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RESEARCH ARTICLE

Agroecological Practices in Traditional Communities and Adjacent Areas of Agrarian Reform Settlements: Rio Una (Chapada Diamantina-Itaeté-Bahia, Northeastern Brazil)

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Abstract

The village of Colonia, in the municipality of Itaeté, is one of the first agrarian reform settlements in Bahia, northeastern Brazil. It corresponds to the ancient locality of Pirainha, located on the banks of the Rio Una, one of the main contributors to the Paraguaçu Rio in the Chapada Diamantina, in the Caatinga domain. Today the community has just over 1600 inhabitants.

Until 1998 the Rio Una was a perennial river. The river beach has always been a place of leisure for riverside residents. But by the end of 1998 the Rio Una was mostly dry, and since then it has been cut in the dry season. Through environmental experiences and practices, a video was prepared and edited – which aims to bring to public knowledge the communicative and affective attitudes, towards the revitalization of the river that is the source of life of the community.

> *"O mundo está agora numa suspensão. E não sei se vamos sair dessa experiência da mesma maneira que entramos. É como um anzol nos puxando para a consciência. Um tranco para olharmos para o que realmente importa."*
>
> *“The world is now on hold. And I am not sure if we're going to come out of this experience the same way we went in. It's like a fish hook pulling us into consciousness. A leap to look at what really matters”*
>
> *Ailton Krenak- in the book - Tomorrow is not for sale [O amanhã não está à venda]*

Introduction

Anthropogenic activities, the inappropriate land use for pasture and agricultural activities may be the main causes of the loss of water quality in headwaters of a river basin. Climate is one of the most important variables in the transformation of the physical aspects of landscape, as it directly influences the shapes of reliefs and the formation of vegetation, and is therefore influenced by both factors. Increases in water temperature and changes in the water flood may be associated to deforestation in the area, which in turn will affect human and ecosystem health. Threats posed by climate change will place additional stress on many already degraded systems, especially in developing countries.

Since the watershed is the planning unit, it is fundamental and essential to think about its management based on its natural characteristics[1][2][3]. It is considered that the behavior of a watershed over time occurs due to two factors, which are natural, responsible for the predisposition of the environment to environmental degradation; and anthropic, where human activities interfere directly or indirectly in the functioning of the basin[4][5]. The environmental impact of human actions has become increasingly present on the planet. The climate changes observed over the years, the future risk of water scarcity and the extinction of biomes and species have alerted the population to the importance of adopting sustainable practices in all social, political and economic spheres.

The harmonious relationship between human society and environmental systems, with regard to the use and occupation of land and the use of water systems, is perceptible in certain social groups, such as indigenous peoples, who occupy approximately 5% of the planet's surface and are responsible for the preservation of 85% of the territory they occupy[6]. But this is not always the case. Land use has often been worked without a correct and integrated management to minimize environmental impacts and ensure the conservation of natural resources. Unsustainable agricultural practices have transformed the landscapes near rivers by suppressing riparian forest. The accelerated deforestation of riparian forests contributes to the increase of erosive processes in soils and, especially on the slopes, has transformed rivers into welcoming sources of polluting waste, causing silting and, in many cases, the drying up of springs and small streams. It is these impacts that contribute to the alteration of river dynamics, favoring soil infertility due to the erosion process and the use of chemical products, thus compromising the natural environment. Not to mention the lack of access to basic sanitation in many parts of the country.

Proper management is a key factor in the protection and conservation of these areas. However, such management is not so notorious in watersheds, especially in rural areas, where agricultural practice focused on the production system occurs. The development of the field with its technological practices, especially focused on the production process, has generated serious damage to nature, many of which are irreversible. Currently, it is verified that such occupations occur in a disorderly way, especially when it comes to the occupation of watersheds, including in Permanent Preservation Areas (APP in portuguese).

This proper management of the Rio Una sub-basin is fundamental, as it has an enormous importance in the region, especially for agriculture. However, in recent years, in the locations that will be analyzed, the improper use of the soil for pasture and agricultural activities has caused silting and caused its regime to change to intermittent. It was a very deep river that in some places required a canoe to cross, but with erosion its bed lost its depth.

The village of Colonia, in the municipality of Itaeté, is one of the first agrarian reform settlements in Bahia, born in 1956, from the implementation of the agrarian reform project by the National Institute of Colonization and Agrarian Reform (INCRA). It corresponds to the ancient locality of Pirainha, located on the banks of the Rio Una, one of the main tributaries of the Paraguaçu Rio in Chapada Diamantina. Today, the community has just over 1600 inhabitants. This territory was part of the Rio de Una farm, whose main activity was the extraction of wood, which was taken to the village of Tamanduá (present-day Itaeté), and taken by the old railroad that connected the Chapada Diamantina to the Recôncavo Baiano, an activity that lasted until the establishment of the National Park in the 1980s.

