Climate-U
Transforming Universities
for a Changing Climate

Challenges of an Ecological and Circular Bio-Economy in the Brazilian Amazon: A Case Study in Anã Village

Transforming Universities
for a Changing Climate
Working Paper Series

No. 22

By: Tânia Suely Azevedo Brasileiro,
Luís Alípio Gomes,
Klaudia Yared Sadala,
Adriane Panduro Gama,
Luciandro Tássio Ribeiro de Souza,
Elian Mara Sousa Carvalho,
Danilo Duarte Godinho,
Aline Sousa Cardoso,
Elizana dos Santos Amorim,
Milena da Silva Godinho,
Jander Ferreira Cardoso.

January 2024

GCRF
Global Challenges Research Fund

UKRI UK Research
and Innovation

Challenges of an Ecological and Circular Bio-Economy in the Brazilian Amazon: A Case Study in Anã Village

Transforming Universities for a Changing Climate
Working Paper Series, No. 22

Federal University of Western Pará (UFOPA):

Tânia Suely Azevedo Brasileiro,
Luís Alípio Gomes,
Klaudia Yared Sadala,
Adriane Panduro Gama,
Luciandro Tássio Ribeiro de Souza,
Elian Mara Sousa Carvalho.
Anã community:
Danilo Duarte Godinho,
Aline Sousa Cardoso,
Elizana dos Santos Amorim,
Milena da Silva Godinho,
Jander Ferreira Cardoso.

January 2024

Abstract

This working paper presents the results of research conducted by the PRÁXIS UFOPA Research Group and the Climate-U project, applying the participatory action research (PAR) methodology. The participating audience included community leaders, elementary and high school students, as well as school teachers and technicians. Questionnaires and interview scripts were used as instruments to profile the socio-economic context of the community and the perception of climate change by school members. The participatory action methodology applied the Mandala of Knowledge and the Affection Map Generating Tool. The results enabled mapping of the students' and teachers´ perceptions of climate change and identify their feelings about the place where they live. Through beekeeping for honey extraction, fish farming, community-based tourism, and handicrafts, the community members believe they are contributing to the sustainable development of their territory. These activities adhere to the principles of ecological and circular bioeconomy, not only generating income but also impacting biodiversity, contributing to climate change mitigation, and preserving the standing forest.
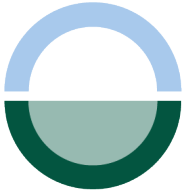
Keywords
Ecological and circular bioeconomy. Climate Change. Amazon.

Authors

Federal University of Western Pará (UFOPA)

Professor Tânia Suely Azevedo Brasileiro, is coordinator of the Climate Project - U PRAXIS UFOPA and Leader of the PRAXIS UFOPA/CNPq research group. She has a post-doctorate in Psychology (IP / USP) and a doctorate in Education (URV-ES / FE-USP). She is a Professor at the Federal University of Western Pará (UFOPA), she works as a professor and advisor in the doctorates in Sciences/Environmental Sciences (PPGSND/UFOPA) and Education in the Amazon (PGEDA), and in the master's degree in Society, Environment and Quality of Life (PPGSAQ/UFOPA).

Dr Luis Alipio Gomes, is deputy coordinator of the Climate-U Project PRAXIS UFOPA He has a PhD in Sciences (PPGSND/UFOPA), he works as a researcher and pedagogue at UFOPA, and he is a reviewer of national and international journals.

Dr. Klaudia Yared Sadala, is a researcher at the Climate-U PRAXIS UFOPA Project. She has a PhD in Sciences (PPGSND / UFOPA) and works in the areas of Environmental Psychology and pro-environmental behaviors from the perspective of gender, health and climate justice.

Adriane Panduro Gama, is a member of the PRAXIS UFOPA Research Group and a researcher at the PRAXIS UFOPA Climate-U Project. PhD student in Environmental Sciences (PPGSND/UFOPA). She is a specialist in Environmental Education and Society, Environment and Development in the Amazon.

