Acta Botanica Brasilica, 2025, 39: e20240167
doi: https://doi.org/10.1590/1677-941X-ABB-2024-0167

Review

Food and Medicinal Plants Managed by the Jê Indigenous Peoples: A Systematic Review of the Literature from 1865 to 2021

Ariane Saldanha de Oliveira[1,2,*], **Aline Pereira Cruz**[3], **Nivaldo Peroni**[4]

[1] Universidade Federal de Santa Catarina, Centro de Ciências Biológicas, Departamento de Ecologia e Zoologia, Programa de Pós-Graduação em Biologia de Fungos, Algas e Plantas, Florianópolis, SC, Brazil.
[2] Instituto Federal do Paraná, Colombo, Paraná, Brazil
[3] Universidade Federal de Santa Catarina, Centro de Ciências Biológicas, Departamento de Ecologia e Zoologia, Programa de Pós-Graduação em Ecologia, Florianópolis, SC, Brazil.
[4] Universidade Federal de Santa Catarina, Centro de Ciências Biológicas, Departamento de Ecologia e Zoologia, Florianópolis, SC, Brazil.
*Correspondence Author: ariane.oliveira@ifpr.edu.br.

ABSTRACT

The diversity of plant species managed by Indigenous peoples is directly related to cultural and linguistic factors. Many species were domesticated to varying degrees in the lowlands of South America. However, there is still a need to better understand the process of species and landscape domestication, especially the management practices of the indigenous populations of inland Brazil, such as the speakers of the Jê language family. With this in mind, we undertook a systematic review of the literature on the plant species used by these peoples for food and medicinal purposes. We examined 126 publications, covering 126 years. A richness of 609 botanical species was identified. Some plants, such as maize, manioc, sweet potatoes, and yams, are managed by peoples across the northern, central, and southern regions, while others are managed exclusively by peoples from within the same linguistic branch or geographical area. The results reveal that the Jê maintain a high level of species diversity with varying degrees of domestication in their food production systems and that the biodiversity generated and managed by these indigenous populations is a key factor for agricultural resilience in a scenario of climatic extremes.

Keywords: Brazil, Ethnobotany; Jê Language Family; Systematic Review; Traditional Ecological Knowledge.

Introduction

Globally, approximately 40 % of protected land areas and ecologically conserved landscapes are managed or owned by Indigenous peoples (Garnett *et al.*, 2018). In addition to conserving natural resources, Indigenous peoples have historically played a significant role in the generation and amplification of species diversity, particularly in the areas of food and medicinal plant species (Posey, 1986; Clement, 1999; Freitas & Zarur, 2007). This ecological diversity managed and generated by Indigenous peoples is closely related to aspects of culture and language, forming complex socio-ecological systems with adaptive capacity (Franco, 2022), in which the human presence acts by directing the processes of structuring communities and landscapes.

The Indigenous peoples who inhabit the lowlands of South America have promoted the domestication of plants and landscapes, with varying degrees of interdependence

Received July 09, 2024; Accepted September 01, 2025
Editor-in-Chief: Thaís Elias Almeida; Associate Editor: Taline Silva

How to cite:
Oliveira AS, Cruz AP, Peroni N. 2025. Food and Medicinal Plants Managed by the Jê Indigenous Peoples: A Systematic Review of the Literature from 1865 to 2021. Acta Botanica Brasilica 39: e20240167. doi: 10.1590/1677-941X-ABB-2024-0167

on human action. The domestication of plant populations is a mutualistic process, whereby humans select useful plants, managing and cultivating populations with more advantageous morphological characteristics (Clement, 1999; Clement *et al.*, 2021). The benefit for the symbiont plants is an increase in population, i.e. greater reproductive success. The benefit for humans is a greater supply of food and other plants with varied uses. Plant selection begins at the individual level, with individuals being managed *in situ*. Varieties with the most desirable characteristics for cultivation are then propagated (Rindos, 1984; Clement, 1999; Clement *et al.*, 2021). In plants with a short life cycle, humans generally manage the reproduction, genetic structure, and dispersal of the domesticated species. In perennial plants, such as tree species, the demographic structure is managed, with taxa that can exhibit different degrees of domestication (Wiersum, 1997; Meyer *et al.*, 2012).

Management actions such as protecting the individual from pests, removing competing species, selecting seeds, planting and transplanting, for example, are forms of care that favor individuals, modifying the density of plant populations (Furlan *et al.*, 2017; Levis *et al.*, 2018). Consequently, dispersal, mediated by anthropogenic action, creates mosaics of domesticated landscapes, favoring populations of useful plants, each domesticated with different intensities and results (Wiersum, 1997; Clement, 1999; Balée, 2006). The domestication of landscapes promotes ecological changes and changes in the demography of plants and animal populations in the environment to make the landscape more productive and safer for humans (Clement, 1999; Levis *et al.*, 2018).

Landscapes with a high degree of domestication typically include orchards, vegetable gardens, swidden, and fallow lands, i.e., integrated agroforestry systems that are efficient in terms of producing food and other useful plants (Posey, 1986; Clement, 1999; Levis *et al.*, 2018). The species that comprise agroforestry systems may have different degrees of alteration in their genotypes, just as they may have different degrees of dependence on humans for propagation (Clement, 1999). Therefore, given the long history of Indigenous peoples in the Americas, processes of species domestication occurred prior to the arrival of Europeans in the South American lowlands, but without the development of a hegemonic agricultural model as practiced in Eurasia, as did the management of species that were not fully domesticated (Shepard Jr. *et al.*, 2020).

The food production systems of the different Indigenous peoples that occupy Brazil's biomes are not limited to the dichotomy of agriculture *versus* hunting-gathering, but there are mixed systems that adapt to the needs of the group (Iriarte *et al.*, 2020; Shepard Jr. *et al.*, 2020; Clement *et al.*, 2021). However, despite the complexity of these production systems, the absence of the hegemonic model of agriculture has led to an understanding that lowland Indigenous peoples are "primitive" (Clement *et al.*, 2021). This premise has been attributed especially to those peoples who occupied the inland areas and did not speak the languages of the Tupi-Guarani family, such as those who spoke the Jê family of languages (Schmidt, 1942; Coelho De Souza, 2002; Lima, 2019).

The peoples who speak languages related to the Jê linguistic family, belonging to the Macro-Jê linguistic trunk, are called Jê (Urban, 1992). In addition to linguistic characteristics, Jê peoples may share cultural similarities, the most striking of which are related to social organization in groups or clans (Coelho de Souza, 2002; Cohn, 2019; Melatti, 2020). The Jê peoples are currently divided into three subgroups (or linguistic branches) (Rodrigues, 2012; Melatti, 2020):

- Northern Jê – Apinajé (Western Timbira), Mebêngôkre – Kayapó, Panará, Suyá, Tapayuna, Eastern Timbiras (Canela Apãniekrá and Ramkokamekrá, Krikati, Krahô, Parakatejê and Pykobjê);
- Central Jê – Xerénte, Xakriabá, Xavánte;
- Southern Jê – Kaingáng and Laklãnõ-Xokléng.

The Jê peoples are present from the transition between the Amazon and the Cerrado in the states of Maranhão, Tocantins, Pará, and Mato Grosso (Northern Jê), and are also found in the Cerrado areas of Mato Grosso, Tocantins and Minas Gerais (Central Jê), as well as occupying regions of the Atlantic Rainforest, especially the Mixed Ombrophilous Forest, in the states of São Paulo, Paraná, Santa Catarina and Rio Grande do Sul (Southern Jê). As such, the Jê peoples have ancestral territories in biomes of high biodiversity and species endemism, with the Atlantic Forest and Cerrado considered priority hotspots for conservation (Myers *et al.*, 2000).

The food species and management characteristics shared by peoples with common linguistic origins and cultural components can provide elements for understanding the domestication of species in the lowlands of South America. Despite the large amount of data in the literature on the plants and agricultural, horticultural, and arboricultural practices of the Jê peoples, there are no compilations that make it possible to synthesize and compare this information in order to generate new knowledge. Furthermore, in times of climatic extremes and loss of biocultural diversity, a deeper understanding of the food production systems and medicinal species managed by Indigenous peoples can provide elements for rethinking the legacy of Indigenous influence on food production, contributing to the recognition of the intellectual and territorial rights of the Jê peoples and the development of more sustainable and equitable agri-food systems.

Given this scenario, this study aims to contribute to the systematization of knowledge about the diversity of food and medicinal plants and the management techniques practiced by the peoples of the Jê linguistic family. To this end, a systematic review of the literature was carried out, a

database was created to examine aspects of the plant species managed and the characteristics of the research surveyed. Based on the data compiled, the results were compared in terms of the species shared by the peoples of the three Jê linguistic branches, as well as some of the management practices identified as common to the three groups.

Materials and Methods

Selection of the scientific literature

A systematic review of the literature was conducted taking into account the diverse range of publication and document types available for digital research (online resources in repositories). To identify relevant scientific articles, four databases were consulted: Scielo, Scopus, JStor, and Web of Science. To locate theses and dissertations, searches were conducted in three databases that aggregate scientific output in Portuguese and English: The Brazilian Digital Library of Theses and Dissertations (*Biblioteca Digital Brasileira de Teses e Dissertações* BDTD), the Networked Digital Library of Theses and Dissertations (NDLTD), and ProQuest Dissertations & Theses Global. These databases were used because of the large number of publications of potential interest available in these repositories and the greater likelihood of finding research of interest when using more than one database (Foo *et al*., 2021).

The online database searches were conducted between August and October 2020, with no date filters applied to the search engines. The languages considered were Portuguese and/or English. The search strategy was defined following preliminary tests on the repositories, to identify the most effective keywords and Boolean operators for retrieving a greater number of articles. However, minor adaptations were made to each database in accordance with the specific characteristics of their search mechanisms, such as the maximum number of characters supported and the language. Chart 1 provides a summary of the general search strategy employed in the repositories.

For each repository, based on the list of studies presented as a result of the search, the title, abstract, and/or full article were read in order to select the research that met the following criteria:

i. The study addressed one or more peoples of the Jê linguistic family;
ii. The study mentioned one or more plants used for food or medicinal purposes by these peoples.

Studies that did not meet these two criteria were excluded from the analysis.

It should be noted that publications from the field of archaeology were not included in this study, as archaeological data is often difficult to directly associate with specific people when using the linguistic family as a criterion for identification. This is due to the fact that characteristics such as the layout of houses in villages and graphics on ceramics can often be shared by peoples from the same linguistic trunk (Wüst, 1999).

The next stage of the selection process involved an examination of titles on the websites of the corresponding repositories for each paper. The metadata of the selected papers was then exported in spreadsheet form in order to identify and remove any duplicates (i.e., studies retrieved from more than one of the databases).

In addition to the articles, theses, and dissertations located in online repositories, the database was augmented with references cited in previously included research using a technique known as "backward search" (Foo *et al*., 2021). Furthermore, it was determined that previously known publications that met the established inclusion criteria should be included.

The database was constructed using information extracted from two distinct sources: "white literature," which encompasses books and articles published in scientific

Chart 1. The general search strategy employed to identify articles, theses, and dissertations within the selected online databases

((plantas OR planta OR vegetais OR frutas OR "Plantas alimentícias" OR "plantas úteis" OR vegetal OR vegetales OR "Plantas Comestibles" OR "plantas utiles" OR "use plants" OR plant* OR "Edible Plant" OR "Edible Plants" OR "Food Plant" OR "Food Plants" OR vegetable OR fruit OR etnobotânica OR ethnobotany OR "conhecimento ecológico tradicional" OR "conocimiento ecologico tradicional" OR "traditional ecological knowledge" OR "manejo tradicional" OR "traditional management" OR "conhecimento tradicional" OR "conocimiento tradicional" OR "traditional knowledge" OR ethno* OR etno* OR horticul* OR agrobiodiversidad* OR agrobiodiversity) AND ("Grupos Jê" OR "grupo Gê" OR botocudo OR timbira OR canela OR kanela OR gavião OR apaniekra OR apinajé OR apinayé OR ramkokamekrá OR parkatejê OR parkateyê OR pykopjê OR pykopcatejê OR kaingang OR caingang OR caingangue OR coroados OR kayapó OR caiapó OR mebengokre OR xikrin OR krikati OR kricatijê OR krahô OR craô OR mehin OR panará OR "Kayapó del Sur" OR "Caiapó do Sul" OR krenakore OR kisêdjê OR kisidjê OR suyá OR tapayuna OR kajkwakratxi OR xakriabá OR xavante OR "Auwe" OR xerente OR akwê OR xoklény OR xokren OR xoklengue OR shokleng OR laklanõ))

journals, and "gray literature," which includes master's dissertations, doctoral theses, technical reports, and other low-circulation and non-indexed publications (Botelho & Oliveira, 2015). In the case of articles and theses or dissertations authored by the same individual, we elected to include all of the works, given that scientific articles often present only a portion of the research and, therefore, may not include all of the information of interest.

The selected scientific articles were then classified according to the fields of knowledge proposed by the Coordination for the Improvement of Higher Education Personnel (CAPES, 2023). To verify the fields of knowledge of the articles, the information provided on the website of each journal was consulted. To verify the fields of knowledge of the theses and dissertations, the names of the postgraduate programs linked to the research carried out at Brazilian universities were evaluated. In the case of foreign research, the department or faculty where the work was carried out was also verified.

The methodology employed to include references in the database was reported in accordance with an adapted form of the PRISMA recommendation (Principal Reporting Items for Systematic Reviews and Meta-analyses) (Galvão *et al.*, 2015).

Data organization and analysis

In order to create the database, after a thorough reading of the publications, the pertinent information on food and medicinal plant species and management techniques was extracted from the studies and organized into categories, as described in their contents. This information was then systematized in a spreadsheet, where each row of the spreadsheet described a species or ethnovariety mentioned in the publication analyzed. The word ethnovariety was used to refer to the morphotypes of the same taxonomic species recognized by the Jê indigenous peoples; the term "variety" was used as a synonym for the name of an infraspecific taxon, in accordance with Article 26, Chapter 3 of the International Code of Botanical Nomenclature (Turland *et al.*, 2018). Figure 1 illustrates a conceptual model of the process of extracting information from the publications analyzed, and Tab. 1 shows the categories used to fill in the information fields.

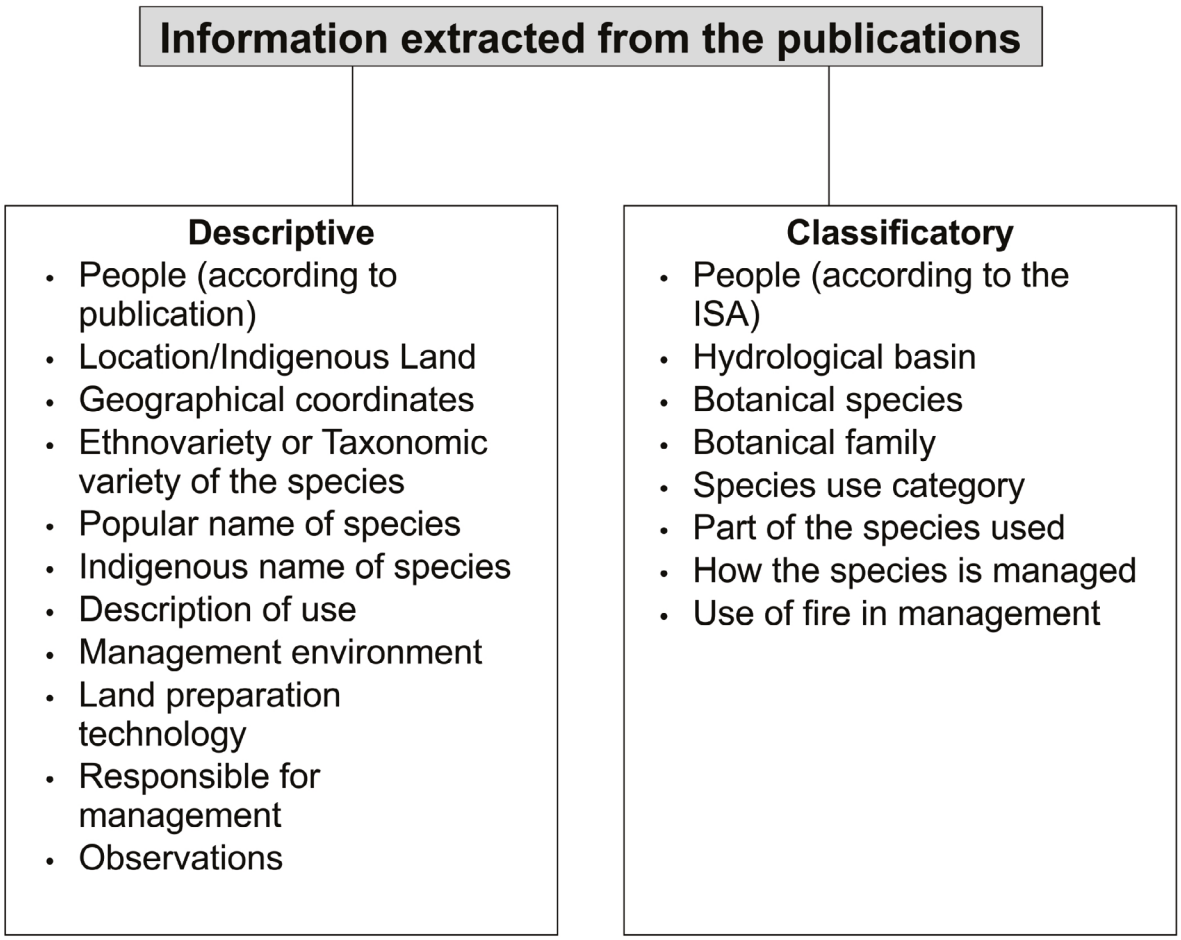

Figure 1. Infographic showing the two classes of information, descriptive and classificatory, extracted from the publications analyzed. ISA: Instituto Socioambiental (Socio-Environmental Institute).

