

ENVIRONMENTAL PERCEPTION IN PERMANENT PRESERVATION AREA (PPA) RESTORED IN THE WESTERN AMAZON, BRAZIL: A CASE REPORT

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ABSTRACT: Restorations of anthropogenically degraded ecosystems present a relative demand for information that influences the success of the project. Environmental analysis, with the interface of ethnobotany and the management of the rural producer with the plants that make up these areas can make the experiments successful. We aimed verify the environmental perception and ethnobotany in the area of permanent preservation (PPA) restored in the Western Amazon. Data were collected through semi-structured and open interviews, direct observation, life history and walks-in-the-woods and participant observations. The restoration takes place nine years ago and was implemented to comply with environmental legislation. Currently the revegetation area serves as an ecological corridor, animal shelter and protection of local water resources, and has been evaluated positively given the environmental importance for the region. The most represented botanical families were Fabaceae and Meliaceae their products are considered sources of food and medicines. The revegetation in the area provides shading, which favors the volume of the water course and also influencing the local microclimate.

Keywords: Restoration, Traditional knowledge, Ethnobotany, PPA

PERCEPCIÓN AMBIENTAL EN EL ÁREA DE PRESERVACIÓN PERMANENTE (APP) RESTAURADA EN LA AMAZONIA OCCIDENTAL, BRASIL: UN RELATO DE CASO

RESUMEN: La restauración de ecosistemas degradados, mediante diversos usos antrópicos del suelo, viene presentando relativa demanda por informaciones para incidir en el éxito del proyecto. Así, analizar la percepción ambiental de los productores y el conocimiento sobre las especies que componen esas áreas pueden auxiliar en esa búsqueda de experiencias exitosas. De esta manera, se objetivó verificar la percepción ambiental y la etnobotánica en área de preservación permanente restaurada en la Amazonía Occidental. Para ello, se realizaron entrevistas de los tipos semiestructurada y abierta, observación directa, historia de vida y posteriormente, caminata transversal en el área de estudio. Se observó que el área tiene nueve años y fue implantada con el objetivo de atender la legislación ambiental. El área sirve, actualmente, de pasillo y abrigo para diversos animales. El propietario evalúa de manera positiva el proyecto de restauración ambiental dada a la importancia para la protección de los recursos hídricos y beneficios a la fauna local. Se registraron 11 etnoespecies distribuidas en nueve familias botánicas con destaque para Fabaceae y Meliaceae, cuyo uso maderero fue el mas citado, seguido de alimentos y medicinas. La revegetación en el área proporciona el sombreado, que favorece el volumen del curso del agua y también influenciando en el microclima local.

Palabras claves: Restauración, Conocimiento tradicional, Etnobotánica, APP.

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INTRODUCTION

Forests are a global resource and important issues dealing with their use and maintenance cannot be effectively dealt with in an insular fashion. Global participation is mandatory, if these resources are to be sustained and equitably utilized (SZARO et al. 2000). Due to the complexity of forestry and the functions associated with forests, when combined with human dynamics, they can succeed in the process of restoring forests. According Szaro et al. (2000) this approach must ensure that these resources will continue to exist at some acceptable levels for the benefit of current and future generations. This is often referred to as 'sustainable forest management'. It is quite complex, as it seeks to value the forest as a whole, treating all its functions as equally important.

Brazil's wealth of natural resources is unique. This is because the country has the largest rainforest biome in the world, the Amazon contains the largest extension of the remaining tropical forests. The Legal Amazon covers about 60% of the Brazilian territory and shelters 21 million inhabitants, 12% of the national population (IBGE, 2010). Brazil also has the largest freshwater spring in the world, with the Amazon region alone accounting for almost one-fifth of the world's fresh water reserves (MARGULIS, 2003).

Although this Brazilian region is home to approximately 10% of all the planet's biodiversity, many species of fauna and flora are now threatened with extinction due to the effects of anthropic activities (MMA, 1998). According Margulis (2003) studies indicate that the greatest threat to Amazonian biodiversity is deforestation.