Luciandro Tassio Ribeiro de Souza, is a researcher at the Climate-U PRAXIS UFOPA Project and is a master's student in Society, Environment and Quality of Life (PPGSAQ/ UFOPA). He is a professor of Portuguese Language and Literature and Educational Information Technology.

Elian Mara Sousa de Carvalho, is a fellow at the Climate-U PRAXIS UFOPA Project and an undergraduate in Biology Sciences at UFOPA. Her research focuses on the Narratives of Climate Change in the Community of Anã, Santarém – PA.

Anã Community

Danilo Duarte Godinho, is indigenous to the Arapiun ethnic group from Anã Village, tutor professor at the Climate-U Project / PRAXIS UFOPA, and coordinator and executor of the socio-productive chain of wooden crafts.

Aline Sousa Cardoso, is indigenous to the Arapiun ethnic group. She is currently living in Anã Village, located on the Arapiuns River (Tapajós Arapiuns Extractive Reserve). She is a high school student and part of the 'Vagalumes' collective of Climate-U Project / PRAXIS UFOPA.

Elizana dos Santos Amorim, lives in Anã Village. She is an activist and environmentalist, dealing with environmental issues mainly within community-based tourism. She is part of the Vagalume collective and the group of Women dreamers of Anã (MUSA in Portuguese). She is part of the Climate-U Project / PRAXIS UFOPA.

Milena da Silva Godinho, is a young resident of Anã Village (Resex Tapajós Arapiuns). She is a student of the Forestry Engineering course at UFOPA and part of the "Vaga-Lumes" collective that fights for the cause of the Amazon and climate justice. She is part of the Climate-U Project / PRAXIS UFOPA.

Jander Ferreira Cardoso, is indigenous to the Arapiun ethnic group. He is currently living in Anã Village located on the Arapiuns River (Reserva Extractive Tapajós Arapiuns). He is coordinator of the youth collective "Vagalumes", a member of the Tapajós Vivo Movement. He is part of the Climate-U Project / PRAXIS UFOPA.

Table of contents

1. Introduction

The Amazon region continues to be disputed by different conceptions of territorial development. The most recurrent scenarios are developments based on logging, mining, expansion of the construction of hydroelectric plants, soy monoculture and agribusiness, contributing to the increase in deforestation, land grabbing and social conflicts, as well as accelerating the imbalance in planetary ecology such as impacts of climate change, depletion of resources and environmental services, and extinction of living beings (Pereira et al. 2023). The situation of people living in the Amazon is complex: indigenous peoples, riverine communities, *quilombolas*[1], and residents of Manaus, Santarém, and Belém have been dramatically exposed in terms of education and health issues during the pandemic. This has led to the conclusion that, beyond Brazil, the Amazon represents a complex and diverse reality (Lastres 2024).

From 2019 to 2022 there was a strategy by the Brazilian Federal Government to weaken the main inspection and environmental protection bodies, pressure on environmental laws in order to favour and increase the illegal occupation of land, in addition to enabling the construction of hydroelectric plants in the region through multinational undertakings. In the riverside region, the chaotic activity of illegal mining has already left traces, including the change in the colour of the Tapajós River, with the advance of mercury and other residual sediments from mining causing a strong impact locally, such as in villages, traditional communities, forests and living beings. There were consequences not only to the forest and environment and climate, but also the local people like indigenous, *quilombolas*, and *ribeirinhos*[2] peoples who depend on the river and the forest to survive.

How can people, especially that live in small communities, contribute to change this environmental reality in the Amazon? What strategies and practices used in small communities can contribute to protecting the forest and addressing climate change? This project aims to make a diagnosis about the main environmental issues in a small community in the Amazon. Other aims are to develop actions that can impact the community's context; to discuss and plan with the community representatives and leadership about what possible action can be done to overcome the main problems; and to establish a relationship between university and community to make an interchange of knowledge and create a research partnership. This working paper covers the details of the actions, and results, of this experience of intensive investigation during the year 2022.