Table 1. Guidance for completing the spreadsheet with the categorical information extracted from the publications: hydrographic basin, categories of species use, parts of the species used, method of management, and use of fire in management.

Name of the Peoples (Rodrigues, 2012)	Hydrographic basin occupied by the Indigenous peoples	Categories of species use	Parts of the species used	Method of species management	Use of fire in management
Apinajé	I.13. Hydrographic sub-basins of the Xingu River	AF: Animal feed	LE: Leaves or similar	1. Cultivation	1. Yes
Kaingáng	II.1. Tocantins River hydrographic sub-basin	CO: Construction	FR: Fruits or pseudo-fruits	2. Gathering	2. No
Mẽbêngôkre - Kayapó	II.2. Araguaia River hydrographic sub-basin	MU: Manufacturing Use/ Utensils and Tools	SE: Seeds	3. Cultivation and gathering	3. Not specified
Laklãnõ - Xokléng	II.4. Hydrographic sub-basins of the Guamá River	EU: Environmental Use	RT: Roots and tubers	4. Not specified	
Panará	III.1. Parnaíba River hydrographic sub-basin	F: Fuel	TR: Trunk or stem		
Suyá Kĩsêdjê	IV.1. São Francisco River hydrographic sub-basin	AL: Food/alimentary use	FL: Flowers		
Xakriabá	V.2. Paraná River hydrographic sub-basin	HM: Human medicinal, therapeutic	ME: Meristem		
Xavánte	V.3. Paraná River hydrographic sub-basin	VM: Veterinary Medicinal	BK: Bark		
Xerénte	VII.2. Hydrographic sub-basins of the Turiaçu River	TO: Toxic	RS: Resin/latex		
Timbira: Canela Apanyekrá	VII.3. Hydrographic sub-basins of the Mearim River	RI: Ritualistic, religious, magical	WP: Whole plant		
Timbira: Canela Ramkokamekrã	VII.4. Hydrographic sub-basins of the Itapecuru River	HA: Hunting attractant	Other (please specify)		
Timbira: Krahô	X.1. Hydrographic sub-basins of the Itajaí River	Other: (specify which)	Absent		
Timbira: Gavião Parkatejê	X.3. Hydrographic sub-basins of the Guaíba River and Lagoon System	Absent			
Timbira: Gavião Piokobjé					
Timbira: Krĩkati					
Timbira: Krenyê					

Given the diversity of objectives of the publications included in the database, some information was not available in the literature analyzed. In these cases, the information was left blank in the spreadsheet. An exception was made for the scientific names of species that are widely recognized as domesticated and not subject to regionalism (e.g., avocado, maize, mango, manioc, melon, papaya, sweet potato, watermelon). For these, the corresponding scientific names were included based on the common name stated in the publication. No scientific name was given for "pumpkin" because different genera and species of Cucurbitaceae can have this popular name (Pio-Corrêa, 1926; Hora *et al.*, 2018).

The scientific names of the species and their respective botanical families were checked using the Flora e Funga do Brasil (2023) website, maintained by the Rio de Janeiro Botanical Garden. In addition, the Flora e Funga do Brasil (2023) website was used to check the classification of the identified species in the categories "native", "cultivated", "naturalized" or "no information". The fields "Parts of the species used" and "Categories of species use" were completed according to the information available in the Useflora database (UFSC, 2021).

The primary focus of this study was to compile data on food plants, with a secondary focus on medicinal plants. However, other uses, such as manufacturing and construction, were also recorded when mentioned in the publications. In cases where the food plants were widely known but the part used was not specified in the publication, the commonly associated part used was attributed. For example, roots and tubers were attributed to manioc and sweet potatoes, and fruits were attributed to oranges and papaya, among others.

The nomenclature used in the "Hydrographic basin occupied by the Indigenous peoples" field has been standardized in accordance with the Methodological Report: Basins and Hydrographic Divisions of Brazil (IBGE, 2021). The hydrographic basins are an important framework for studying the territoriality of the Jê peoples (Góes, 2018). The data on the basins were verified through the references to the local rivers in the publications, or the website Terras Indígenas no Brasil (Indigenous Lands in Brazil, 2023), when the publication contained only the name of the Indigenous Land. To standardize the spelling of the names of Indigenous peoples, the classification of linguist Aryon Rodrigues (Rodrigues, 2012) was used.

Descriptive statistics were employed for the presentation and discussion of data on the year of publication, the number of species and ethnovarieties cited in each publication, as well as categorized information such as the number of citations about the parts of the species used, categories of species use, method of species management, and the use of fire in management. In this article, we understand as citation all ethnovarieties associated with a botanical species or genus mentioned in each of the publications

Binary matrices were systematized using electronic spreadsheet software to determine which species were cited among the Jê peoples. In this matrix, the columns contain the names of the peoples and the rows contain the species. We assigned the number one to those species that were cited in one or more publications associated with a Jê people, and the number zero to those taxa that were not found in the literature for a given people. When constructing the matrix, information on infra-specific taxa (subspecies or varieties) was disregarded. These were grouped with the corresponding species and we accepted species with a confirmatory identification 'cf.' as belonging to the named species. Based on this information, a bar chart was constructed to compare the richness among the indigenous peoples. To verify the possible influence of the number of publications on the richness of species associated with the Indigenous peoples, Spearman's correlation coefficient (Mukaka, 2012) was applied using electronic spreadsheets, so that it was possible to check for possible associations between the variables "number of species and botanical genera" and "number of publications associated with each people".

To check the number of common species and genera among the floras managed by the linguistic branches of the Jê, a second binary matrix was systematized using electronic spreadsheets. The number 1 was associated with the species or genera cited in the literature for at least one people belonging to the branch, while the number 0 corresponded to the taxa not mentioned for the peoples of the linguistic branch. A Venn diagram was then constructed to illustrate the number of taxa shared among the branches (Northern, Central, and Southern). Microsoft PowerPoint was used to create and edit graphic presentations. It was decided to include plants identified to the genus level since important plants in the indigenous diet were identified to this level in the publications analyzed.

To show the indigenous lands cited in the research publications analyzed, a map was created using data on the location of indigenous lands provided by the Brazilian National Water Agency (Agência Nacional de Águas - ANA, 2023).

With regard to the ethical aspects involved in the protection of traditional knowledge, a joint curatorship agreement for the information gathered in the research was established with the NGO Uirapuru, founded by the Indigenous Kaingáng people of Paraná. The activity of accessing traditional knowledge about biodiversity from secondary sources was registered in the National System for the Management of Genetic Heritage and Associated Traditional Knowledge (Sistema Nacional de Gestão do Patrimônio Genético e do Conhecimento Tradicional

Associado - SisGen), under the code A019EC6, and the consent of the Indigenous representatives of the Uirapuru NGO was obtained for the presentation of the results.

Results and Discussion

Characterization of the literature reviewed

A total of 1,467 records were retrieved from the databases, and information extracted from 126 publications was included in the database (Fig. 2), corresponding to a period of 126 years.

The earliest publications refer to the Kaingáng people. One of these is a study by the Argentine researcher Juan Bautista Ambrosetti about the Kaingáng who lived near San Pedro (Missiones), in Argentina (Ambrosetti, 1895); today this area is no longer occupied by this people (D'Angelis & Fernandes, 2004).

The other publication is a translation by Fernando de Sá Moreira (2017) of a text by Telêmaco Borba, also about the Kaingáng of Paraná, published in German in 1886. According to Moreira (2017), the first version of this text dates from 1883. The most recent study included in the database is from May 2021 and deals with forest restoration practiced by the *Kĩsêjdê* people in the Suiá-Miçu River Basin, a tributary of the Xingu River (Sanches *et al.*, 2021).

There were only 12 studies published before 1970 (Fig. 3). There was a slight increase in the number of studies between the 1970s and 1990s, with a significant increase in the number of publications from the 2000s onwards. In just 20 years, twice as many studies were published as in the entire 20th century. The maximum number of publications in a single year was nine, which occurred in 2014.

A significant number of publications with low circulation in scientific communication media ("gray literature") were identified, with theses, dissertations, and technical reports representing 23 % of the publications included in the database. Gray literature requires greater care in terms of the quality of the information (Botelho & Oliveira, 2015); in the case of this study, this meant paying special attention to the identification of the plant species mentioned in these works.

Despite this peculiarity, these publications contributed very detailed data on the species and management practices of the Jê peoples. For example, for the same authors whose research was conducted with a particular people, their theses and dissertations analyzed a greater number of species and ethnovarieties than the published scientific articles (Heineberg, 2014; Miller, 2014; Miller, 2015; Lima, 2016; Miller, 2016; Lima, 2017; Miller, 2017; Heineberg & Hanazaki, 2019).

The scientific journals in which the articles were published have a broad scope and were classified by CAPES (2023) in different fields of knowledge: Anthropology/Archaeology, Biodiversity, Agricultural Sciences, Environmental Sciences, Education, Nursing, Pharmacy, Geography, History, Interdisciplinary - Environment and Agriculture, Medicine, Veterinary Medicine, Public Health, and Sociology. Most of the journals (18) could be classified in the field of Anthropology/Archaeology (CAPES, 2023).

Another prominent field was Interdisciplinary - Environment and Agriculture, with 11 journals. The two journals with the highest number of articles included in the database were Human Ecology and Cadernos de Saúde Pública (Public Health Notebooks), with five publications each analyzed. With regard to the theses and dissertations included, the postgraduate programs associated with the research are: Anthropology (12), Biodiversity (2), Health Sciences (1), Environmental Sciences (1), Sustainable Development or Sustainability (3), Ecology (4), Food Engineering (1), Production Engineering (1), Letters (1), Medicine (1), and Nutrition (2).

Of the total of 126 publications included, 114 dealt with only one Indigenous people, six dealt with two, and three mentioned three peoples. No research was found on the use and management of plants by the Tapayuna and Timbiras peoples: *Krĩkati*, Canela Apanyekrá, and Krenyê; therefore, not all the peoples of the Jê linguistic family are covered in this study.

The works of Nimuendajú (1946) and Arnaud (1975) presented general aspects about more than one Timbira-speaking people. However, their research detailed the plants managed by the Canela Ramkokamekrã and the Gavião Parkatejê, respectively. After standardizing the names of the peoples according to Rodrigues (2012), it was found that the Jê people included in the highest number of publications were the Xavánte (34), the *Mẽbêngôkre* - Kayapó (26) and the Kaingáng (22). Regarding the lowest number, the Xakriabá people were identified in only one publication (Mendonça & Fonseca, 2017) (Tab. 2).

The publications included dealt with between one and up to 316 species and/or ethnovarieties, however, the majority of publications (18 or 14,29 %) discussed only one plant species or ethnovariety.

Territories covered

According to data on Indigenous Lands (IL) from the National Water Agency (*Agência Nacional de Águas* – ANA) (2023), the Jê-speaking peoples occupy 80 IL that have been recognized or demarcated in Brazil. Thirty-three of these indigenous territories occupied by the Jê are mentioned in the publications analyzed; in other words, this research covered 41.3 % of these territories. Figure 4 shows the location of the Jê Indigenous Lands and identifies those covered by the study.

It should be noted that some of the territories occupied by the Jê, as cited in the publications and incorporated into the database, have not yet been recognized as Indigenous Lands: examples of this are the Sêgu Indigenous Land and

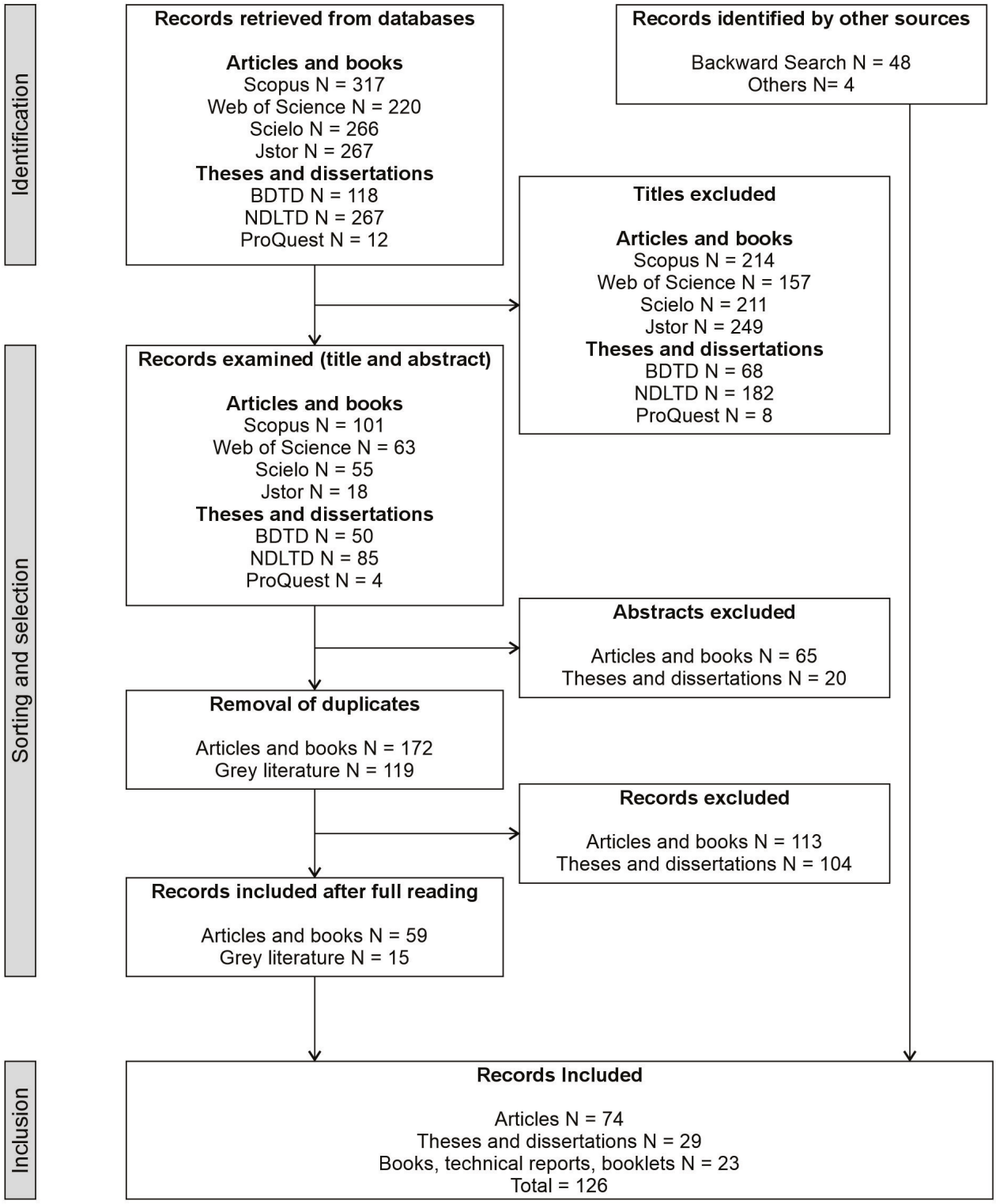

Figure 2. Flowchart based on the PRISMA model with the results of the studies publications included in the database. Legend: BDTD = *Biblioteca Digital Brasileira de Teses e Dissertações* (Brazilian Digital Library of Theses and Dissertations); NDLTD = Networked Digital Library of Theses and Dissertations.