The population of the Brazilian Amazon has increased by 19 million inhabitants in the last 50 years, in part due to governmental occupation plans. Within this growth period, approximately 80% of the Brazilian Amazon's original forest cover was suppressed (MALHI & DAVIDSON 2009). And greater oscillations in the rate of deforestation are strongly related to economic factors, such as capital availability and inflation index, indicating that deforestation is carried out in greater proportions by medium and large-scale farmers. According to the National Institute of Space Research (INPE, 2017), in 2004 the state of Rondonia reported a considerable increase in the rate of deforestation relative to reports from the previous decade, reaching 3.858 km² year⁻¹. This rate increase may be influenced by heightened globalization and stimulated by growth within the international soybean and beef markets (ALENCAR et al., 2004; KAIMOWITZ et al., 2004).

Understanding how the social actors involved perceive the process of forest restoration is fundamental, because the results occur in the medium and long term, comprising vegetation development, forest establishment, reproduction of local biodiversity, and improvement of the quantity and quality of water resources (GONÇALVES and GOMES, 2014). The revelations, therefore, are the results of individual and collective perceptions, of cognitive processes, judgments, and expectations (FERNANDES et al., 2004)

According to Pacheco and Silva (2017) the concepts of environmental perception are not always representative of reality. Rather, the concepts clarify the scientific, social and political perspectives disseminated through the use of this concept. It is also understood that the internalization of popular perception surrounding environmental management lends support to their cause and serves as a subsidy for the formulation, implementation and evaluation of local public environmental policies (RODRIGUES et al. 2013).

Ethnobotany that studies the interrelationships between people, their cultures and plants in the environment, addresses social, cultural and environmental factors, as well as conceptions and practices developed by different individuals (HANAZAKI et al. 2015). Through a case report, this science aims to recover the traditional empirical knowledge related to the use of local flora resources (PASA, 2011). Thus, environmental and ethnobotanical

perception can provide more information about the importance of forests. In this context, the study aimed verify the environmental perception and ethnobotany in the area of permanent preservation (PPA) restored in the Western Amazon.

MATERIALS AND METHODS

The study was carried out in a Permanent Preservation Area (PPA) restored nine years ago, located near the D'Alincourt stream, in the municipality of Rolim de Moura, Rondônia, Brazil. The climate of the region is characterized as rainy tropical type Am according to Koppen classification, presenting altitudes between 200 and 300 meters, temperature of 24-26°C and annual precipitation of 2,287 mm (ALVARES et al. 2013).

The methodology consisted of the case report, and the data were obtained through interviews of semi-structured and open types (Minayo, 2012), addressing socioeconomic and environmental issues, direct observation and field diary were carried out during walks in-the-woods, in the area regeneration (Fonseca-Kruel & Peixoto, 2004), with registration of plant species, vernacular names and silvicultural uses. Oral history (Meihy, 2007) and transversal walk during the course in which the owner pointed out the ethnicities present, exposing the known uses and maneuvers performed in the area, according to methodology suggested by JERNECK & OLSSON (2013). Every human society accumulates information about the environment in which it coexists (AMOROZO, 2013). In regions where environmental and social transformations occur, interactions between man and plants can be lost within a few generations. In this context, ethnobotany is a useful tool that can be applied to avoid this loss (PASA, 2011; GANDOLFO & HANAZAKI, 2011).

For the application of the interviews, the Free and Informed Consent Term (TCLE) was used, in accordance with Resolution CNS 196/96 (MINISTRY OF HEALTH, 2017), Approval of the Research Ethics Committee of the Federal University of Mato Grosso REC - Health of the UFMT, nº 03646018.9. 0000. 8124/2019. The plants were identified by professionals from the Herbarium of the University of Rondônia - UNIR, and by the Tropicos database (TROPICOS, 2017). For the purposes of botanical and ethnobotanical studies, the species listed by the owner were identified at the lowest taxonomic level, comparing the morphological characteristics with the specialized literature, according to APG IV (TROPICOS, 2017) and LORENZI (2013) and voucher specimens were deposited Herbarium of the University of Rondônia – UNIR.