[1] *Quilombola* is a member of the territory called *quilombo*. African people first came to Brazil to work as slaves in agriculture. When they escaped from this cruel life, they went to the forest and organized farms to provide for their own needs. This place is called *quilombo* and their descendants are called *quilombolas*.

[2] *Ribeirinho* is a typical resident along the rivers in Amazon Region. They have a close contact with the river and the forest where they fish and collect fruits and hunt wild animals.

2. Climate change in the Amazon

The trajectory of the Amazon has been marked by various events, some of which are referred to as the "Amazonian paradox" by certain authors (Veríssimo 2023). Considering its potential, the region boasts a forest that covers approximately 3,800,000 km2. The Amazon rainforest is home to around 4,000 plant species, 2500 - 2800 fish species, approximately 360 mammal species, about 1,500 bird species, and millions of species of insects. The Amazon is home to the most abundant hydrographic basin, housing the world's highest-volume river - the Amazon River (Loureiro 2010). On the flip side, the Amazon exhibits various marks that reveal its paradox.

One of these early marks is related to population growth, which surged from 7 million in 1970 to approximately 28 million people in 2021. In conjunction with this trend, there has been a rise in deforestation from 0.5% of the total area in 1975, to 21% in 2021 (Veríssimo 2023). Large infrastructure projects such as roads, dam construction, logging, mining exploitation, and more recently, agribusiness ventures, are also characteristic of this region (Rolemberg & Lacerda 2022). Despite the exuberance of its biodiversity and the growing population across the nine states of the Brazilian Amazon, including over 180 indigenous ethnicities, quilombola, extractivist, and riverside communities, the Amazon still faces strong threats, including contemporary violence against social movement leaders (Rolemberg and Lacerda 2022) and environmental degradation (Pereira et al. 2023).

Projections of climate change globally indicate that the Amazon is vulnerable to its effects. Such changes may lead to a collapse of the Amazon rainforest, and deforestation can impact the climate within and beyond the Amazon Basin (Marengo et al. 2011). The dynamic balance of the atmosphere, especially in the Amazon, has been impacted on various fronts, and several explanations can be provided for this situation:

i) climatic variations in the Amazon due to global climatic variations, resulting from natural causes such as El Niño effects;
ii) anthropogenic climate changes due to land use within the Amazon region, and deforestation aimed at converting the forest into pasture and/or large plantations;
iii) climatic variations resulting from global climate changes caused by anthropogenic actions (Nobre, Sampaio and Salazar 2007).