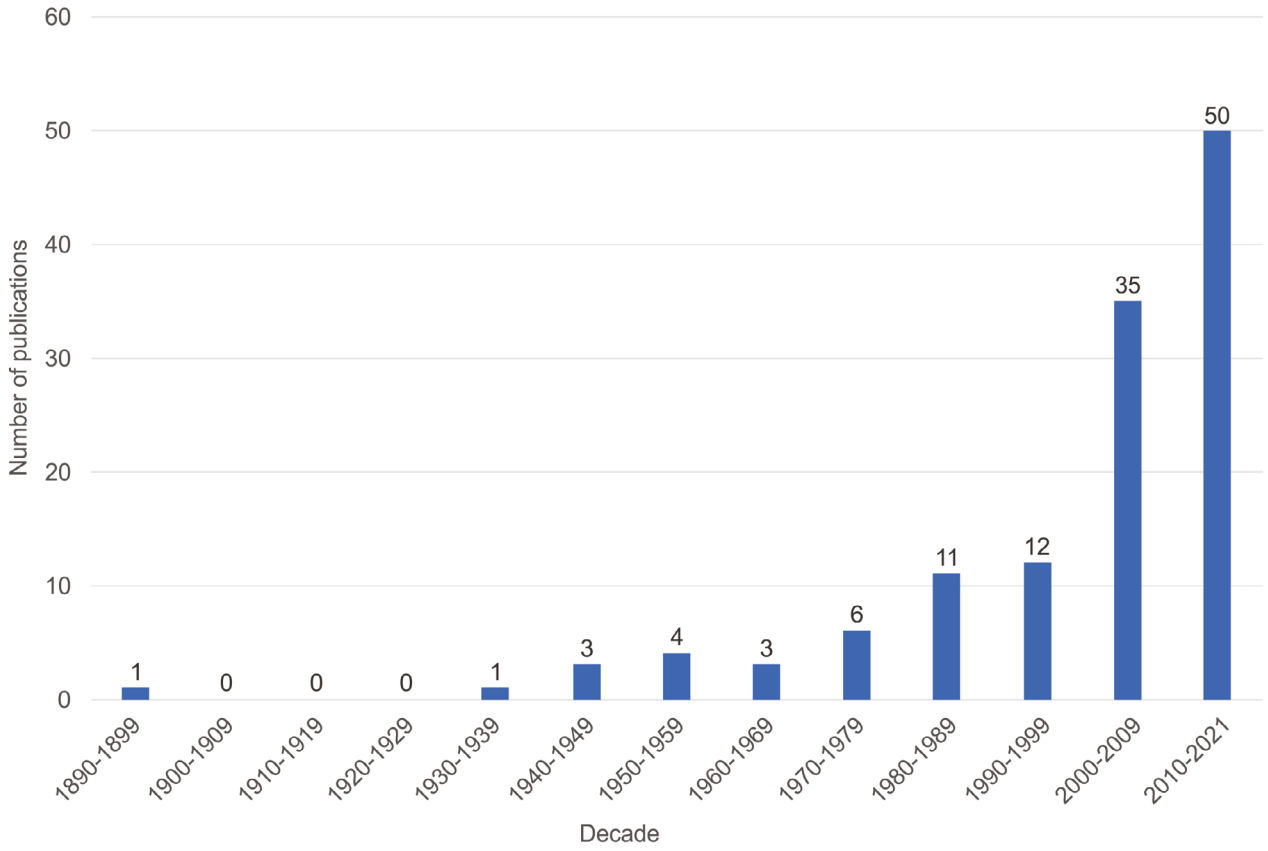

Figure 3. Number of studies in the database by decade.

the Foxá Indigenous Land of the Kaingáng people, both in Rio Grande do Sul (Rocha, 2011; Prestes & Laroque, 2018). The designation of Indigenous Lands facilitates the continued survival of indigenous peoples by ensuring the protection of their ancestral lands, as well as enabling the preservation of cultural traditions and the maintenance of natural habitats. However, the concentration and size of Indigenous Lands are not proportional throughout the Brazilian territory, with a smaller number of approved Indigenous Lands in threatened biomes such as the Atlantic Forest, the ancestral territory of the Kaingáng (Pacheco *et al.*, 2018). Although the territorial rights of Indigenous peoples are guaranteed by the Brazilian 1988 Federal Constitution (Brasil, 1988), the processes involved in the identification and demarcation of territories up to the final approval of Indigenous Lands by the federal authorities can be very slow (Cavalcante, 2016).

Studies from the 19th century analyzed in the review mentioned historically occupied territories that no longer have the presence of Jê peoples, such as Ambrosetti's work (1895), mentioned above. Other studies mentioned parts of territories that were later recognized as Indigenous Lands - although reduced in size when compared to traditionally occupied territories, considering the vast areas used for hunting practices and management of semi-domesticated or incipiently domesticated plants. Seasonal population movements for hunting and species management activities are cited, for example, for peoples who speak Timbira languages, for the Apinajé, for the Xavánte and Xerénte (Nimuendajú, 1942; Nimuendajú, 1946; Maybury-Lewis, 1984; Maybury-Lewis, 1990).

Conflicts over territory with non-indigenous peoples were frequently mentioned in the works reviewed, with these conflicts having a direct impact on the food production practices of the Jê peoples. These conflicts can be explained in part by public settlement policies aimed at reducing Indigenous territories for occupation by "settlers", replacing native vegetation with species of commercial interest. In addition, in different historical and economic periods, public policies had the objective of the supposed "incorporation" of Indigenous peoples into the hegemonic society, leading to the consequent cultural disruption (Fernandes & Piovezana, 2015).

Examples of these phenomena can be found in different times and places. Nimuendajú (1942) reports on the Xerénte, a people plagued by epidemics (such as smallpox) and who suffered from disputes over territory with non-indigenous people. Additionally, the ethnologist observed incursions into Apinajé territory during his field research, which spanned from 1928 to 1937 (Nimuendajú, 1956).

Table 2. Indigenous peoples included in the database, nomenclatures of the peoples and publications analyzed.

Linguistic Branch	Names of the peoples standardized	Names of the peoples according to the authors	Publications (Chronological order and alphabetical)
Southern Jê	Kaingáng	Caingang, Caingangue, Kaingang, Kaingangue	Ambrosetti, 1895; Fernandes, 1941; Lévi-Strauss, 1950; Brieger *et al.*, 1958; Metraux, 1963; Golte, 1983; Veiga, 1994; Haverroth, 1997; Schuch, 2001; Inácio, 2005; Oliveira, 2009; Rocha, 2011; Schallenberger & Machado, 2013; Reis *et al.*, 2014; Borghi & Carreira, 2015; Fernandes & Piovezana, 2015; Moreira, 2017; Nascimento, 2017; Fernandes & Góes, 2018; Prestes & Laroque, 2018; Vedoy *et al.*, 2018; Serviço Florestal Brasileiro, 2019.
	Laklãnõ - Xokléng	Aweikoma-Caingang, Botocudo, Botocudo de Santa Catarina, Grupo Kaingang de Santa Catarina, Laklãnõ, Laklãnõ-Xokleng, Shokleng, Socré, Xokleng	Metraux, 1963; Henry, 1964; Golte, 1983; Sens, 2002; Cruz, 2014; Heineberg, 2014; Reis *et al.*, 2014; Guislon *et al.*, 2017; Mota, 2017; Gomes, 2018; Heineberg & Hanazaki, 2019.
Central Jê	Xakriabá	Xakriabá	Mendonça & Fonseca, 2017.
	Xavánte	Akwe Xavante, Chavante, Xavánte, Xavante	Brieger *et al.*, 1958; Neel *et al.*, 1964; Giaccaria & Heide, 1972; Gross *et al.*, 1979; Vieira-Filho, 1981; Flowers *et al.*, 1982; Flowers, 1983; Vieira-Filho *et al.*, 1983; Maybury-Lewis, 1984; Maybury-Lewis, 1990; Carneiro & Jardim, 1993; Santos *et al.*, 1997; Vieira-Filho, 1997; Silva, 1999; Arantes *et al.*, 2001; Coimbra Jr. *et al.*, 2001; Gugelmin, 2001; Gugelmin & Santos, 2001; Marimon & Felfili, 2001; Souza & Santos, 2001; Coimbra Jr. *et al.*, 2002; Leite *et al.*, 2006; Leeuwenberg *et al.*, 2007; Melo, 2007; Silva, 2008; Arantes *et al.*, 2009; Verona, 2009; Welch *et al.*, 2009; Souza *et al.*, 2011; Gonçalves, 2012; Silva, 2013; Welch *et al.*, 2013; Welch, 2014.
	Xerénte	Akwe Xerente, Akwen Xerente, Šerente, Xerente	Nimuendajú, 1942; Kerr *et al.*, 1978; Maybury-Lewis, 1990; Silva, 1999; Schmidt, 2011; Rocha *et al.*, 2016.
Northern Jê	M bêngôkre – Kayapó	Caiapó-Xikrin, Kayapó Mêbêngôkre, Kayapó Xikrin, Kayapó Mekranot, Mekranoti, Xikrin	Vieira Filho, 1972; Black *et al.*, 1977; Kerr *et al.*, 1978; Gross *et al.*, 1979; Flowers *et al.*, 1982; Posey, 1985; Posey, 1986; Anderson & Posey, 1989; Elisabetsky & Posey, 1989; Elisabetsky & Posey, 1994; Peres & Baider, 1997; López, 1998; Posey, 2002; Barbosa & Pinto, 2003; Salm *et al.*, 2009; Salm *et al.*, 2010; Robert & Katz, 2010; González-Pérez, 2011; Manaças, 2011; González-Pérez *et al.*, 2012; López Garcés & Robert, 2012; Robert *et al.*, 2012; González-Pérez *et al.*, 2013; Ribeiro *et al.*, 2014a; Ribeiro *et al.*, 2014b; Zanotti, 2014.
	Panará	Panará	Schwartzman, 1988; Ewart, 2000; Schmidt, 2002; Ewart, 2005; Ewart, 2008; Schwartzman, 2010.
	Suyá Kĩsêdjê	Kĩsêjdê, Suyá	Sanches *et al.*, 2021; Seeger, 1987; Coelho, 2007.
	Apinajé	Apinagé, Apinajé, Apinayé	Oliveira, 1930; Nimuendajú, 1956; Souza, 1956; Kerr *et al.*, 1978; Ribeiro, 2015.
	Timbira: Canela Ramkokamekrã	Canela Ramkokamekra, Canela Timbira Oriental, Kanela Ramkokamekra, Ramkôkamekra Canela, Ramkokamekra Kanela, Ramko'kamekra, Timbira do Leste	Nimuendajú, 1946; Gross *et al.*, 1979; Flowers *et al.*, 1982; Crocker, 1990; Greene & Crocker, 1994; Miller, 2014; Fisher, 2015; Miller, 2015; Miller, 2016; Miller, 2017.
	Timbira: Krahô	Krahô	Rodrigues, 2001; Melatti, 2002; Ávila, 2004; Mistry *et al.*, 2005; Rodrigues & Carlini, 2005; Rodrigues & Carlini, 2006; Rodrigues, 2007; Terra-Nascimento *et al.*, 2009; Niemeyer, 2011; Borges & Niemeyer, 2012; Borges, 2014; Lima, 2016; Lima 2017.
	Timbira: Gavião Parkatejê	Gaviões de Oeste – Parkateye, Gaviões Parkateye, Parkatêjê	Arnaud, 1975; Kerr *et al.*, 1978; Reis, 2017.

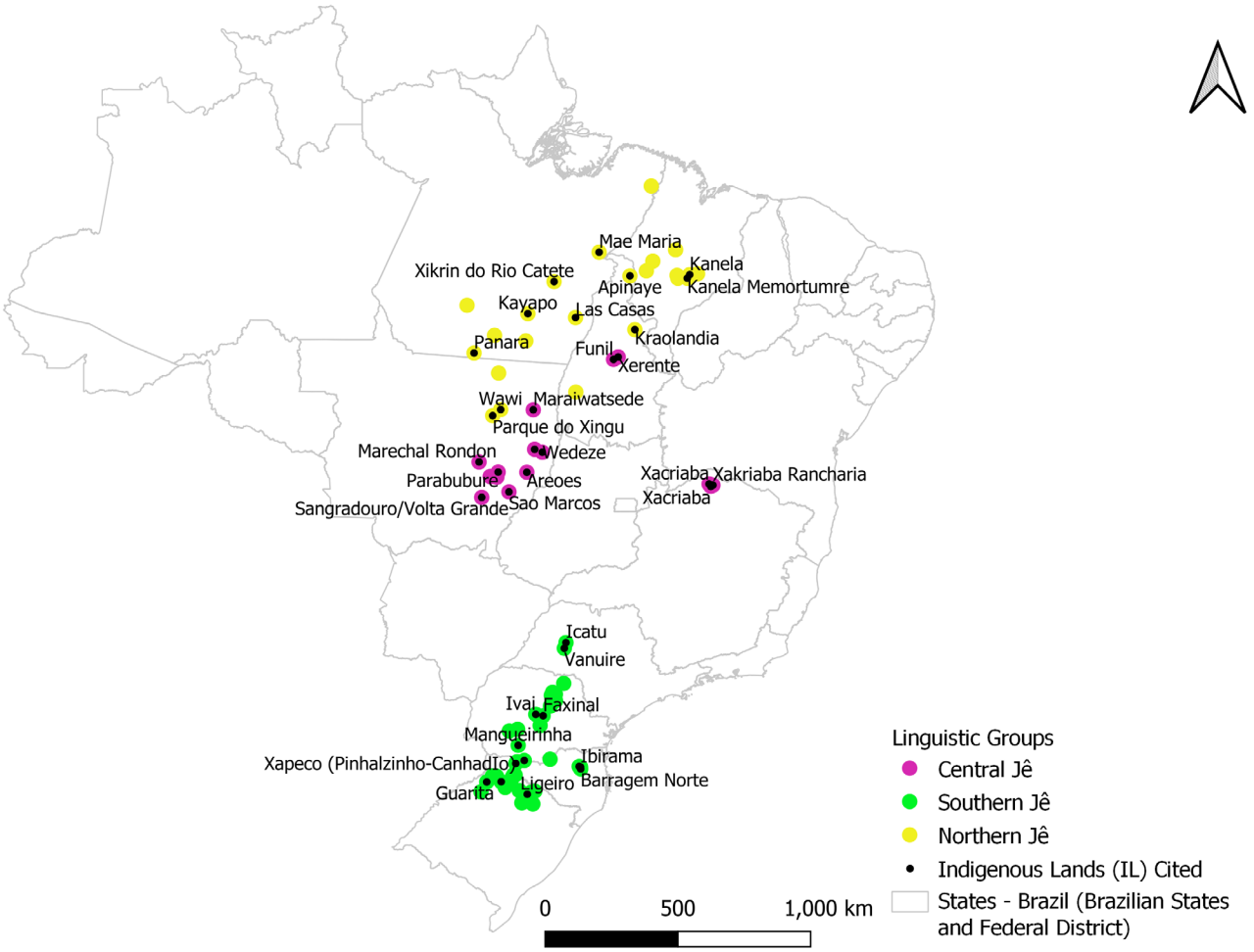

Figure 4. Location of recognized or demarcated Indigenous Lands (IL) occupied by the Jê peoples, indicating those cited in the research and included in the database.

In the first half of the 20th century, Fernandes (1941) observed that the Kaingáng of Palmas, in Paraná, had reduced the availability of Araucaria pine nuts [*Araucaria angustifolia* (Bertol.) Kuntze, Araucariaceae], caused by the destruction of the mixed ombrophilous forest. The author also highlights the reduction of traditional territories and the different survival strategies of different Kaingáng groups in the process of contact with non-indigenous people: some Kaingáng groups became allies of the non-indigenous people, others used confrontation as a strategy.