RESULTS AND DISCUSSION

The rural owner is 72 years old, married and has incomplete elementary education. The deponent reported that he bought the property in 2010 and that the reforestation of the PPA had been carried out two years earlier. When asked about the trees present he replied ... *"This one (pointing to the unidentified tree) was not planted. This is native, but these trees and these pines were all planted."*

When asked about tree planting, the deponent pointed out that:

"José makes the tree nursery, right, and distributes the seedlings. Now who planted them? I think it was Mr. J., right... He was the owner. So, José makes the tree nursery and gives the seedlings to

the people. This was the beginning of the reforestation." (Mr. L. B.Z. 72 years. Rondônia, Brazil).

The informant says that José is an employee of the Nursery Citizen Project, an initiative sponsored by Petrobras through the Petrobras Socio-Environmental Program, which aims to expand the projects for the restoration of degraded areas in the municipalities of Rolim de Moura, Novo Horizonte and Castanheiras, located in Central Region of Rondônia.

Restoration of this area was carried out primarily to comply with environmental legislation, according to the report of the deponent:

"[The] people have an obligation to reforest the stream's edges, [but] a lot of people do not think so, [even though reforestation] is a positive thing that must do... [Losing] that one little piece of land does not matter, you know... The important thing is water, good water." (Mr. L. B.Z. 72 years. Rondônia, Brazil).

When asked if he would carry out the restoration project, had it not been done by the previous owner, he replied:

"I think I would do it... Because in the place I had before, I already had a stream for me to reforest. That place had three areas, two still were virgin forests then I even said that I was not going to cut that bush because that bush already was reforested." (Mr. L. B.Z. 72 years. Rondônia, Brazil).

When asked about the recommendation of restoration activity in riparian forests, the farmer said:

"...if the person comes to see me, [and if] we have the opportunity to talk ... I think it's very good to have this here, this reforestation. Because if the person understand about such things, he will see that we need this... and one thing is the need, that everyone needs water. And there is a high risk of running low on water, right? (Mr. L. B.Z. 72 years. Rondônia, Brazil).

The informant recognizes the importance of environmental agencies and legislation as to the initiative to restore degraded areas and says: *"...that it should come from each owner ... because each one thinks about it, right? So we can not force the person to do it ... "*

The rural landowner also points out that there are birds, monkeys, capybaras and otters in the region, recognizing the importance of these areas as ecological corridors and food supply for the local fauna according to the meme reproduced below:

"The wild animals suffer a lot, right? For us to think that they are not like us that have food. They have to go out and look for food, and sometimes it's difficult to find a fruit or a meal if none of the trees has fruits (...) they go out from there (referring to monkeys) and come here, get here and go to those mango trees there. Whether there are mangos or not, they come to visit there,

all that place... that row of animals.” (Mr. L. B.Z. 72 years. Rondônia, Brazil).

The importance of environmental perception is highlighted by the good progress of the project, since it was possible to verify trees with well developed crowns, different layers of canopy in formation, presence of litter and soil without erosions, events highly significant for local environmental integrity. The ecological significance of vegetation cover in the restoration process in degraded areas is highlighted by Cardoso et al. (2015) when reporting that the amount of carbon sequestered by a certain vegetation cover is an important indicator environmental services and that despite the total stored in the soil is higher than that found in plant biomass, the restoration of degraded areas contributes significantly for the increase of carbon storage.

Forest restoration has been occurring in different regions of the Brazilian Amazon, generated from projects promoted jointly by public agencies, private institutions, social movements and non-governmental organizations. For the most part, they are initiatives that seek to reverse the aggregate degradation of areas rich in natural resources. These initiatives require varying methodologies since they sought to involve the communities and social actors where the initiatives are taking place (FERRONATO et al. 2015).

