a colheita	Não tem informações	Não tem informações	Não tem informações
Qual o modo mais eficiente para compartilhar estas informações na comunidade?	Ficaria melhor se tivesse alguém para avisar, pois nem todos têm celular para passar notícias. E não tem radio	Através de alguém que possa tá explicando sobre essas informações sobre o clima, o que devemos fazer, na roça e na pesca.	seria através dos professores, das pessoas de fora que vem para comunidade e dos caciques	Seria através de alguém que pudesse falar sobre as cheias e secas	Através de avisos nas comunidades através da escola	nas escolas, na rádio e TV
E entre comunidades?	Os caciques responsáveis pela comunidade ou pela escola	Entre as comunidades é difícil, porque ninguém está preocupado com outras comunidades, as lideranças não são unidas.	poderia ser feito reuniões com as comunidades ou se estivesse radio	Através de reuniões com as comunidades	Às vezes os caciques das comunidades falam sobre algumas notícias que acontece nas outras comunidades	Os caciques, os professores e agentes de saúdes.

Add File 8. Focus groups for exploring local adaptation strategies.

Fieldwork step	Adaptation and climate smart agriculture	Adaptation and climate smart agriculture	Adaptation and climate smart agriculture
Community	Novo Paranapara	Ütapü	Nupune
Focus group	women e men	women e men	women e men
Há (ou havia antes da mudança) uma rotação de cultivo nas roças na terra firme e nas várzeas?	Na várzea, não tinha rotação de cultura, agora na terra firme ainda não temos roça grande.	Nem na várzea e nem na terra firme	Não fazem rotação de cultura
Há prática de pecuária (em que escala?) ou de pequenos animais?	Somente criação de pequenos animais para consumo	Só galinhas e patos	Galinhas e patos
Há alguma integração entre lavoura e pecuária (ou criação de pequenos animais)?	Não, só criação de galinhas e patos	Não	Não
Quais as práticas para melhoramento da qualidade do solo (se houver)?	Não utilizam nenhuma prática, continuam plantando da mesma forma que na várzea	Roça sem queima	Não tem
São utilizados adubos químicos e pesticidas?	Não	Não	Não
Se houver, há alguma prática para evitar ou reduzir sua migração para os rios?	Não	Não	Não
Há alguma prática em uso para adaptar a agricultura aos EEC? Quais? (para secas extremas; para cheias extremas).	Não	Não	Não
Quais as práticas para evitar poluição das águas (mananciais) ou sua escassez nos EEC?	Não tem, fazem captação da água da chuva	Fazem captação da água da chuva	Não tem
Quais os efeitos dos EEC sobre as populações de pirarucu, tambaqui, tartaruga, jacaré e caças de médio e grande porte?	Nas enchentes grandes fica difícil de pescar alguns peixes, como o tambaqui; tartaruga não tem mais e a caça também não tem quase nada	Nas grandes cheias, os peixes se espalham tornando a pescaria mais difícil	Na seca longa, os lagos ficam muito secos, os peixes morrem com a temperatura da água.

Add File 9. Extreme weather events recorded by the media between 1999 and 2017 in the upper Solimões River region.

URL	Year	Families affected	Municipalities	Situation	Month	Author
www.g1.globo.com	2017	2,5 mil	Tabatinga, Benjamin Constant, São Paulo de Olivença, Amaturá, Santo Antônio do Iça, Tonantins e Atalaia do Norte	Atenção	Maio	Leandro Tapajós
www.d.emtempo.com.br	2016	66	São Paulo de Olivença	Emergência	Maio	Mara Magalhães
www.g1.globo.com	2015	88 (somente em Tabatinga)	Atalaia do Norte, Benjamin Constant, Tabatinga, Amaturá, Santo Antônio do Içá, São Paulo de Olivença e Tonantins	Emergência	Abril	Adneison Severiano
www.noticias.bol.uol.com.br	2012	Não informado	Atalaia do Norte, Amaturá, Benjamin Constant, Tonantins, Tabatinga, Santo Antônio do Iça e São Paulo de Olivença	Emergência	Maio	Kátia Brasil
www.portaldopurus.com.br	2011	3,7 mil	Tabatinga, Atalaia do Norte e Benjamim Constant	Emergência	Maio	Agostinho Alves
www.folhadelondrina.com.br	1999	14,780 mil (pessoas)	Benjamin Constant, Tabatinga, Tonantins e Atalaia do Norte	Calamidade	Maio	Kátia Brasil
			Secas			
www.noticias.uol.com.br	2010	66	Tabatinga, Atalaia do Norte, Benjamim Constant, São Paulo de Olivença, Santo Antônio do Iça e Tonantins	Emergência	Outubro	Guilherme Balzar
www.folha.uol.com.br	2005	4 mil (pessoas)	Tabatinga, Benjamim Constant, São Paulo de Olivença, Santo Antônio do Içá e Atalaia do Norte	Emergência	Outubro	Kátia Brasil e Eduardo de Oliveira