In the second half of the twentieth century, publications began to emerge on the changes in the production systems of some Xavánte territories as a result of the mechanized rice cultivation project implemented by the National Foundation for Indigenous Peoples (FUNAI). The introduction of rice cultivation and the reduction of their traditional territories were some of the factors that led the Xavánte to reduce their expeditions to obtain game and native roots, as well as the cultivation of protein-rich legumes (Neel *et al.*, 1964; Gross *et al.*, 1979; Vieira Filho, 1981; Flowers *et al.*, 1982; Flowers, 1983; Santos *et al.*, 1997). The monotonous diet based on polished rice led to malnutrition, with cases of muscle paralysis caused by vitamin deficiency (Vieira Filho, 1981; Vieira Filho & Russo, 1983; Vieira Filho *et al.*, 1997).

In addition to incorporating polished rice into their diet, the Xavánte began to consume industrialized foods, a situation that some studies suggest is linked to malnutrition in children and excess weight in adults and the elderly (Vieira Filho & Russo, 1983; Coimbra Jr. *et al.*, 2001; Leite *et al.*, 2006). Furthermore, changes in the oral health of indigenous populations have been observed, with an increase in the prevalence of dental caries (Arantes *et al.*, 2001; Arantes *et al.*, 2009).

The Panará also experienced significant disruption to their agro-ecological systems as a result of an extremely violent contact. In the 1970s, their traditional territory, situated in the areas of the Peixoto Azevedo River between the states of Pará and Mato Grosso, was traversed by the construction of the BR-163 highway and subsequently invaded by gold miners. This contact with non-indigenous people resulted in the transmission of infectious diseases, which led to the deaths of numerous Panará. In 1975, the

Panará were relocated to the Indigenous Park of the Xingu to prevent their population from collapsing. However, they arrived weakened, malnourished, and suffering from illness. Additionally, the traditional varieties of yam and watermelon that they cultivated were lost during the transfer. When they arrived in the park, they undertook several moves in an attempt to find an ideal area to settle, but many of them did not adapt to the environmental conditions of the Xingu, where they could not find precious foods such as Brazil nuts (*Bertholletia excelsa* Bonpl., Lecythidaceae), and açaí (*Euterpe oleracea* Mart., Arecaceae). In 1995, the Panará were able to reclaim a portion of their traditional territories in the vicinity of the Peixoto de Azevedo River (Schwartzman, 1988; Ewart, 2000; Schmidt, 2002; Ewart, 2005; Ewart, 2008; Schwartzman, 2010).

Indigenous peoples must have secure and legally defined territories to effectively promote the conservation and amplification of biological diversity through their traditional productive practices. The diverse histories of contact with non-indigenous peoples among the various Jê peoples demonstrate that, despite changes in their way of life and the disruption of food production systems at critical junctures, this study identified a high richness of species and ethnovarieties managed by the Jê peoples, which will be detailed below.

The botanical diversity of the database

The richness of plant species managed by the Jê peoples is represented in a total of 609 plants identified at the species level, divided into 442 genera and 130 families. Out of respect for indigenous intellectual property and in accordance with the shared curation of research data with the NGO Uirapuru, the complete list of species, genera and botanical families is available upon request to the authors. The five families with the highest species richness were Fabaceae (n=74), Arecaceae (n=54), Asteraceae (n=46), Myrtaceae (n=40), and Rubiaceae (n=25), i.e. these botanical families have the highest number of different species managed by the Jê. Of the 609 species identified, 479 were classified as "native", 77 as "cultivated", and 43 as "naturalized", while for 10 species no category was found in the Flora e Funga do Brasil website (2023).

The most cited categories of species use were: Food (2946 citations), Medicinal (634), and Manufacturing use/ Utilities and tools (83), which was to be expected given the selection criteria for inclusion of studies in the database. As for the parts of the species used, the citations were mostly related to fruits or pseudo-fruits (1188 citations), seeds (861), roots and tubers (761), leaves or similar (203), and trunk or stem (89).

With regard to the richness of species managed that was reported for each people, it was found that the largest number was compiled for the *Mẽbêngôkre* - Kayapó peoples (275 species reported), followed by the Laklãnõ - Xokléng (238) and the Kaingáng (231). To establish the number of species compiled from the publications for the Jê peoples, only plants identified at the species level were considered, excluding ethnovarieties and/or varieties (Fig. 5).

The Spearman correlation coefficient obtained (r_s = 0.89) suggests a high and positive correlation between the variables "number of species compiled among the peoples" and "number of publications associated with the Jê peoples"; therefore, a higher number of studies is associated with a higher number of species. However, it is important to emphasize that the number of species used and managed by each people (as shown in Fig. 5) does not reflect the exact reality of the biodiversity and richness of species managed by the peoples, given that our database was built with information from publications with different methodologies and objectives. That is, these studies did not necessarily aim to provide a comprehensive survey of the species managed by the Jê indigenous peoples.

Furthermore, many of the publications included studies did not botanically identify all species, did not report the scientific names of the species, or reported them inaccurately. As a result, the botanical richness managed by the Jê is likely greater than what this review could assess. Despite the methodological limitations, the figures presented show the high species richness in the different indigenous food production systems and the importance of Indigenous peoples in the domestication and conservation of food and medicinal plants. Future research on the Jê indigenous peoples and their plants will allow more species to be verified in the Jê production systems.

Common plants among the Jê linguistic branches

Some species management characteristics are shared among the Jê peoples of the three linguistic branches (n=26) who occupy a variety of biomes and regions, while other species are managed exclusively by peoples within the same branch or geographical area, with variations in the richness of species or genera shared among the Central, Southern, and Northern Jê peoples (Fig. 6).

Among the 26 species shared by the Jê peoples of the three linguistic branches, 17 species or genera have been domesticated in different regions of the American continent: maize (*Zea mays* L., Poaceae), manioc (*Manihot esculenta* Crantz., Euphorbiaceae), sweet potato (*Ipomoea batatas* (L.) Lam., Convolvulaceae), yams (*Dioscorea* spp., Dioscoreaceae), peanuts (*Arachis hypogaea* L., Fabaceae), beans (*Phaseolus* spp. and *Phaseolus vulgaris* L., Fabaceae), ingá (*Inga* spp., Fabaceae), pumpkin (*Cucurbita* spp.), papaya (*Carica papaya* L., Caricaceae), potato (*Solanum tuberosum* L., Solanaceae), guava (*Psidium guajava* L., Myrtaceae), avocado (*Persea americana* Mill., Lauraceae), tucum (*Bactris setosa* Mart., Arecaceae), palms of the genus *Attalea* (*Attalea* spp., Arecaceae), annatto (*Bixa orellana* L., Bixaceae) and tobacco (*Nicotiana tabacum* L., Solanaceae).

Among these shared species, maize, manioc, sweet potatoes, yams, beans, and pumpkins are plants associated

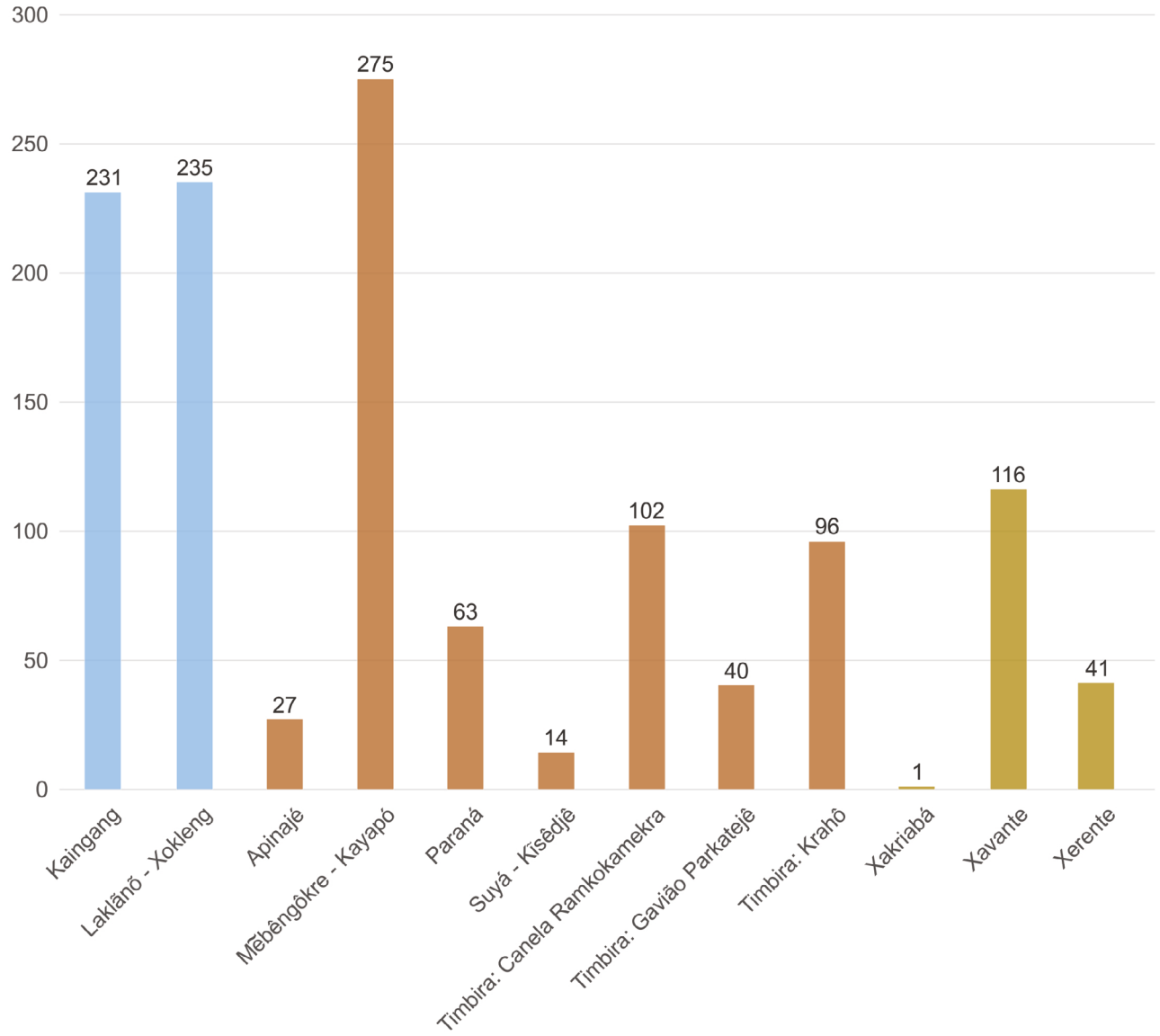

Figure 5. Number of species compiled for the different Jê peoples. The colors of the bars are associated with the linguistic branches. Blue: Southern Jê, orange: Northern Jê, mustard: Central Jê.

with archaeological sites of traditions linked to peoples speaking languages of the Macro-Jê trunk and the Jê family, demonstrating the long history between the Jê peoples and food and medicinal plants (Gardiman *et al.*, 2016; González, 1996; Gessert *et al.*, 2011; Corteletti *et al.*, 2015).

In addition, when considering the total number of citations of species, the four most cited species in the papers were maize (249 citations), manioc (245), sweet potato (178), and yam (174). These species stand out for their large number of associated ethnovarieties, which contributed to the high number of citations, and their high prevalence among the different Jê peoples.

Considering this prevalence, maize was cited for all the peoples studied. Maize is of great cultural importance to the Jê peoples, being a species mentioned in traditional stories of the origin of cultivated plants for the Kaingáng (Borba, 1908), the Mebêngôkre - Kayapó (Banner, 1957), and the Apinajé and Timbira (Nimuendajú, 1946; Lima *et al.*, 2020). Domestication of maize began in the region corresponding to present-day southern Mexico approximately 9,000 years before present (BP) (Piperno *et al.*, 2009). The species was dispersed in the lowlands of South America in a state of partial domestication (Kistler *et al.*, 2018), through exchanges between human groups (Brieger *et al.*, 1958),

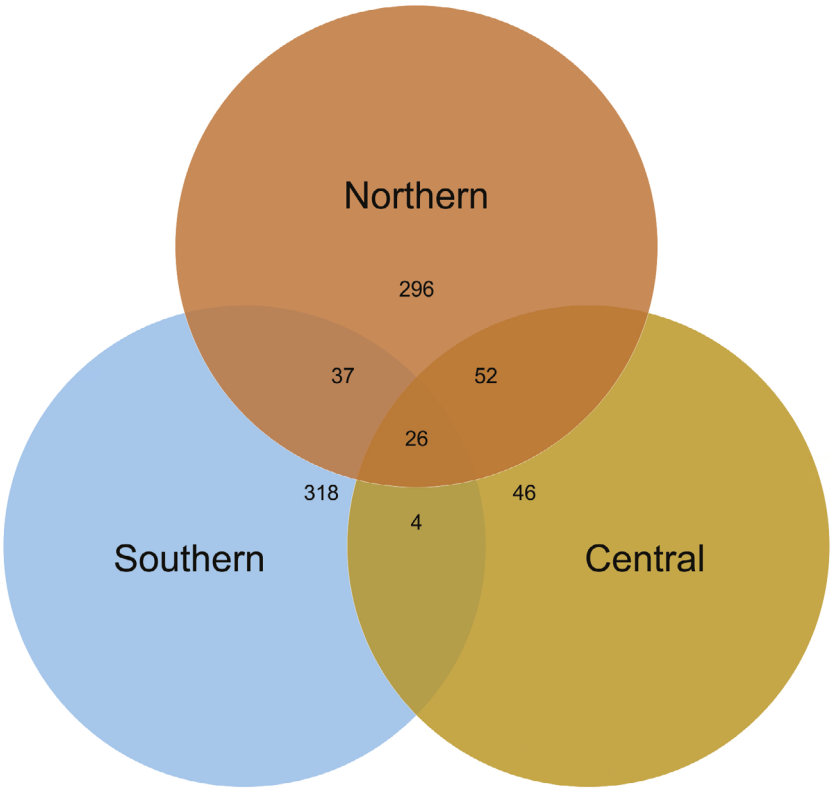

Figure 6. Richness of species or genera shared by Central, Southern, and Northern peoples.

as well as the processes of expansion of peoples across the territory, such as those belonging to the Macro-Jê linguistic trunk (Costa *et al.*, 2022).

Brieger and colleagues (1958) located maize varieties managed by the Xavánte and Kaingáng peoples that are among the most representative of the species in the lowlands of the Americas, considering the pre-conquest period. The Xavánte manage 'interlaced' maize, which has a morphology in the arrangement of the grains on the cob related to an ancestral characteristic, while the Kaingáng manage maize varieties with toothed endosperm, a derived character (Brieger *et al.*, 1958).

Maize is also very present in the archaeological record associated with the Jê peoples: evidence such as maize starch granules in ceramics and the morphology of vessels associated with the Aratu-Sapucaí tradition, a group with macro-Jê linguistic affiliation, indicate the importance of this species for this Cerrado group (González, 1996; Gardiman *et al.*, 2016). In archaeological sites associated with the southern Jê, studies by Gessert *et al.* (2011) and Corteletti *et al.* (2015) found pollen grains and maize phytoliths on ceramics, while Parellada (2015) found the presence of cave paintings with botanical characteristics resembling maize.

Roots and tubers also stood out among the plants cultivated by the Jê; several of these species were domesticated or underwent secondary diversification processes in the lowlands of South America (Martins, 2005). Nimuendajú (1946) reports that despite the prejudice of the non-indigenous peoples, who claimed that the Timbira Canela Ramkokamekrã lived by stealing and begging, Indigenous manioc flour guaranteed food security in the Barra do Corda region in the early 1930s when manioc crops in Maranhão were not productive. The author explains that the manioc of the Timbira and Apinajé has a different name (*kwụr*) from that adopted by speakers of Tupi languages, as well as different flour-making techniques compared to their Guajajara and Karajá neighbors, using unfermented manioc (Nimuendajú, 1946; Nimuendajú, 1956).

The use of unfermented manioc to make flour is also reported in the practices of the Kaingáng (Fernandes, 1941) and the Xavánte (Giaccaria & Heide, 1972; Vieira Filho *et al.*, 1997). However, Maybury-Lewis (1984) reports that, at the beginning of systematic contact with non-indigenous people, the Xavánte refused to plant the manioc offered by the Indian Protection Service (SPI), even though they liked the flour because more intensive and prolonged care of their crops would have meant abandoning the practice of trekking through their vast territories.