According to Szaro et al. (2000) forests are a global resource and important issues dealing with their use and maintenance cannot be effectively dealt with in an insular fashion. Therefore, silvicultural practices that allow for extractive uses and conserve biodiversity, are methods of restoration and reforestation and sustainability in forests.

We recorded 11 ethnoespecies and 11 genera and distributed in nine botanical families. The plants present in the study area were grouped into two categories of uses: wood and non-wood. The ethnobotanical categories show predominance of wood uses, followed by food and medicinal uses, and expressed in Table 1.

It is observed that the knowledge of uses exposed by the producer are in agreement with the uses mentioned in the literature. Thus, studies in this sense are of paramount importance for valuing traditional knowledge, bringing it to the scientific milieu. In addition, the importance of the environmental perception of the producer to the success of the restoration projects, together with the knowledge of the species for its use, both timber and non-timber, as well as ethnobotanical practice in the daily life of the resident is observed.

Euterpe oleraceae widely marketed as food in the Brazilian Amazon, so that it is possible to take advantage of the palm heart and the fruits, being the fruits avidly consumed by several species of birds, also used as ornamental in architectural design due to its beauty aesthetics. The species is also used as medicinal, according to the informant:

“... açai we drink the wine, it makes ice, it makes sweet. There are people who make tea from his root to treat anemia, malaria, because it gives blood to the person. It is also used to treat people with hepatitis. It is very good for the liver ... It makes the tea boiling the roots of the açai, It lets boil for a few minutes, it cools and it drinks three liters of the medicine ” (Mr. L. B.Z. 72 years. Rondônia, Brazil).

The use of *C. fissilis*, which is widely used in landscaping, has wood appreciated in the manufacture of furniture in general, musical instruments, civil construction, also has an indication of its use in the recovery of areas, together with other species. The informant reports: *“...healing worm and inflammation ... very fragrant wood that is the power of healing... prepare the sick person to boil the bark of the tree and when it is well stained and warm gives the bath in the beginning of the night and shelter for two days”* (Mr. L. B.Z. 72 years. Rondônia, Brazil).

The multiple uses cited for *H. courbaril* stand out by the use of their wood and food and medicinal potential of the flour present in their fruit, which is highly appreciated by man and wild animals, besides being an essential species in the composition of heterogeneous reforestation and afforestation of parks and large gardens. Jatobá traditionally used in the preparation of home remedies to treat gastritis and inflammation of the uterus. The part of the plant that is used to make the remedy is the red bark. The method of preparation and administration is to clean a piece of the peel of the tree, cut into smaller pieces and soak in the clean water for about 12 hours and then strain into a cloth and drink a glass three times a day until the of pain (PASA et al. 2017).

Table 1: Ethnospécies in restored PPA in the Western Amazon. RO. Brazil. 2020.

Family/ Ethnospécie ¹	Scientific name	Description of use ²
Arecaceae Açaí	<i>Euterpe oleracea</i> Eng.	"This one here is a good thing... there are many people that sell it at the farmers market"
Anacardiaceae Aroeira	<i>Myracrodruon urundeuva</i> Allemão	"This one is a heartwood, she provides wood to build cattle sheds, fences ... it's a very good wood ... the bark of aroeira is medicine"
Malvaceae Barriguda	<i>Ceiba speciosa</i> (A. St. Hil.) Ravenna	"At first, people... my aunts... my people would use it because it provides a fruit. And the fruit gives a fiber ... and they would use this fiber to make pillows"
Meliaceae Cedar	<i>Cedrela fissilis</i> Vell.	"It's a very special wood for you to cut, to make furniture, tables, any type of furniture... it provides a really good finish"
Myrtaceae Guava	<i>Psidium guajava</i> L.	"Just the fruit"
Bignoniaceae Ipê	<i>Handroanthus</i> sp.	"Great wood and many people use the bark to make treatment ... it provides heartwood"
Fabaceae Jatobá	<i>Hymenaea courbaril</i> L.	"This one here gives fruits (...) there are many people that like this, because it makes a powder, right? ... and then you put it in the milk"
Rubiaceae Jenipapo	<i>Genipa americana</i> L.	"It has a good fruit ... and wild animals eat it"
Meliaceae Magnum	<i>Swietenia macrophylla</i> King	"It is also a good wood to make furniture, to make houses"
Fabaceae Pine/Bandarra	<i>Schizolobium parahyba</i> var. <i>amazonicum</i> (Huber ex Ducke) Barneby	"It also serves as wood, to make furniture"
Lamiaceae Teak	<i>Tectona grandis</i> L. f.	"It's a great wood too, it gives heartwood ... it becomes a big tree"