Agricultural interventions. The main purpose of this research was to make an analysis of the situation of the Rio Una, based on an environmental and social diagnosis, identifying the main environmental impacts of the Rio Una sub-basin, thus analyzing the relationship of society with water resources. In view of the reality in which the Rio Una is found in view of the issue of agriculture, this research aims to raise awareness among farmers and the community about the importance of preserving water resources, taking into account that convictions about the environmental context directly influence the way people interact with the environment and that this view is built from their experiences. However, it is questioned how farmers perceive this interdependence between human beings and the environment, especially when it comes to water resources. Aiming at the need for greater involvement of farmers and students in environmental issues, we return our eyes to the practices in Environmental Education during the school life of these inspection agents, which is a viable way to promote better visibility of environmental elements.

Methods

Study area**.** The Caatinga domain, in northeastern Brazil, is one of the driest biomes in the territory. The Chapada Diamantina contains one of the highest mountains in Bahia, with unique phytophisiognomies, and corresponds to a watershed divide between the rivers draining to the west, towards the Rio São Francisco, and to the east, to the coast. The sub-basin of the Rio Una located in the southern part of the Eastern Piedmont of Chapada Diamantina, at coordinates 41º10'00" and 13º8'45". It is one of the main contributing sub-basins of the Rio Paraguaçu Basin in its upper third, in the Chapada Diamantina. The Rio Una has an area of 2,317.38 km2 (4.31% of the total area of the Paraguaçu Basin). The Rio Una sub-basin (SBHRU) runs through the rural areas of the municipalities of Itaeté, Iramaia, Ibicoara, Andaraí, Mucugê, Nova Redenção and Barra da Estiva. In the vicinity of the Rio Una there are farms, agrarian reform settlements, rural communities, districts, small and large producers with rainfed agriculture and irrigation. All of these use the water resources of the sub-basin.[7]