The central and northern Jê cultivated both tame (or sweet) and wild (or bitter) varieties of manioc, while the southern Jê cultivated only the tame varieties. Corteletti and colleagues (2015) found manioc starch grains in archaeological Jê ceramics from 1200 years BP in Santa Catarina, and Parellada & Gomes (2022) reported the presence of rock art with characteristics of the species in a

shelter in the Campos Gerais region of Paraná. The Kaingáng consume the leaves of the so-called wild manioc, the *kumî* (*Manihot grahamii* Hook, Euphorbiaceae), boiled for many hours (Veiga, 1994; Haverroth, 1997; Schallenberger & Machado, 2013; Nascimento, 2017). Haverroth (1997) reports that wild manioc is not cultivated, while Nascimento (2017) reports that *kumî* grows mainly in places where fields have been burned.

Furthermore, sweet potatoes are very important in Jê food and culture, which is reflected in their high prevalence among the different peoples and high intraspecific variability. Lima (2017) reveals that, from the Krahô point of view, sweet potato cultivation encompasses aspects of affectivity: the species is a non-human "relative". Intraspecific diversity is especially high among the northern Jê: Lima (2017) found 15 ethnovarieties managed by Krahô women; Miller (2015) sampled 16 different morphotypes of the species; a study carried out with the Panará found eight ethnovarieties (Schmidt, 2002).

Robert and colleagues (2012) recorded 56 sweet potato ethnovarieties among the Mebêngôkre-Kayapó. The sweet potato is also very important from a nutritional point of view, as reported by Vieira Filho (1972) in relation to the Xikrin, a Kayapó-speaking people. The author observed that there was no goiter among the Indigenous people of the Xikrin do Cateté Indigenous Land and measured the iodine content of the sweet potatoes they managed and consumed, finding large quantities of the mineral, which would explain the absence of this nutritional deficiency. Goiter is a disease caused by a diet low in the mineral iodine, which was frequently diagnosed in inland Brazil, such as those living near the Xikrin territory (Vieira Filho, 1972).

With several species of the genus *Dioscorea* spp., yams were frequently cited in works, with emphasis on the high number of citations in research related to the Timbira Canela Ramkokamekrã, the Timbira Krahô, the Mebêngôkre - Kayapó and the Xavánte. However, most studies did not present taxonomic identification at the species level. The only species identified were *Dioscorea amaranthoides* C.Presl (González-Pérez, 2011), which has medicinal use among the Mẽbêngôkre-Kayapó, *Dioscorea trifida* L.f. (Silva, 2008) and *Dioscorea trifoliata* Kunth (Leeuwenberg *et al.*, 2007) whose tubers are consumed cooked, or roasted by the Xavánte.

Dioscorea amaranthoides is a species with a wide distribution in Brazil, occurring in a variety of habitats, including the Amazonian forests and grasslands, as well as seasonal forests, gallery forests, and savannahs of São Paulo (Pedralli, 2002). Santos *et al.* (2012) documented the medicinal use of this species among Amazonian riverine dwellers.

Dioscorea trifida is a species that is widely distributed in the Neotropics and is widely cultivated in Brazil to produce tubers with purplish or white flesh (Nascimento *et al.*, 2015). Pedralli *et al.* (2002) posit that the species was domesticated in the pre-conquest period by the Indigenous peoples occupying the areas bordering Brazil and the Guianas.

The species *D. trifoliata* has a confirmed record of occurrence restricted to the state of Acre (Couto & Fraga, 2023). Additionally, Leeuwenberg *et al.* (2007) report that the Xavánte name associated with the species is *Pidzi*. This indigenous name appears in the work of Giaccaria & Heide (1972) without taxonomic identification. However, it was identified as *Dioscorea* sp. in the research of Silva (2008).

Maybury-Lewis (1984) cites the indigenous names of seven types of roots or tubers collected by the Xavánte women, while Giaccaria & Heide (1972) list 14. The authors mention that two or three ethnovarieties (or ethno-species) are also cultivated; however, the taxonomic identifications of these food plants are not presented in the studies. Subsequently, Leeuwenberg *et al.* (2007) and Silva (2008) presented plants bearing the same indigenous names, with many of them identified as *Dioscorea*.

In Brazil, there are 130 species of *Dioscorea*, which occur in various habitats. Despite the large number of species and the food potential of those that produce edible tubers, identification at the species level is complicated by the low number of taxonomic studies with a wide geographical scope (Couto, 2010).

Predominant species among peoples of the same linguistic branch or region

Cultural, ecological, and geographical factors can influence the selection of useful species by indigenous and traditional peoples and communities (Gaoue *et al.*, 2017; Phumthum & Balslev, 2019). The influence of cultural factors has been demonstrated, for example, among the Tsimane of the Amazon region of Bolivia, where ethnobotanical knowledge is shared by the ethnic group, even among inhabitants of different communities (Reyes-Garcia *et al.*, 2003). Teka *et al.* (2020) also found that communities in Ethiopia within the same ethnic group generally share more medicinal species. Ecological and geographic factors dominate the pharmacopeias of communities in Thailand, where the similarity of medicinal plants among people from the same floristic region is greater than the similarity of species cultivated by people from the same ethnic group (Phumthum & Balslev, 2019). The results found in Thai communities reinforce the ecological appearance hypothesis, according to which the plants most used by a community are those that are easiest to find or those that are most abundant at the local level (Albuquerque *et al.*, 2018).

To understand the trends in the use of some food plants relevant to the Jê, we can verify both the influences of cultural factors and the availability of some species in the environment. The cupá (*Cissus gongylodes* (Baker) Planch, Vitaceae) is an example of the strong relevance of cultural factors in the selection of species for the food systems of the Jê people (Kerr *et al.*, 1978).

Cupá is another species typically managed by the Northern and Central Jê. Its cultivation has been documented among the Timbira Canela Ramkokamekrã,

Gavião Parkatejê and Krahô (Nimuendajú, 1946; Arnaud, 1975; Kerr *et al*., 1978; Ávila, 2004; Borges, 2014), among the Apinajé (Nimuendajú, 1956; Souza, 1956; Kerr *et al.*, 1978), among the Mebêngôkre - Kayapó (Kerr *et al.*, 1978; Posey, 1985; 1986; Robert *et al.*, 2012) and the Xerénte (Kerr *et al.*, 1978). Nimuendajú (1946) stressed the importance of the species in the diet of the Jê and defended the originality of the agriculture of these peoples based on the antiquity of this cultivation and reports that the species is not managed by the indigenous and rural peoples neighboring the Jê territories. Kerr *et al.* (1978) reported that sections of the stem that store starch, called *manivas* by the authors, are eaten roasted or serve as the basis for making flour and *beiju* by the Mebêngôkre - Kayapó. Despite the importance of the species for the Timbira, Miller (2015) did not find cupá in the Timbira Canela Ramkokamekrã fields. Additionally, he notes that seedlings of the species stored in a germplasm bank of the Brazilian Agricultural Research Corporation (Embrapa) were donated to indigenous farmers.

We have verified the combination of cultural and geographic factors that contribute to for the management of species such as the Brazil nut (*Bertholletia excelsa* Bonpl., Lecythidaceae) and the Paraná pine (*A. angustifolia* (Bertol.) Kuntze, Araucariaceae). The seeds and fruits of the Brazil nut are used for food and medicinal purposes by the Timbira Gavião Parkatejê (Arnaud, 1975), the Panará (Schwartzman, 1988; Schmidt, 2002; Schwartzman, 2010) and the Mebêngôkre - Kayapó (Posey, 1985; Posey, 1986; Elisabetsky & Posey, 1989; Peres & Baider, 1997; Posey, 2002; Salm *et al.*, 2010; González-Pérez, 2011; Manaças, 2011; Robert *et al.*, 2012; Ribeiro *et al.*, 2014a; b). Research by Ribeiro *et al.* (2014a; b) showed that the Mebêngôkre - Kayapó intentionally plant seeds and seedlings of *B. excelsa* in their territories, as well as dispersing the seeds along trails; therefore, the form of management of current and past indigenous groups explains the formation and maintenance of forests of the species throughout the Amazon basin (Shepard Jr. & Ramirez, 2011). In addition to the Jê peoples of the northern branches, other indigenous groups occupying the Amazon basin, belonging to different linguistic families such as Arawak, Carib, Tupi, and Pano, practice the traditional management of Brazil nuts (Shepard Jr. & Ramirez, 2011).

The araucaria is used for food, medicine, rituals, and construction by the Kaingáng (e.g., Ambrosetti, 1895; Fernandes, 1941; Haverroth, 1997; Schallenberger & Machado, 2013; Nascimento, 2017) and Laklãnõ-Xoklέng peoples (e.g., Henry, 1964; Sens, 2002; Cruz, 2014; Gomes, 2018; Heineberg & Hanazaki, 2019). The dispersal of araucaria between 1410- and 900 years BP corresponds to the expansion and increase in complexity and size of Jê archaeological sites indicating the management of the species (Bitencourt & Krauspenhar, 2006; Lauterjung *et al.*, 2018; Robinson *et al.*, 2018).

Like other species of the Mixed Ombrophilous Forest (MOF), in a phytophysiognomy of the Atlantic Forest, the araucaria has a distribution that coincides with Jê archaeological sites and localities historically associated with these peoples (Noelli, 1996; Reis *et al.*, 2014; Cruz *et al.*, 2020). The cultural importance of the species for the Jê peoples is supported by the presence of cave paintings in archaeological sites probably associated with these peoples (Pontes *et al.*, 2023). Therefore, these factors reinforce that the MOF is a domesticated landscape, much like the Amazonian Brazil nut groves (Clement, 1999; Levis *et al.*, 2018; Clement *et al.*, 2021).

The "planting" vs. "gathering" dichotomy and the literature on the Jê people

Food production systems among the Jê include plants with a greater or lesser degree of dependence on human beings for their propagation and multiplication. Species such as araucaria, Brazil nut trees, wild manioc (*M. grahamii*), cupá, and yams managed by the Xavánte are species that can be classified as incipiently domesticated, incipiently coevolved or semi-domesticated; in other words, their genotypes and phenotypes have not undergone the severe changes that occur in plants with a higher degree of domestication, such as maize and manioc (Clement, 1999).

The domestication of plants in the Neotropics depends on human behaviors involving selection, accumulation, and care, within food production systems that focus on individual plants rather than populations, as occurred in the Fertile Crescent region (Clement *et al.*, 2021). In this way, the attribution of a dichotomy between "planting" or "gathering" species may be more related to the visions and narratives built over time about food production systems, centered on a model of "agriculture" and plant domestication exogenous to Neotropical reality, than to what is in fact developed among the Jê Indigenous peoples (Iriarte *et al.*, 2020; Clement *et al.*, 2021).

The "planting" or "gathering" dichotomy guided the classification systems of indigenous peoples of South America presented in works published in the 1940s. In the book *Ethnologia Sul Americana*, Wilhelm Schmidt (1942) divided Indigenous peoples into three categories: a) groups in the "gathering phase"; b) groups in the "dug-crop cultivation phase"; and c) "peoples of superior culture". Schmidt (1942) classified the Jê indigenous peoples as belonging to the "gathering phase" groups, which have as one of their characteristics the lack of knowledge of agriculture, the exceptions being attributed to the influences of more advanced neighboring cultures. Rudimentary or absent horticulture is also one of the characteristics attributed to the Indigenous groups of the so-called "marginal culture", to which the Jê peoples belong, according to the concept of Cooper (1942). This author divides the Indigenous peoples of South America into three groups: "Sierral", "Silval" and

"Marginal"; his proposed cultural division is adopted in the work *Handbook of South American Indians*, which adds a fourth group composed of circum-Caribbean cultures (Steward, 1946).

However, ethnologist Curt Nimuendajú (1946) opposes the conception that limited the Jê people to hunters and gatherers. In his research carried out with the Timbira and Apinajé peoples, Nimuendajú verified the great richness and diversity of cultivated species (Nimuendajú, 1946; 1956). The author also detailed in his works the sociopolitical complexity of the Timbira, Apinajé, and Xerénte peoples, with social divisions affecting ceremonial activities and marriages (Nimuendajú, 1942; 1946; 1956). In this way, an apparent ethnographic anomaly was established among the Jê peoples of Central Brazil: societies with presumably simple material culture, lacking boats, nets, and sophisticated pottery, with apparently little agriculture, but with complex social systems and a very elaborate ceremonial life (Wagley, 1979; Maybury-Lewis, 1984). Maybury-Lewis (1979) suggested that this supposed anomaly stems from a limited form of understanding that believes that technological complexity must be linked to sociological sophistication. The author also defends the inaccuracy of the generalization of the economic systems of the "marginal" peoples of Central Brazil, which limits them to hunting and gathering, with little or no agriculture (Maybury-Lewis, 1979).

Ethnoscientific studies conducted by Darrel Posey and his collaborators among the Mebêngôkre-Kayapó in the late 1970s and 1980s highlighted the complexity of the management of productive areas and the wealth of indigenous knowledge about the species and landscapes of the Amazon and Cerrado (Posey, 1985; 1986; 2002; Anderson & Posey, 1989; Elisabetsky & Posey, 1989; Elisabetsky & Posey, 1994). Posey's research found that many areas once considered pristine are the result of indigenous management of the species. The management of the species practiced by the Jê indigenous peoples contradicts the idea that these societies, which are not socioeconomically stratified, do not have a long-term effect on the landscape, but are merely subject to environmental constraints (Balée, 2006).

General characteristics of Jê food production systems

The data synthesized by this research support an understanding of the dynamism of Jê production systems, which incorporated plant species and varieties domesticated in other continents after contact with non-indigenous peoples. An example of this was the prominence of exotic species such as banana (*Musa paradisiaca* L., Musaceae), mango (*Mangifera indica* L., Anacardiaceae), sugarcane (*Saccharum officinarum* L., Poaceae), citrus (*Citrus* × *limon* (L.) Osbeck, *Citrus aurantium* L., *Citrus sinensis* (L.) Osbeck, Rutaceae), rice (*Oryza sativa* L., Poaceae) and watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai, Cucurbitaceae), these species are managed by the peoples of the three linguistic branches according to the Venn diagram (Fig. 6).

In addition to shared plant species, Jê food production systems may also share common management practices. In the literature reviewed, 36 % of the publications (45 out of 126) mentioned the use of fire to manage production systems. The use of fire is practiced by Indigenous peoples in swidden systems, known as coivara agriculture, and is also used in traditional pasture management in various places around the world (Huffman, 2013; Sühs *et al.*, 2020).

The food production systems of the Jê peoples are not only diverse in terms of species composition and ethnovarieties but also in terms of landscapes. So far, no categories have been developed for management environments or landscape units (Johnson & Hunn, 2010); however, it was possible to identify some places with a high number of citations among the different peoples: plantations, areas with high humidity (gallery forests, riparian areas, swamps, marshes, murundu fields, etc.), yards, forest areas, areas with less dense vegetation such as plots of land, and so on), yards, wooded areas, areas with less dense vegetation such as clearings and fields, savannahs, or even areas with characteristic species such as bamboo groves, taquarais, buritizais, babaçuais, taboca forests, and *Brosimum* forests (monodominant forests of this genus of the Moraceae family).

Some studies, such as those conducted among the Mẽbêngôkre - Kayapó, Panará, Xerénte, and Xavánte - detail the types of soil in managed areas, identified by these peoples according to color: black soil, black sandy soil, black soil from archaeological sites, white soil, yellow soil, and red soil (Vieira Filho, 1972; Maybury-Lewis, 1990; Ewart, 2000; Schmidt, 2002; Posey, 2002; Leeuwenberg *et al.*, 2007; Schwartzman, 2010). In the indigenous lands of Southern Jê, traditional food production sites may occur in the interstices between areas of mechanized agriculture (Nascimento, 2017).

Another common element among the three branches of Jê food production systems is that women play a leading role in various stages of management, such as planting, harvesting, and collecting food and medicinal plant species with varying degrees of domestication. However, some species are managed exclusively by men, such as the planting of peanuts by the Panará (Schwartzman, 1988; Ewart, 2000; 2005; Schmidt, 2002), the planting of tuberous species and the collection of wild fruits by the Timbira Gavião Parkatejê (Arnaud, 1975), the planting of rice and maize by the Timbira Krahô (Ávila, 2004; Lima, 2016), and the management of some medicinal species by the Krahô healing specialist, the *wajaca* (Rodrigues & Carlini, 2005).

The systematic review of the literature and the synthesis of this unprecedented database of Jê plants have made it possible to identify trends in the sharing of plant species used for food among the Jê peoples of different localities, making the knowledge about this biodiversity more easily traceable.