¹According to the farmer.

²Description of uses and importance described by the farmer during walks in-the-woods.

In the descriptions of the Lorenzi (2013) it was verified that *Ceiba speciosa* possesses landscape potential, wood and in the manufacture of pulp cellulosic. And its pain to be used in the filling of mattresses and pillows, being a species with excellent development in mixed plantations. For *Myracrodruon urundeuva* the main use is like wood, although the use of the landscape should also be emphasized.

As ornamental the *Swietenia macrophylla* is much appreciated and the wood indicated for the manufacture of luxury furniture. Considered for its exuberant beauty the *Handroanthus* is an excellent choice for landscaping use and its wood is used in heavy constructions and external structures, both civil and naval (LORENZI, 2013).

In the report the informant says that *Genipa americana* is used for environmental recovery projects, in the supply of food for the fauna. The fruit can also be used as a dye and in human food, and its wood useful enough. Pharmacological studies of *G. americana* approximate empirical knowledge of science, according to Leonti et al. (ripe fruit pulp) are used as antiasthmatics, aphrodisiacs, antianemics, tonics, diuretics, useful in affections of the spleen, liver and jaundice, external wounds and pharyngitis (fresh and macerated fruits).

Studies in traditional communities indicate that the category of use of a plant species can be cumulative, that is, a species can be used for both food and medicinal category, species that have stood out for having multiple uses in this study are guava (*Psidium guajava*), jenipapo (*Genipa americana*), açaí (*Euterpe oleraceae*), and jatobá (*Hymenaea courbaril*). The importance of forests is expressed in the speech of the informant in a traditional Mato Grosso community (PASA et al. 2019):

(...) of the woods we strip everything, the wood, the food, medicine, food for us and pros animals (...) in the dry season is more difficult, the animals go out to get food (...) in the rainy season has more abundance (...) in the forest always has water for bugs (...) Mr. C. F. B. 85 years. MT, Brazil).

The Amazonian cabloco also expresses its admiration for the forests and what they contain. Traditional riverside community of Mamirauá (PASA et al. 2017):

*(...)The forest is a wealth ... there we have food, medicine, fruits, firewood, shade ... there is water inside the forest which is another great wealth ... we do not live without water and without forests ... she is good also for all the animals ... inside the forest there are many animals that live there, they sleep there ... it is abundant in the lives of people.
I live here in the Solimões forest since I was a child ... I always liked the trees and the forest ... (Mr. F. F. 79 years. Mamirauá. AM, Brazil)*

Among the medicinal plants used empirically 15 categories of health complications or diseases were recorded. The species used for the medical ethnocategory in the research area are recorded in Table 2.

In the study area, many plants are used empirically to treat respiratory diseases (bronchitis, cough, flu, sinusitis) followed by complications of the genitourinary tract (diuretics, kidney stones and colic) and circulatory system such as blood depurative, high blood pressure, among others.

Table 2. Plants used by the informant in folk medicine. Rolim de Moura. RO Brazil. 2020.