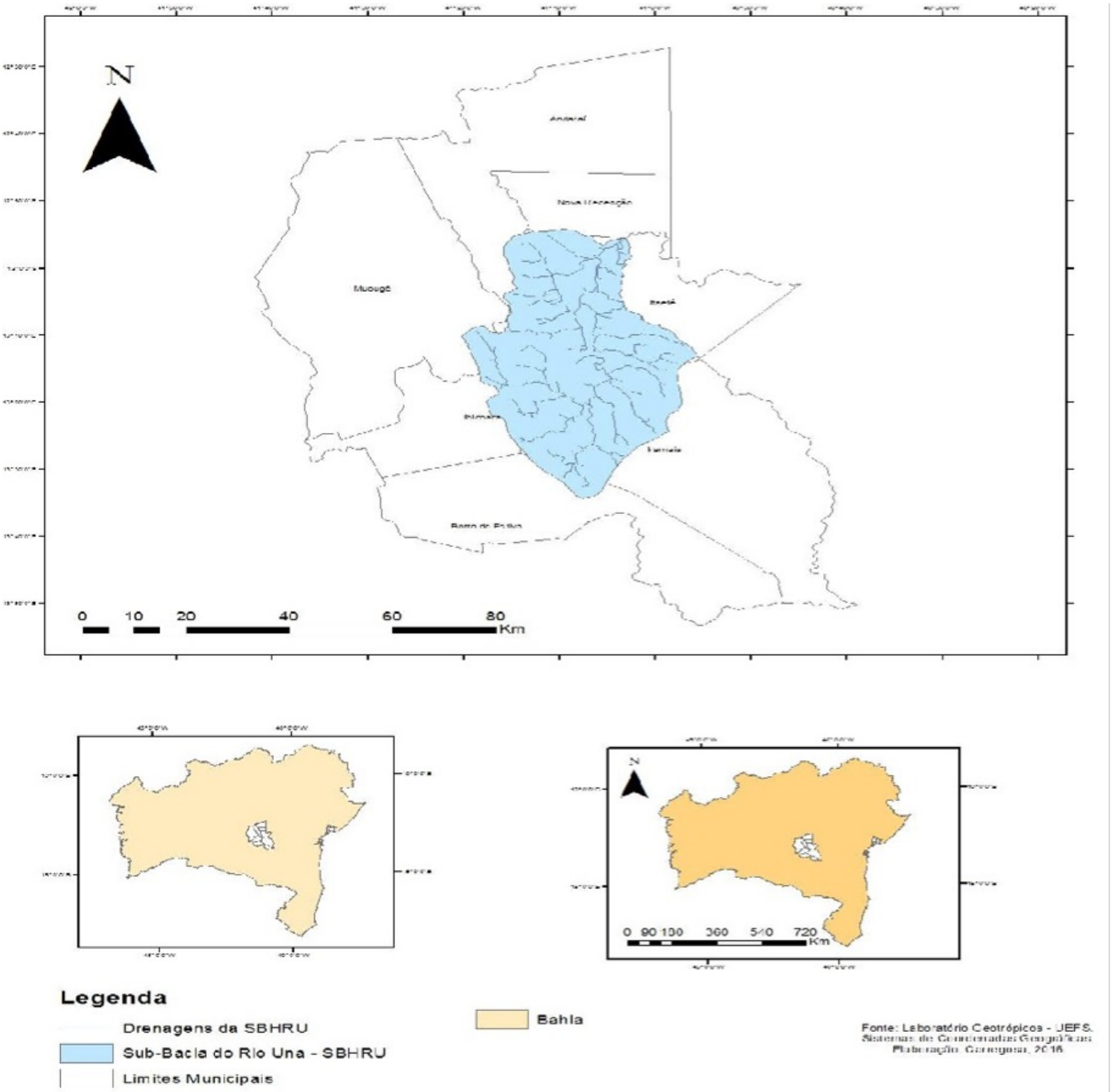

Figure 1. Location of Rio Una hydrographic sub-basin (SBHRU) (in blue, at top) with municipalities around at Chapada Diamantina and the position of the area in the Brazilian state of Bahia (in orange, below) (adapted from Carregosa[7]).

Interviews. For the interviews, the snowball sampling was used as a method, which locates and selects the study participants. This type of sampling uses reference chains, that is, it is not possible to determine which participants will actually participate in the research, being a non-probabilistic form of sampling[8].

The study involved 12 families of farmers and local residents (Table 1). The interviewes were taken at the village of Colonia, municipality of Itaeté, and the Colonia Volunteer Brigade, which has been carrying out an campaign in partnership with schools and communities to recover the environment, with restoration action especially on the banks of the Rio Una. Such action turn local students as natural multipliers towards environmental conservation.

Table 1. Interview script applied.

INTERVIEW SCRIPT	
Interviewer _____ Gender_____ Marital status _____ Place of Birth _____ Age _____ How long have you lived in the community _____	
Area size	
Where commerciate	
Which plagues are the most common	
Makes use of pesticides	
There is another alternative available	
Waters: what is the origin of water source Makes use of irrigation	
Electric power: What type of energy is used What has changed with the arrival of electricity	
What types of inputs are used in production	
Do you think that the farmer here in the territory live in a sustainably way	

Source: Elaborated by Antônia Santos 2024

Methodological strategies. In the USA, during the mid-1980s, qualitative evaluation methods were defined by environmental agencies in order to reduce the high cost and delay of quantitative research. Studies related to water quality were developed in 1986 by the EPA (Environmental Protection Agency) and the surface water monitoring agencies, resulting in the report "Surface Water Monitoring: A Framework for Change" in 1987, which established the restructuring of monitoring programs and assistance in the development of research at low costs. During this period, the report enabled the development of protocols for rapid assessment of rivers[9] that are a potentially useful tool for the preliminary diagnosis of watercourses, presenting information about their state and possible problems in a quick and coherent way.

From the protocol of rapid assessment of rivers, a tool that allows the environmental monitoring of water systems, through which qualitative information was collected, where passage openings were analyzed so that cattle and the population have access to the river, but the biggest problem of these points was the use and exploitation of the resources of the sub-basin. (Colonia/Passagem de Miliano, by Mr. João, Agripino, Jovem/Assentamentos Baixão, União da Chapada, Europa, places chosen for the application of the PARs. It was observed at these points that the river was depth and, according to the residents' report, it was possible to dive by jumping from the treetops. Nowadays, this practice is no longer possible,

as its bed has completely lost its depth. Anthropogenic alterations related to agriculture and pasture is the most evident classification in all the stretches analyzed, explained by the fact that it is a totally ruralized environment with agricultural-based economic activities. These economic activities have transformed the landscape, degraded the environment and triggered problems throughout the Rio Una sub-basin system. The points with this classification are: Baixão, Europa, União da Chapada.

To achieve the objectives of this research, in addition to the Rapid Protocol of Rivers, a documentary was made (Supplementary material 1). In the video the interviewees narrate their coming to the village right at the beginning of its foundation in hard conditions, remembering and narrating the lessons of life, difficulties and victories that lead them to knowledge and learning.

In view of the reports and the experience lived during the research, it was found that when the resident or farmer is an integral part of the research, he perceives himself as part of the history, through the personal experiences in his community, being able to speak and listen to the oral narratives, reflecting on the development of the region, the appreciation of the cultural identity and having his vision of history after participating in this research.