A high richness of managed plant species and ethnovarieties was identified, with varying degrees of domestication. This reflects a long history between humans and plants and a high level of knowledge about biodiversity. In other words, the cultural heritage is based on the conservation and sustainable use of biological diversity. Some food crops, such as maize, manioc, and yams, are notable for their widespread distribution across different regions and biomes. Future research may elucidate the potential role of the Jê peoples in the dispersal of these species throughout the Brazilian territory. The biodiversity maintained by Indigenous peoples in low-impact food production systems could serve as a valuable tool for enhancing agricultural resilience in the context of climate change and the reduction of genetic diversity in food plants (Emperaire *et al.*, 2016). This is because a decline in genetic variability and the homogenization of species can increase vulnerability to biotic and abiotic stresses.

An understanding of the medicinal and food plant management and use practices of the Jê peoples can contribute to the development of public programs and policies, as well as to the actions of organized civil society, in areas ranging from environmental restoration (Campos-Filho *et al.,* 2013) to food sovereignty and security (Semeghini *et al.,* 2020). In addition, scientific research focused on a better understanding of the ancestral relationships between Indigenous groups and biodiversity allows for a rethinking of the legacy of Indigenous peoples, historically associated with a supposed "primitivism".

Acknowledgements

The authors would like to express their gratitude to the following individuals for their invaluable contributions: To the librarian Crislaine Zurilda Silveira, who provided help in formulating the search strategy and offered explanations about the specificities of each indexing database in which the searches were conducted. To Marcio Kokoj dos Santos, an indigenous Kaingáng and the president of the Uirapuru NGO, with whom we are partners in data curation. We would also like to express our appreciation to the professors and other staff of the Program in Biology of Fungi, Algae, and Plants at the Federal University of Santa Catarina for their support in conducting the research. We would also like to thank the Federal Institute of Paraná for granting paid leave to the first author.

References

Agência Nacional de Águas (ANA). Terras Indígenas. Catálogo de Metadados da Agência Nacional de Águas. https://metadados.snirh.gov.br/geonetwork/srv/api/records/3fa8cc38-79b4-4aa1-8179-bba315baea4b. 02 Feb. 2023.

Albuquerque UP, Soldati GT, Ramos MA *et al*. 2018. A influência do ambiente sobre o uso de recursos naturais: evidências da aparência. In: Albuquerque UP (org.). Etnobiologia: bases ecológicas e evolutivas. 2nd ed. Recife, Nupeea. p. 107-134.

Ambrosetti JB. 1895. Los indios Kaingangues de San Pedro (Misiones) con un vocabulario. Revista del Jardin Zoológico de Buenos Aires 2: 305-387.

Anderson AB, Posey D. 1989. Management of a Tropical Scrub Savanna by the Gorotire Kayapó of Brazil. Advances in Economic Botany 7: 159-173.

Arantes R, Santos RV, Coimbra Jr. CEA. 2001. Saúde bucal na população indígena Xavánte de Pimentel Barbosa, Mato Grosso, Brasil. Cadernos de Saúde Pública 17: 375-384. doi: 10.1590/s0102-311x2001000200012

Arantes R, Santos RV, Frazão P, Coimbra Jr. CEA. 2009. Caries, gender and socio-economic change in the Xavante Indians from Central Brazil. Annals of Human Biology 36: 162-175. doi: 10.1080/03014460802672844

Arnaud E. 1975. Os índios Gaviões de Oeste Pacificação e integração. Museu Paraense Emilio Goeldi 28: 1-86. https://repositorio.museu-goeldi.br/handle/mgoeldi/902

Ávila TAM. 2004. "Não é do jeito que Eles quer, é do jeito que nós quer": os Krahô e a biodiversidade. MSc Thesis, Universidade de Brasília, Brazil.

Balée W. 2006. The Research Program of Historical Ecology. Annual Review of Anthropology 35: 75-98. doi: 10.1146/annurev.anthro.35.081705.123231

Banner H. 1957. Mitos dos índios Kayapó. Revista de Antropologia 5: 37-66. doi: 10.11606/2179-0892.ra.1957.110359

Barbosa WLR, Pinto LDN. 2003. Documentação e valorização da fitoterapia tradicional Kayapó nas aldeias A'Ukre e Pykanu – sudeste do Pará. Revista Brasileira de Farmacognosia 13: 47-49. doi: 10.1590/s0102-695x2003000300018

Bitencourt ALV, Krauspenhar PM. 2006. Possible prehistoric anthropogenic effect on *Araucaria angustifolia* (Bert.) O. Kuntze expansion during the late Holocene. Revista Brasileira de Paleontologia 9: 109-116. doi: 10.4072/rbp.2006.1.12

Black FL, Hierholzer WJ, Black DP, Lamm SH, Lucas L. 1977. Nutritional Status of Brazilian Kayapo Indians. Human Biology 49: 139-153. http://www.jstor.org/stable/41465089

Borba T. 1908. Actualidade indígena (Paraná, Brazil). Curitiba, Impressora Paranaense.

Borges JC. 2014. Feira Krahô de sementes tradicionais: cosmologia, história e ritual no contexto de um projeto de segurança alimentar. PhD Thesis, Universidade de Brasília, Brazil.

Borges JC, Niemeyer F. 2012. Cantos, curas e alimentos: reflexões sobre regimes de conhecimento Krahô. Revista de Antropologia 55: 255-290.

Borghi AC, Carreira L. 2015. Condições de vida e saúde do idoso indígena Kaingang. Escola Anna Nery 19: 511-517. doi: 10.5935/1414-8145.20150068

Botelho RG, Oliveira CC. 2015. Literaturas branca e cinzenta: uma revisão conceitual. Ciência da Informação 44: 501-513. doi: 10.18225/ci.inf.v44i3.1804

Brasil. 1988. Constituição da República Federativa do Brasil de 1988. Brasília, Presidência da República. https://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm. 13 Jan. 2025.

Brieger F, Gurgel JPF, Paterniani E, Blumenschein A, Alleoni M. 1958. Races of maize in Brazil and other eastern South American countries. Washington, The National Academies Press.

Campos-Filho EM, Costa JNMN, Sousa OL, Junqueira RGP. 2013. Mechanized Direct-Seeding of Native Forests in Xingu, Central Brazil. Journal of Sustainable Forestry 32: 702-727. doi: 10.1080/10549811.2013.817341

CAPES – Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Plataforma Sucupira (CAPES). Plataforma sucupira. https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/veiculoPublicacaoQualis/listaConsultaGeralPeriodicos.jsf. 02 Nov. 2023.

Carneiro O, Jardim PC. 1993. Pressão Arterial em Tribo Xavante. Comparação 15 Anos Depois. Arquivos Brasileiros de Cardiologia 61: 279-282.

Cavalcante TLV. 2016. "Terra indígena": aspectos históricos da construção e aplicação de um conceito jurídico. História (São Paulo) 35: e75. doi: 10.1590/1980-436920160000000075

Clement CR. 1999. 1942 and the Loss of Amazonian Crop Genetic Resources. I. The Relation between Domestication and Human Population Decline. Economic Botany 53: 188-202.

Clement CR, Casas A, Parra-Rondinel FA *et al*. 2021. Disentangling Domestication from Food Production Systems in the Neotropics. Quaternary 4: 4. doi: 10.3390/quat4010004

Coelho LFH. 2007. A nova edição de Why Suyá Sing, de Anthony Seeger, e alguns estudos recentes sobre música indígena nas terras baixas da América do Sul. Mana 13: 237-249. doi: 10.1590/s0104-93132007000100009

Coelho de Souza M. 2002. O traço e o círculo: o conceito de parentesco entre os Jê e seus antropólogos. PhD Thesis, Universidade Federal do Rio de Janeiro, Brazil.

Cohn C. 2019. Os vários modelos Jê em Dialectical Societies. Revista de Antropologia da UFSCar 11: 17-50. doi: 10.52426/rau.v11i2.307

Coimbra Jr. CEA, Chor D, Santos RV, Salzano FM. 2001. Blood Pressure Levels in Xavánte Adults from the Pimentel Barbosa Indian Reservation, Mato Grosso, Brazil. Ethnicity & Disease 11: 232-240.

Coimbra Jr. CEA, Flowers NM, Salzano FM, Santos RV. 2002. The Xavante in Transition: Health, Ecology, and Bioanthropology in Central Brazil. Michigan, University of Michigan Press.

Cooper JM. 1942. Areal and Temporal Aspects of Aboriginal South American Culture. Primitive Man 15: 1-38. doi: 10.2307/3316342

Corteletti R, Dickau R, DeBlasis P, Iriarte J. 2015. Revisiting the economy and mobility of southern proto-Jê (Taquara-Itararé) groups in the southern Brazilian highlands: Starch grain and phytoliths analyses from the Bonin site, Urubici, Brazil. Journal of Archaeological Science 58: 46-61. doi: 10.1016/j.jas.2015.03.017

Costa FM, Silva NCA, Vidal R *et al*. 2022. Maize dispersal patterns associated with different types of endosperm and migration of indigenous groups in lowland South America. Annals of Botany 129: 737-751. doi: 10.1093/aob/mcac049

Couto RS, Fraga FRM. 2023. Dioscoreaceae in Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB28616. 02 Aug. 2023.

Couto RS. 2010. Dioscoreaceae (R. Br.) Lindley do Estado do Rio de Janeiro, Brasil. MSc Thesis, Universidade Federal do Rio de Janeiro, Brazil.

Crocker W. 1990. Canela (Eastern Timbira), I: An Ethnographic Introduction. Smithsonian Contributions to Anthropology 33: 1-487. doi: 10.5479/si.00810223.33.1

Cruz AP, Giehl ELH, Levis C, Machado JS, Bueno LR, Peroni N. 2020. Pre-colonial Amerindian legacies in forest composition of southern Brazil. PLoS One 15: e0235819. doi: 10.1371/journal.pone.0235819

Cruz TMS. 2014. Etnoecologia de paisagens na terra indígena Ibirama Laklãnõ, Santa Catarina, Brasil. MSc Thesis, Universidade Federal de Santa Catarina, Brazil.

D'Angelis WR, Fernandes DSB. 2004. O vocabulário Kaingáng de Ambrosetti (1894) e as relações lingüísticas e históricas da Aldeia de Ingacorá (RS) com Misiones (Arg.). LIAMES: Línguas Indígenas Americanas 4: 83-89. doi: 10.20396/liames.v4i1.1426

Elisabetsky E, Posey DA. 1989. Use of contraceptive and related plants by the Kayapo Indians (Brazil). Journal of Ethnopharmacology 26: 299-316. doi: 10.1016/0378-8741(89)90103-7

Elisabetsky E, Posey DA. 1994. Ethnopharmacological search for antiviral compounds: Treatment of gastrointestinal disorders by Kayapó medical specialists. Ciba Foundation Symposium 185: 77-94. doi: 10.1002/9780470514634.ch6

Emperaire L, Eloy L, Seixas AC. 2016. Redes e observatórios da agrobiodiversidade, como e para quem? Uma abordagem exploratória na região de Cruzeiro do Sul, Acre. Boletim do Museu Paraense Emílio Goeldi 11: 159-192. doi: 10.1590/1981.81222016000100009

Ewart E. 2000. Living with each other: Selves and alters amongst the Panará of Central Brazil. PhD Thesis, University of London, England.

Ewart E. 2005. Fazendo pessoas e fazendo roças entre os Panará do Brasil Central. Revista de Antropologia 48: 9-35. doi: 10.1590/S0034-77012005000100001

Ewart E. 2008. Seeing, Hearing and Speaking: Morality and Sense among the Panará in Central Brazil. Ethnos 73: 505-522. doi: 10.1080/00141840802563949

Fernandes L. 1941. Os Caingangues de Palmas. Arquivos do Museu Paranaense 1: 161-209.

Fernandes RC, Piovezana L. 2015. The Kaingang perspectives on land and environmental rights in the south of Brazil. Ambiente & Sociedade 18: 111-128. doi: 10.1590/1809-4422ASOCEx07V1822015en

Fernandes RC, Góes PRH. 2018. Kaingang ethnic territories. Vibrant: Virtual Brazilian Anthropology 15: e152407. doi: 10.1590/1809-43412018v15n2a407

Fisher WH. 2015. Social Organization as the Framework for Interpreting Demographic Measures of Urban Emigration among the Canela of South Central Maranhão, Brazil. The Journal of Latin American and Caribbean Anthropology 20: 34-56. doi: 10.1111/jlca.12137

Flora e Funga do Brasil. 2023. Jardim Botânico do Rio de Janeiro. http://floradobrasil.jbrj.gov.br/. 30 Jun. 2024.

Flowers NM, Gross D, Ritter ML, Werner D. 1982. Variation in Swidden practices in four central Brazilian Indian societies. Human Ecology 10: 203-217. doi: 10.1007/bf01531241

Flowers NM. 1983. Forager-farmers: The Xavánte Indians of Central Brazil. PhD Thesis, University of New York, United States of America.

Foo YZ, O'Dea RE, Koricheva J, Nakagawa S, Lagisz M. 2021. A practical guide to question formation, systematic searching and study screening for literature reviews in ecology and evolution. Methods in Ecology and Evolution 12: 1705-1720. doi: 10.1111/2041-210X.13654

Franco FM. 2022. Ecocultural or biocultural? Towards appropriate terminologies in biocultural diversity. Biology 11: 207. doi: 10.3390/biology11020207

Freitas FO, Zarur SBBC. 2007. Casa do Kukurro – tradição cultural e sua influência na amplificação e manutenção da diversidade em uma roça. Revista do Museu de Arqueologia e Etnologia 17: 381-389. doi: 10.11606/issn.2448-1750.revmae.2007.89806

Furlan V, Pochettino ML, Hilgert NI. 2017. Management of fruit species in urban home gardens of Argentina Atlantic Forest as an influence for landscape domestication. Frontiers in Plant Science 8: 1690. doi: 10.3389/fpls.2017.01690

Galvão TF, Pansani TSA, Harrad D. 2015. Principais itens para relatar Revisões sistemáticas e Meta-análises: A recomendação PRISMA. Epidemiologia e Serviços de Saúde 24: 335-342. doi: 10.5123/s1679-49742015000200017

Gardiman GG, Rodrigues IMM, Cascon LM, Isnards A. 2016. A morfologia dos vasos Jê na produção de cauim de milho em Vereda III: uma proposição. Revista do Museu de Arqueologia e Etnologia 27: 111-120. doi: 10.11606/issn.2448-1750.revmae.2016.137288

Garnett ST, Burgess ND, Fa JE *et al*. 2018. A spatial overview of the global importance of Indigenous lands for conservation. Nature Sustainability 1: 369-374. doi: 10.1038/s41893-018-0100-6

Gaoue OG, Coe MA, Bond M, Hart G, Seyler BC, McMillen H. 2017. Theories and Major Hypotheses in Ethnobotany. Economic Botany 71: 269-287. doi: 10.1007/s12231-017-9389-8

Gessert S, Iriarte J, Ríos RC, Behling H. 2011. Late Holocene vegetation and environmental dynamics of the Araucaria forest region in Misiones

Province, NE Argentina. Review of Palaeobotany and Palynology 166: 29-37. doi: 10.1016/j.revpalbo.2011.04.006

Giaccaria B, Heide A. 1972. Xavante (Auwẽ Uptabi: Povo Autêntico). Brasília, Editora Dom Bosco.

Góes PRH. 2018. Morfológicas: um estudo etnológico de padrões socioterritoriais entre os Kaingang (dialeto Paraná) e os Mbya (Litoral Sul). PhD Thesis, Universidade Federal do Paraná, Brazil.

Golte W. 1983. Araucaria seed as a staple food – a cultural-ecological convergence of three harvesting peoples in South America and Australia. Erdkunde 37: 227-237. doi: 10.3112/erdkunde.1983.03.06

Gomes TCC. 2018. Paisagens culturais e biodiversidade: mudanças socioecológicas e estratégias locais para conservação na Terra Indígena Laklãnõ, Santa Catarina, Brasil. PhD Thesis, Universidade Federal de Santa Catarina, Brazil.

Gonçalves RC. 2012. A diversidade sociocultural no Programa Nacional de Alimentação Escolar: uma etnografia da alimentação escolar indígena entre os Xavánte de Parabubure, Mato Grosso MSc Thesis, Universidade Federal de Santa Catarina, Brazil.