Family/Scientific name	Brazilian (Popular) name	Used Part	Preparation method	Therapeutic indication
Anacardiaceae				
<i>Myracrodruon urundeuva</i>	Aroeira	Leaves	Tea	Kidney
	Aroeira	Bark	Bath and ointment	Bruise and healing
Arecaceae				
<i>Euterpe oleracea</i>	Açaí	Fruit pulp	Juice, sweet, ice cream	Anemia / blood
Bignoniaceae				
<i>Handroanthus</i> sp.	Ipê	bark / flower	Tea	Initial cancer
Fabaceae				
<i>Hymenaea courbaril</i>	Jatobá	Bark	Tea, soak in water and syrup	Flu (dry cough), tonic, blood, bronchitis, inflammation and pain in the bones
Meliaceae				
<i>Cedrela fissilis</i>	Cedar	Bark	Infusion / bath	Worms and inflammations
Myrtaceae				
<i>Psidium guajava</i>	Guava	Shoots and Bark	Tea and soak in water	Diarrhea
Rubiaceae				
<i>Genipa americana</i>	Genipapo	Fruit	Juices	Anemia Papeira/goiter

Pharmacology seeks the combination of empirical information from the popular pharmacopoeia and the combination of chemical and pharmacological studies, an important strategy in the investigation and registration of medicinal plants. Substances with therapeutic activities vary by plant organ, stage of development, time of year and time of day (MARTINS et al., 2004). The alkaloids and essential oils are concentrated in the morning and the glycosides in the afternoon (LEONTI et al. 2013, DA VILLA and PASA, 2020).

According to studies by Zurra & Pasa (2017) and Da Vila & Pasa (2020) products found in the forests of the western Amazon are part of the diets for food and medicinal purposes such as bacuri (*Garcinia brasiliensis* Mart.), buriti (*Mauritia flexuosa* L. f.), açaí (*Euterpe precatoria* Mart.), patuá (*Oenocarpus bataua* Mart.), babaçu (*Orbignya speciosa* Mart. ex Spreng.), cacau (*Theobroma cacao* L.), chestnut (*Bertholletia excelsa* Bonpl), jatobá (*Hymenaea parvifolia* Huber), copaíba (*Copaifera* spp.), cumbaru (*Dypterix alata* Vogel), quina (*Cinchona* L.), bush-cupuaçu (*Theobroma* sp.), pine (*Annona* sp.), apurui (*Alibertia edulis* (Rich.) A. Rich. ex DC.), araçá-guava (*Siparuna guianensis* Aubl.), araçá-boi (*Eugenia stipitata* MC Vangh), araticum (*Annona montana* Macfad.), bacuri-crown (*Garcinia madruno* (Kunth) Hammel), caapeba (*Piper umbellatum* L.), caapitiu (*Siparuna guianensis* Aubl.), canela (*Cinnamomum zeylanicum* Blume), catanga-de-mulata (*Leucas martinicensis* (Jacq.) W. T.Aiton), cubiu (*Solanum crinitum* Lam.), cupuaçu (*Theobroma grandiflorum* (Spreng.) Schum), jambu (*Acmella oleracea* L.), pião branco (*Jatropha curcas* L.), and taperebá (*Spondias mombim* L.).

The scientific and traditional knowledge are approximated by ethno-pharmacochemical studies where the empirical record is directed to solutions of environmental,

social and health problems, in order to improve the quality of life (ROCHA et al., 2015, PASA et al. 2020).

CONCLUSIONS

The rural owner positively evaluates the environmental restoration project, given the importance of protecting water resources, as well as the benefits to the local fauna. The trees that compose the forest mass in this area of PPA, offer their food products (fruits) and medicinal (leaf, flowers and bark). Ethnospecies of multiple uses stand out like wood, followed by food and medicine in the local popular medicine, since they live and live with the forests and exercise an ecologically sustainable cultural management in this biome of the Western Amazon.

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