Results

The sub-basin currently has an intermittent regime, but in its original condition it had a perennial regime. This process may have ocurred in result of the suppression of native vegetation in its surroundings and by aridization processes (figure 2). To ascertain the reason for such events, itinerant visits were made to map the springs and an integrated analysis of the natural conditions and anthropic actions in relation to the use and occupation of the natural resources of the Rio Una sub-basin.

Landscapes of unprotected soils are very common in the area of the Rio Una sub-basin. Erosive agents are present mainly in the absence of vegetation cover, harming the soil, as well as transporting this material to the lower areas of the relief (unprotected by vegetation), thus contributing to the silting of the Rio Una, which is deprived of its riparian forests and susceptible to erosive processes.

The use and occupation of land in the sub-basin of the Rio Una demonstrate the relationship of man in the geographical space and its consequences for natural systems. The analysis of land use and occupation in the village that covers the Rio Una hydrographic sub-basin (SBHRU) shows the suppression of natural vegetation even in the areas bordering the river (riparian forest areas), which should be preserved for the balance of the entire sub-basin and, above all, of the water system (drainage, infiltration and others). Based on the Brazilian Forest Code, modified in 2012, headwaters and river channels must be protected by riparian forests, with springs protected by a circle of 50m of riparian forest, while river channels, as in the case of the Rio Una sub-basin where rivers do not exceed 10 meters in width, require 30 meters of forest for each bank.

The village does not have a sewage system, only an open network and the absence of basic sanitation is related to a

greater proliferation of diseases, as sanitation is important for the well-being and evolution of society, since contact with sewage and the ingestion of untreated water are linked to high mortality rates, having as its main causes diseases of hydric vinculum as diarrhea and vermis.

Figure 2a. Locality of Passagem de Miliano

Source: Antônia Santos[10]

Figure 2b. Passagem de João de Nil.

Source: Antônia Santos[10]

Figure 2. Environmental impacts in the Rio Una headwaters- Water loss and cattle.

Figure 3a. eroded soil with roots exposed

Source: Antônia Santos[10]

Figure 3b. Main Rio Una silted in the dry season

Source: Antônia Santos Agosto (2021)

Figure 3. Environmental impacts in the Rio Una headwaters- Erosion and siltation.

Table 2. Environmental data of the surveyed points in the village of Colonia and surroundings.

LAND USE	HANDLING	POINTS	ENVIRONMENTAL REALITY
Agricultural	Deforestation	Colonia/Jovem/ Agripino/Miliano	Areas with bare soil
Agricultural	Deforestation	Agripino/Jovem/Assentamento Europa	Irregular dissected surface, trampled soil (cattle), friable and denuded, intensification of erosive processes.
Cattle ranching	Deforestation	Colonia/ Jovem/Agripino	Trampled and denuded soil, intensification of erosive processes.
Cattle ranching		Colonia/Jovem/Miliano/Assentamento Europa	Bare soils and active erosive processes, where parts of the roots of the vegetation are exposed.
Cattle ranching		Baixão/Assentamento Europa/União da Chapada	Small and spaced vegetation, predominance of exposed soil. Location of an intermittent river channel, where the riparian forest has been suppressed, favoring the erosion of the banks and silting of the channel.
Agricultural		Colonia	Planting of beans and palm oil, the palm being used to feed the cattle.

Final concerns

The vast majority of the works published to date deal with the Paraguaçu stretch in Chapada Diamantina, being of an academic nature, many in another language, restricting its reading to a specific audience. There are practically no general studies that talk about the populations and environments of Paraguaçu[11][12]. The present study showed that in the vicinity of the Rio Una sub-basin, there are environmental impacts that impair the natural balance. Anthropogenic intervention through deforestation to make way for activities, agriculture and cattle raising were one of the main causes of the water decrease of the Rio Una, which was evident by observing the silting of the sub-basin in the area where the PARs were applied, thus compromising its biodiversity. Since the river is extremely important for the region, we discussed the main environmental considerations and observations in order to promote opportunities for sustainable development based on the available water and its demand.

However, it was also possible to observe that the documentary video produced and edited (Supplementary Material 1) had an important connection between different means of knowledge that unite the relations between the environment and society, with regard to social responsibilities and participation in their locality, thus constituting a pleasurable experience, about reporting such information, how to integrate and dialogue with these different knowledges, how to explore the potential of image and sound, forms of expression and languages to be able to work the whole set of contents within a pleasant rhythm. All of these efforts are aligned with the intention of improving the bond with the academy and the community.

Supplementary material 1

Video production – Yesterday, today and tomorrow in the Rio Una, Itaeté, Bahia, Brazil [Ontem, hoje e o amanhã no rio Una, Itaeté, Bahia, Brazil].

https://www.youtube.com/watch?v=fv0fqcL2KMA

Length: 11:09 min. [in portuguese]

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