González EMR. 1996. Os grupos ceramistas pré-coloniais do Centro-Oeste brasileiro. Revista do Museu de Arqueologia e Etnologia 6: 83-121. doi: 10.11606/issn.2448-1750.revmae.1996.109255

González-Pérez S. 2011. Produtos Florestais Não Madeireiros em Terras Indígenas Kayapó no Estado do Pará: Diversidade e Uso. MSc Thesis, Museu Paraense Emilio Goeldi, Universidade Federal Rural da Amazônia, Brazil.

González-Pérez SE, Coelho-Ferreira M, Robert P, Garcés CLL. 2012. Conhecimento e usos do babaçu (*Attalea speciosa* Mart. e *Attalea eichleri* (Drude) A. J. Hend.) entre os Mebêngôkre-Kayapó da Terra Indígena Las Casas, estado do Pará, Brasil. Acta Botanica Brasilica 26: 295-308. doi: 10.1590/S0102-33062012000200007

González-Pérez SE, Robert P, Coelho-Ferreira M. 2013. Seed Use and Socioeconomic Significance in Kayapó Handicrafts: A Case Study from Pará State, Brazil. Economic Botany 67: 1-16. doi: 10.1007/s12231-013-9220-0

Greene ME, Crocker WH. 1994. Some demographic aspects of the Canela Indians of Brazil. South American Indian Studies 4: 47-62.

Gross D, Eiten G, Flowers NM, Leoi FM, Ritter ML, Werner D. 1979. Ecology and acculturation among native peoples of central Brazil. Science 206: 1043-1050. doi: 10.1126/science.206.4422.1043

Gugelmin SA. 2001. Antropometria nutricional e ecologia humana dos Xavánte de Sangradouro-Volta Grande, Mato Grosso. PhD Thesis, Escola Nacional de Saúde Pública, Fundação Oswaldo Cruz, Brazil.

Gugelmin AS, Santos RV. 2001. Ecologia humana e antropometria nutricional de adultos Xavánte, Mato Grosso, Brasil. Cadernos de Saúde Pública 17: 313-322. doi: 10.1590/S0102-311X2001000200006

Guislon AV, Elias GA, Bernardo VM, De Assunção VK, Santos RD. 2017. Histórico de Uso e Ocupação da Floresta Atlântica em uma Unidade de Conservação no Sul do Brasil. Fronteiras: Journal of Social, Technological and Environmental Science 6: 47-64. doi: 10.21664/2238-8869.2017v6i2.p47-64

Haverroth M. 1997. Kaingang: um estudo etnobotanico: O uso e a classificação das plantas na área indígena Xapecó (oeste de SC). MSc Thesis Universidade Federal de Santa Catarina, Brazil.

Heineberg MR. 2014. Conhecimento e uso das plantas pelos Xokleng na TI Ibirama-Laklãnõ, Santa Catarina. MSc Thesis, Universidade Federal de Santa Catarina, Brazil.

Heineberg MR, Hanazaki N. 2019. Dynamics of the botanical knowledge of the Laklãnõ-Xokleng indigenous people in Southern Brazil. Acta Botanica Brasilica 33: 254-268. doi: 10.1590/0102-33062018abb0307

Henry J. 1964. Jungle people: A Kaingang tribe of the highlands of Brazil. New York, Vintage Books.

Hora RC, Camargo J, Buzanini AC. 2018. Cucurbitáceas e outras. In: Brandão Filho JUT, Freitas PSL, Berian LOS, Goto R (orgs.). Hortaliças-fruto. Maringá, EdUEM. p. 710-111.

Huffman MR. 2013. The many elements of traditional fire knowledge: Synthesis, classification, and aids to cross-cultural problem solving in fire-dependent systems around the world. Ecology and Society 18: 3. doi: 10.5751/es-05843-180403

Inácio JC. 2005. Zoneamento etno-ambiental da terra indígena de Ligeiro: um estudo com base na ecologia de paisagem. MSc Thesis, Universidade Federal do Rio Grande do Sul, Brazil.

Instituto Brasileiro de Geografia e Estatística (IBGE). 2021. Bacias e Divisões Hidrográficas do Brasil. Série Relatórios metodológicos. Coordenação de Recursos Naturais e Estudos Ambientais. https://www.ibge.gov.br/geociencias/cartas-e-mapas/informacoes-ambientais/31653-bacias-e-divisoes-hidrograficas-do-brasil.html. 25 Jan. 2021.

Iriarte J, Elliott S, Maezumi SY *et al*. 2020. The origins of Amazonian landscapes: Plant cultivation, domestication and the spread of food production in tropical South America. Quaternary Science Reviews 248: 106582. doi: 10.1016/j.quascirev.2020.106582

Johnson LM, Hunn ES. 2010. Introduction Landscape Ethnoecology Concepts of Biotic and Physical Space. In: Johnson LM, Hunn ES (eds.). Landscape Ethnoecology: Concepts of Biotic and Physical Space. New York, Berghahn Books. p. 1-12. doi: 10.2307/j.ctt9m0wg8.5

Kerr WE, Posey DA, Filho WW. 1978. Cupá, ou cipó-babão, alimento de alguns índios amazônicos. Acta Amazonica 8: 702-705. doi: 10.1590/1809-43921978084702

Kistler L, Maezumi SY, Souza JG *et al*. 2018. Multiproxy evidence highlights a complex evolutionary legacy of maize in South America. Science 362: 1309-1313. doi: 10.1126/science.aav0207

Lauterjung MB, Bernardi AP, Montagna T, Candido-Ribeiro R, Mantovani A, Reis MSD. 2018. Phylogeography of Brazilian pine (*Araucaria angustifolia*): Integrative evidence for pre-Columbian anthropogenic dispersal. Tree Genetics & Genomes 14: 36. doi: 10.1007/s11295-018-1250-4

Leeuwenberg FJ, Melo MAR, Nascimento WR. 2007. Dasa Uptabi: De Volta às Raízes. Goiás, Sociedade de Proteção e Utilização do Meio Ambiente (PUMA).

Leite MS, Santos RV, Gugelmin SA, Coimbra Jr. CEA. 2006. Crescimento físico e perfil nutricional da população indígena Xavánte de Sangradouro-Volta Grande, Mato Grosso, Brasil. Cadernos de Saúde Pública 22: 265-276. doi: 10.1590/S0102-311X2006000200004

Levis C, Flores BM, Moreira PA *et al*. 2018. How People Domesticated Amazonian Forests. Frontiers in Ecology and Evolution 5: 171. doi: 10.3389/fevo.2017.00171

Lévi-Strauss C. 1952. The use of wild plants in tropical South America. Economic Botany 6: 252-270. doi: 10.1007/bf02985068

Lima AGM. 2016. "Brotou batata para mim" Cultivo, gênero e ritual entre os Krahô (TO, Brasil). PhD Thesis, Universidade Federal do Rio de Janeiro, Brazil.

Lima AGM. 2017. A Cultura da batata-doce: Cultivo, parentesco e ritual entre os Krahô. Mana 23: 455-490. doi: 10.1590/1678-49442017v23n2p455

Lima AGM. 2019. Etnografias Jê e as plantas cultivadas: contribuições para o debate sobre sistemas agrícolas tradicionais. Revista de Antropologia da UFSCar 11: 293-325. doi: 10.52426/rau.v11i2.323

Lima AGM, Krahô CP, Aldé V. 2020. Histórias e cantos do milho Krahô: as muitas vozes do cerrado. In: Oliveira JC, Amoroso M, Lima AGM, Shitratori K, Marras S, Emperaire L (orgs.). Vozes vegetais: diversidade, resistências e histórias da floresta. São Paulo, Ubu Editora. p. 283-300.

López Garcés CL, Robert P. 2012. El legado de Darrell Posey: de las investigaciones etnobiológicas entre los Kayapó a la protección de los conocimientos indígenas. Boletim do Museu Paraense Emílio Goeldi 7: 565-580. doi: 10.1590/S1981-81222012000200015

López E. 1998. A creative perspective of environmental impacts by native Amazonian human populations. Interciencia 23: 232-240.

Manaças MEA. 2011. Além do que os olhos veem: etnogênese, Xikrin-Mebêngôkre e a macrorregião de Marabá. Boletim do Museu Paraense Emílio Goeldi 6: 633. doi: 10.1590/s1981-81222011000300017

Marimon BS, Felfili JM. 2001. Ethnobotanical comparison of "Pau Brasil" (*Brosimum rubescens* Taub.) forests in a Xavante Indian and a non-Xavante community in eastern Mato Grosso State, Brazil. Economic Botany 55: 555-569. doi: 10.1007/bf02871718

Martins PS. 2005. Dinâmica evolutiva em roças de caboclos amazônicos. Estudos Avançados 19: 209-220. doi: 10.1590/S0103-40142005000100013

Maybury-Lewis D. 1979. Conclusion: Kinship, ideology, and culture. In: Maybury-Lewis D (ed.). Dialectical societies: The Gê and Bororo of Central Brazil. Cambridge, Harvard University Press. p. 301-312.

Maybury-Lewis D. 1984. A Sociedade Xavante. Rio de Janeiro, Francisco Alves.

Maybury-Lewis D. 1990. O Selvagem e o Inocente. Campinas, Editora da Unicamp.

Melatti JC. 2002. Dos Krahó aos Marubo: a aventura etnográfica. Mana 8: 195-211. doi: 10.1590/S0104-93132002000100009

Melatti JC. 2020. Aspectos culturais (não linguísticos) dos povos falantes de línguas do tronco Macro-Jê. In: Miranda M, Borges AAC, Santana AC, Sousa SA (orgs.). Línguas e culturas Macro-Jê: saberes entrecruzados. Cuiabá, Grupo de Estudos, Descrição e Documentação de Línguas Indígenas (GEDELLI) da Universidade Federal de Mato Grosso. p. 37-94.

Melo MM. 2007. A confluência entre a ecologia do fogo e o conhecimento Xavante sobre o manejo do fogo no Cerrado. PhD Thesis, Universidade de Brasília, Brazil.

Mendonça AAN, Fonseca MCFR. 2017. Indigenização de práticas de numeramento no desenvolvimento e na gestão de projetos sociais do povo indígena Xakriabá. Revista do Instituto de Estudos Brasileiros 68: 68-83. doi: 10.11606/issn.2316-901X.v0i68p68-83

Metraux A. 1963. The Caingang. In: Steward JH (ed.). Handbook of South American Indians. Washington, DC, Cooper Square Publishers. p. 445-475.

Meyer RS, DuVal A, Jensen HH. 2012. Patterns and processes in crop domestication: An historical review and quantitative analysis of 203 global food crops. New Phytologist 196: 29-48. doi: 10.1111/j.1469-8137.2012.04253.x

Miller TL. 2014. Valuing Varietal Diversity: Indigenous Canela Horticulture in Northeast Brazil. Society, Biology & Human Affairs 78: 62-82.

Miller TL. 2015. Bio-sociocultural aesthetics: Indigenous Ramkokamekra-Canela gardening practices and varietal diversity maintenance in Maranhão, Brazil. PhD Thesis, University of Oxford, England.

Miller TL. 2016. Living Lists: How the Indigenous Canela Come to Know Plants through Ethnobotanical Classification. Journal of Ethnobiology 36: 105-124. doi: 10.2993/0278-0771-36.1.105

Miller TL. 2017. Valuing the Bad and the Ugly: Tasting agrobiodiversity among the Indigenous Canela. Food, Culture and Society 20: 325-346. doi: 10.1080/15528014.2017.1305831

Mistry J, Berardi A, Andrade VM, Krahô T, Krahô P, Leonardos OH. 2005. Indigenous Fire Management in the Cerrado of Brazil: The Case of the Krahô of Tocantíns. Human Ecology 33: 365-386. doi: 10.1007/s10745-005-4143-8

Moreira FS. 2017. Os índios caingangues na província brasileira do Paraná, Trad. "Die Caingangs-Indianer in der brasilianischen Provinz Paraná" (1886), de Telêmaco Borba. Revista de História Regional 22: 243-260. doi: 10.5212/Rev.Hist.Reg.v.22i1.0011

Mota LT. 2017. Passo Ruim 1868: as estratégias dos Xokleng nas fronteiras de seus territórios do alto rio Itajaí. Revista Brasileira de História 37: 169-193. 10.1590/1806-93472017v37n75-07

Mukaka MM. 2012. Statistics corner: A guide to appropriate use of correlation coefficient in medical research. Malawi Medical Journal 24: 69-71. doi: 10.4236/jwarp.2015.77047

Myers N, Mittermeier RA, Mittermeier CG, Fonseca GAB, Kent J. 2000. Biodiversity hotspots for conservation priorities. Nature 403: 853-858. doi: 10.1038/35002501

Nascimento D. 2017. A resiliência do sistema agrícola tradicional Kaingang frente ao avanço do agronegócio: o caso da Terra Indígena Nonoai- RS. MSc Thesis, Universidade de Brasília, Brazil.

Nascimento W, Siqueira M, Ferreira A, Ming L, Peroni N, Veasey E. 2015. Distribution, management and diversity of the endangered Amerindian yam (*Dioscorea trifida* L.). Brazilian Journal of Biology 75: 104-113. doi: 10.1590/1519-6984.08313

Neel JV, Salzano FM, Junqueira PC, Keiter F, Maybury-Lewis D. 1964. Studies on the Xavante Indians of the Brazilian Mato Grosso. American Journal of Human Genetics 16: 52-140.

Niemeyer F. 2011. Cultura e Agricultura: Resiliência e transformação do sistema agrícola Krahô. MSc Thesis, Universidade Estadual de Campinas, Brazil.

Nimuendajú C. 1942. The Šerente. Publications of the Frederick Webb Hodge Anniversary Publication Fund. Los Angeles, The Southwest Museum. v. IV.

Nimuendajú C. 1946. The Eastern Timbira. University of California Publications in American Archeology and Ethnology. California, University of California Press. v. XLI.

Nimuendajú C. 1956. Os Apinayé. Boletim do Museu Paraense Emilio Goeldi 12: 1-150.

Noelli FS. 1996. Os Jê do Brasil meridional e a antiguidade da agricultura: Elementos da linguística, arqueologia e etnografia. Estudos Ibero-Americanos 22: 13-26. doi: 10.15448/1980-864X.1996.1.28773

Oliveira CE. 1930. Os Apinagé do Alto-Tocantins. Trajes, crenças, artes, lendas, contos e vocabulário. Boletim do Museu Nacional 6: 61-110.

Oliveira PHA. 2009. Comida forte e comida fraca: alimentação e fabricação dos corpos entre os Kaingáng da terra indígena Xapecó (Santa Catarina, Brasil). MSc Thesis, Universidade Federal de Santa Catarina, Brazil.

Pacheco AA, Neves ACO, Fernandes GW. 2018. Uneven conservation efforts compromise Brazil to meet the Target 11 of Convention on Biological Diversity. Perspectives in Ecology and Conservation 16: 43-48. doi: 10.1016/j.pecon.2017.12.001

Parellada CI. 2015. Arte rupestre no Paraná: novas discussões. Tecnologia e Ambiente 21: 45-69. doi: 10.18616/ta.v21i0.1927

Parellada CI, Gomes GR. 2022. Arqueologia funerária e arte rupestre no Paraná: entrelaçando saberes, materialidades e territorialidades. In: Anais do XII Encontro da SABSUL, IV Jornadas de Atualização em Arqueologia Guarani. Chapecó, Núcleo Regional Sul da Sociedade de Arqueologia Brasileira [SAB-Sul].

Pedralli G, Carmo CAS, Cereda M, Puiatti M. 2002. Uso de nomes populares para as espécies de Araceae e Dioscoreaceae no Brasil. Horticultura Brasileira 20: 530-532. doi: 10.1590/S0102-05362002000400002

Peres CA, Baider C. 1997. Seed dispersal, spatial distribution and population structure of Brazil nut trees (*Bertholletia excelsa*) in southeastern Amazonia. Journal of Tropical Ecology 13: 595-616. doi: 10.1017/S0266467400010749

Pio-Corrêa M. 1926. Dicionário das plantas úteis do Brasil e das exóticas cultivadas. Rio de Janeiro, Imprensa Nacional.

Piperno DR, Ranere AJ, Holst I, Iriarte J, Dickau R. 2009. Starch grain and phytolith evidence for early ninth millennium B.P. maize from the Central Balsas River Valley, Mexico. Proceedings of the National

Academy of Sciences of the United States of America 106: 5019-5024. doi: 10.1073/pnas.0812525106

Pontes HS, Junghans R, Massuqueto LL *et al*. 2023. First rupestrian representations of *Araucaria angustifolia* in Southern Brazil. Caderno de Geografia 33: 174-201. doi: 10.5752/p.2318-2962.2023v33n72p174

Posey DA. 1985 Indigenous management of tropical forest ecosystems: the case of the Kayapó indians of the Brazilian Amazon. Agroforestry Systems 3: 139-158. doi: 10.1007/BF00122640

Posey DA. 1986. Manejo da floresta secundária, capoeiras, campos e cerrados (Kayapó). In: Ribeiro D (coord.). Suma etnológica brasileira: Etnobiologia. 3rd edn. Belém, Editora da UFPA. p. 199-213.

Posey DA. 2002. Kayapó Ethnoecology and Culture. London, Routledge.

Prestes FS, Laroque LF. 2018. O Saber Sensível do Kujà sobre Ambiente e Saúde: Um estudo de caso da comunidade indígena foxá de Lajeado/RS. Fronteiras 7: 342-356. doi: 10.21664/2238-8869.2018v7i3

Phumthum M, Balslev H. 2019. Use of Medicinal Plants Among Thai Ethnic Groups: A Comparison. Economic Botany 73: 64-75. 10.1007/s12231-018-9428-0

Reis JA. 2017. Socioterminologia de plantas medicinais em Parkatêjê. MSc Thesis, Universidade Federal do Pará, Brazil.

Reis MS, Ladio A, Peroni N. 2014. Landscapes with *Araucaria* in South America: Evidence for a cultural dimension. Ecology and Society 19: 43. doi: 10.5751/ES-06163-190243

Reyes-Garcia V, Godoy R, Vadez V *et al*. 2003. Ethnobotanical Knowledge Shared Widely Among Tsimane' Amerindians, Bolivia. Science 299: 1707.

Ribeiro MBN, Jerozolimski A, De Robert P, Magnusson WE. 2014a. Brazil nut stock and harvesting at different spatial scales in southeastern Amazonia. Forest Ecology and Management 319: 67-74. doi: 10.1016/j.foreco.2014.02.005

Ribeiro MBN, Jerozolimski A, De Robert P *et al*. 2014b. Anthropogenic landscape in Southeastern Amazonia: Contemporary impacts of Low-Intensity Harvesting and Dispersal of Brazil nuts by the Kayapó Indigenous people. PLoS One 9: e102187. doi: 10.1371/journal.pone.0102187

Ribeiro PO. 2015. Plantas-filha e a beleza das roças: o lugar das plantas na cosmologia Apinajé. MSc Thesis, Universidade Federal do Tocantins, Brazil.

Rindos D. 1984. The Origins of Agriculture: An Evolutionary Perspective. Cambridge, Academic Press.

Robert P, Katz E. 2010. Usos alimentarios de palmeras. Un estudio comparativo en Amazonía brasileña. In: Pochetino ML, Ladio AH, Arenas PM (eds.). Tradiciones y Transformaciones en Etnobotánica. San Salvador de Jujuy, Universidad Nacional de Jujuy. p. 370-375.

Robert P, Garcés CL, Laques AE, Coelho-Ferreira M. 2012. A beleza das roças: agrobiodiversidade Mebêngôkre-Kayapó em tempos de globalização. Boletim do Museu Paraense Emílio Goeldi 7: 339-369. doi: 10.1590/S1981-81222012000200004

Robinson M, Souza JG, Maezumi SY *et al*. 2018. Uncoupling human and climate drivers of late Holocene vegetation change in southern Brazil. Scientific Reports 8: 7800. doi: 10.1038/s41598-018-24429-5

Rocha CC. 2011. From socio-politics to kinship dynamics among the Kaingang. Vibrant: Virtual Brazilian Anthropology 8: 359-374. doi: 10.1590/s1809-43412011000200016

Rocha TES, Silva RP, Nascimento MM. 2016. Changing dietary habits among Akwen Xerente. Revista da Escola de Enfermagem da USP 50: 96-100. doi: 10.1590/S0080-623420160000300014

Rodrigues AD. 2012. Para o estudo histórico-comparativo das línguas Jê. Revista Brasileira de Linguística Antropológica 4: 279-288. doi: 10.26512/rbla.v4i2.20692

Rodrigues E. 2001. Usos Rituais de plantas que indicam ações sobre o Sistema Nervoso Central pelos índios Krahô, com ênfase nas psicoativas. PhD Thesis, Universidade Federal de São Paulo, Brazil.

Rodrigues E. 2007. Plants of restricted use indicated by three cultures in Brazil (Caboclo-river dweller, Indian and Quilombola). Journal of Ethnopharmacology 111: 295-302. doi: 10.1016/j.jep.2006.11.017

Rodrigues E, Carlini EA. 2005. Ritual use of plants with possible action on the central nervous system by the Krahô Indians, Brazil. Phytotherapy Research 19: 129-135. doi: 10.1002/ptr.1636

Rodrigues E, Carlini EA. 2006. A comparison of plants utilized in ritual healing by two Brazilian cultures: Quilombolas and Krahô Indians. Journal of Psychoactive Drugs 38: 285-295. doi: 10.1080/02791072.2006.10399858

Salm R, Feder L, Jalles-Filho E, Jardim MAG. 2010. Planting coconuts in Indian villages: Ethnoecological aspects and evaluation of a "sustainable development" project. Biota Neotropica 10: 141-154. doi: 10.1590/S1676-06032010000100014

Salm R, Feder L, Jardim MAG, Hass N, Jalles-Filho E, Costa AM. 2009. Conservation value of an exotic species: the case of coconuts on the Kayapo indigenous lands, south-eastern Amazonia. Environment, Development and Sustainability 11: 161-173. doi: 10.1007/s10668-007-9102-7

Semeghini MG, Soave FM, Menezes MAO *et al*. 2020. Guia Prático. Alimentação escolar indígena e de comunidades tradicionais. Caso PNAE Indígena no Amazonas. Série "Agricultura familiar: boas práticas replicáveis de comercialização de produtos da sociobiodiversidade e agroecologia". Brasília, Ministério da Agricultura, Pecuária e Abastecimento (MAPA)/Cooperação Alemã - Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ). https://www.bivica.org/file/view/id/6526. 25 Sep. 2024.

Sanches R, Futemma C, Alves HQ. 2021. Indigenous territories and governance of forest restoration in the Xingu River (Brazil). Land Use Policy 104: 104755. doi: 10.1016/j.landusepol.2020.104755

Santos JFL, Pagani E, Ramos JF, Rodrigues E. 2012. Observations on the therapeutic practices of riverine communities of the Unini River, AM, Brazil. Journal of Ethnopharmacology 142: 503-515. doi: 10.1016/j.jep.2012.05.027

Santos RV, Flowers NM, Coimbra Jr. CEA, Gugelmin SA. 1997. Tapirs, tractors, and tapes: The changing economy and ecology of the Xavánte Indians of Central Brazil. Human Ecology 25: 545-566. doi: 10.1023/a:1021881823603

Schallenberger L, Machado G. 2013. Uso de produtos de origem florestal pelos índios Kaingang da reserva indígena de Mangueirinha (PR). Revista Acadêmica Ciências Agrárias e Ambientais 11: 163-173. doi: 10.7213/academica.10.S01.AO19

Schmidt MVC (coord.). 2002. O Conhecimento dos recursos naturais pelos antigos Panará. São Paulo, Instituto Socioambiental.

Schmidt R. 2011. Nossa cultura é pequi, frutinha do mato: Um estudo sobre as práticas alimentares do povo Akwe. MSc Thesis, Universidade Federal de Goiás, Brazil.

Schmidt W. 1942. Ethnologia sul-americana: círculos culturaes e estratos culturaes na América do Sul. São Paulo, Companhia Editora Nacional.

Schuch I. 2001. Perfil socioeconômico e alimentar das famílias indígenas Kaingang de Guarita-RS. MSc Thesis, Universidade Estadual de Campinas, Brazil.

Schwartzman S. 1988. The Panará of the Xingú National Park: the transformation of a society. PhD Thesis, University of Chicago, United States of America.

Schwartzman S. 2010. Nature and culture in Central Brazil: Panará Natural resource concepts and tropical forest conservation. Journal of Sustainable Forestry 29: 302-327. doi: 10.1080/10549810903548161

Seeger A. 1987. Why Suyá Sing: A Musical Anthropology of an Amazonian People. Illinois, University of Illinois Press.

Sens SL. 2002. Alternativas para a auto-sustentabilidade dos Xokleng da Terra Indígena Ibirama. MSc Thesis, Universidade Federal de Santa Catarina, Brazil.

Serviço Florestal Brasileiro. 2019. Inventário Florestal Nacional: principais resultados – Terra Indígena Mangueirinha. Brasília, Ministério da Agricultura e Pecuária, Brasil.

Shepard Jr. GH, Clement CR, Lima HP, Santos GMD, Moraes CP, Neves EG. 2020. Ancient and traditional agriculture in South America: Tropical lowlands. Oxford Research Encyclopedia of Environmental Science. doi: 10.1093/acrefore/9780199389414.013.597

Shepard GH, Ramirez H. 2011. "Made in Brazil": Human Dispersal of the Brazil Nut (*Bertholletia excelsa*, Lecythidaceae) in Ancient Amazonia1. Economic Botany 65: 44-65. doi: 10.1007/s12231-011-9151-6

Silva AL. 1999. Enfants autochtones et apprentissage: La corporalité comme langage en Amérique du Sud Tropicale. In: King L (ed.). Learning, Knowledge and Cultural Context. Dordrecht, Springer eBooks. p. 251-268. doi: 10.1007/978-94-011-4257-1_2

Silva RJN. 2008. Seis décadas de contato: transformações na subsistência Xavante. MSc Thesis, Universidade de São Paulo, Brazil.

Silva SMO. 2013. Alimentos, restrições e reciprocidade no ritual Xavante do Wapté mnhõno (Terra Indígena Marãiwatsédé, Mato Grosso). MSc Thesis, Universidade de Brasília, Brazil.

Souza HB. 1956. O cipó-babão (*Cissus gongylodes* Baker): Um agente coagulante do látex de *Hevea*. Boletim Técnico do Instituto Agronômico do Norte 31: 163-186.

Souza LG, Santos RV. 2001. Perfil demográfico da população indígena Xavánte de Sangradouro-Volta Grande, Mato Grosso (1993-1997), Brasil. Cadernos de Saúde Pública 17: 355-365. doi: 10.1590/S0102-311X2001000200010

Souza LG, Santos RV, Pagliaro H, Carvalho MS, Flowers NM, Coimbra Jr. CEA. 2011. Demography and health of the Xavante Indians of Central Brazil. Cadernos de Saúde Pública 27: 1891-1905. doi: 10.1590/S0102-311X2011001000003

Steward JH. 1946. Introduction. In: Steward JH (ed.). Handbook of South American Indians. Washington, Smithsonian Institution. p. 1-9.

Sühs RB, Giehl ELH, Peroni N. 2020. Preventing traditional management can cause grassland loss within 30 years in southern Brazil. Scientific Reports 10: 783. doi: 10.1038/s41598-020-57564-z

Teka A, Asfaw Z, Demissew S, Van Damme P. 2020. Medicinal plant use practice in four ethnic communities (Gurage, Mareqo, Qebena, and Silti), south central Ethiopia. Journal of Ethnobiology and Ethnomedicine 16: 27. doi: 10.1186/s13002-020-00377-1

Terra Nascimento AR, Santos AA, Martins RC, Dias TAB. 2009. Comunidade de palmeiras no Território Indígena Krahò, Tocantins, Brasil: biodiversidade e aspectos etnobotânicos. Interciencia 34: 182-188.

Terras Indígenas no Brasil. Instituto Socioambiental. https://terrasindigenas.org.br/. 19 Dez. 2023.

Turland NJ, Wiersema JH, Barrie FR *et al*. (eds.). 2018. International Code of Nomenclature for algae, fungi, and plants (Shenzen Code). In: Nineteenth International Botanical Congress Shenzhen, July 2017, China. Regnum Vegetabile 159, Koeltz Botanical Books. doi: 10.12705/code.2018

Universidade Federal de Santa Catarina (UFSC). 2021. Banco de dados sobre o uso, manejo e domesticação de plantas nas Américas. Useflora. https://www.useflora.ufsc.br/. 30 Jun. 2024.

Urban GP. 1992. A história da cultura brasileira segundo as línguas nativas. In: Cunha MC (org.). História dos Índios no Brasil. São Paul, Companhia das Letras. p. 87-102.

Vedoy MIB, Laroque LFD, Machado NTG. 2018. Conflitos envolvendo colonizadores e indígenas em áreas territoriais da bacia hidrográfica do Taquari-Antas, Rio Grande do Sul. Novos Cadernos NAEA 21: 187-208. doi: 10.5801/ncn.v21i3.5370

Veiga J. 1994. Organização Social e Cosmovisão Kaingang: uma introdução ao parentesco, casamento e nominação em uma sociedade Jê meridional. MSc Thesis, Universidade Estadual de Campinas, Brazil.

Verona LDP. 2009. Comida auwe comida, waradzu e ressignificação: o sistema alimentar dos Xavante da aldeia Nossa Senhora de Guadalupe, Mato Grosso. MSc Thesis, Universidade do Estado do Rio de Janeiro, Brazil.

Vieira Filho JPB. 1972. Considerações a propósito da inexistência de bócio entre os indígenas brasileiros Xikrin. Revista Associação Médica Brasileira 18: 345-348.

Vieira Filho JPB. 1981. Problemas da aculturação alimentar dos Xavantes e Bororo. Revista de Antropologia 24: 37-40. doi: 10.11606/2179-0892.ra.1981.110963

Vieira Filho JPB, Oliveira ASB, Silva MRD, Amaral AL, Schultz RR. 1997. Polineuropatia nutricional entre índios Xavantes. Revista da Associação Médica Brasileira 43: 82-88. doi: 10.1590/S0104-42301997000100018

Vieira Filho JPB, Russo EMK, Novo NF. 1983. A hemoglobina glicosilada (HbA1) dos índios Xavantes. Arquivos Brasileiros de Endocrinologia & Metabologia 27: 153-155.

Wagley C. 1979. Foreword. In: Maybury-Lewis D (ed.). Dialectical societies: The Gê and Bororo of Central Brazil. Cambridge, Harvard University Press. p. 9-14.

Welch JR. 2014. Xavante Ritual Hunting: Anthropogenic fire, reciprocity, and collective landscape management in the Brazilian Cerrado. Human Ecology 42: 47-59. doi: 10.1007/s10745-013-9637-1

Welch JR, Ferreira AA, Santos RV, Gugelmin SA, Werneck GL, Coimbra Jr. CEA. 2009. Nutrition transition, socioeconomic differentiation, and Gender among adult Xavante Indians, Brazilian Amazon. Human Ecology 37: 13-26. doi: 10.1007/s10745-009-9216-7

Welch JR, Santos RV, Flowers NM, Coimbra Jr. CEA. 2013. Na primeira margem do rio: território e ecologia do Povo Xavante de Wedezc. Caderno de Saúde Pública 30: 4. doi: 10.1590/0102-311XRE020414

Wiersum K. 1997. From natural forest to tree crops, co-domestication of forests and tree species, an overview. Netherlands Journal of Agricultural Science 45: 425-438. doi: 10.18174/njas.v45i4.503

Wüst I. 1999. Etnicidade e tradições ceramistas: algumas reflexões a partir das antigas aldeias Bororo do Mato Grosso. Revista do Museu de Arqueologia e Etnologia Suplemento 3: 303-317. doi: 10.11606/issn.2594-5939.revmaesupl.1999.113475

Zanotti L. 2014. Political ecology of movement: Trekking and territoriality among the Kayapó. Journal of Political Ecology 21: 108-126. 10.2458/v21i1.21127

Authors' Contributions

This article represents part of the results of the doctoral research of Ariane Saldanha de Oliveira, under the supervision of Nivaldo Peroni. Ariane and Nivaldo were responsible for the conceptualization. Ariane was responsible for collecting, analyzing, and interpreting the data and writing the text. Nivaldo was responsible for project management, supervision, and writing the text. Aline Pereira Cruz contributed to the discussions on indigenous territories, data curation on indigenous lands, and map design.

Conflict of Interest

The authors have no conflicts of interest to declare, including personal, scientific, commercial, political, or financial interests.

Data Availability

All data generated in this study are available in the body of the article.