This atmospheric imbalance can harm the functioning of the Amazon as a forest ecosystem, reducing its ability to sequester carbon, weakening the water cycle, increasing soil temperature, and driving the Amazon toward a gradual move to savannah plantation process (Marengo et al. 2011). Resulting from this scenario is a concern about what to do, in determining what strategies can be adopted to address this situation.
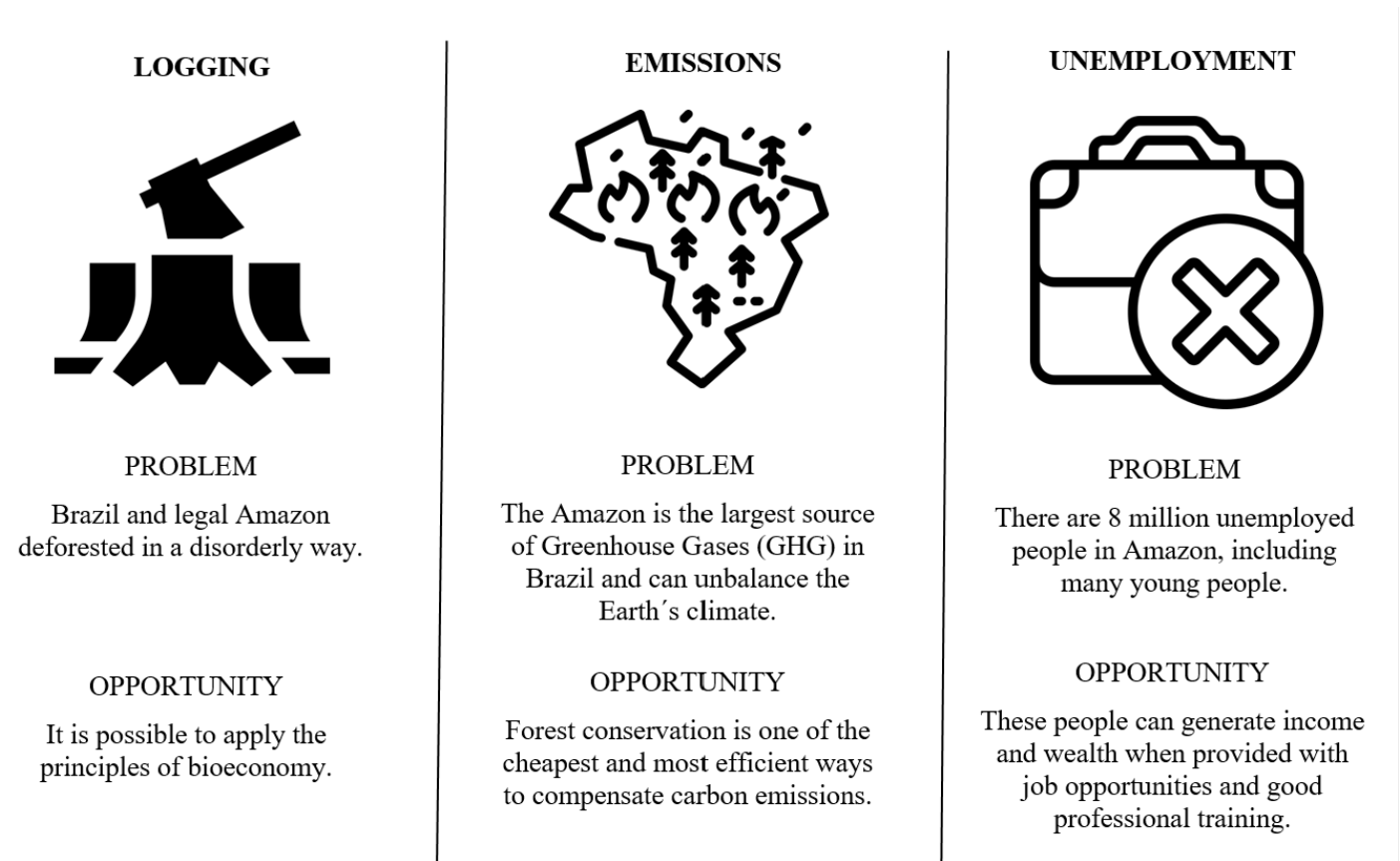
LOGGING	EMISSIONS	UNEMPLOYMENT
PROBLEM	**PROBLEM**	**PROBLEM**
Brazil and legal Amazon deforested in a disorderly way.	The Amazon is the largest source of Greenhouse Gases (GHG) in Brazil and can unbalance the Earth´s climate.	There are 8 million unemployed people in Amazon, including many young people.
OPPORTUNITY	**OPPORTUNITY**	**OPPORTUNITY**
It is possible to apply the principles of bioeconomy.	Forest conservation is one of the cheapest and most efficient ways to compensate carbon emissions.	These people can generate income and wealth when provided with job opportunities and good professional training.

Figure 1: *The Amazon Paradox. Source: Created by authors, based on Veríssimo (2023)*

The term 'Amazonian paradox' (Veríssimo 2023) has been employed to illustrate that in the face of problems, there are opportunities that can be envisioned, as presented in Figure 1 (above).

One of the challenges faced by public policy planners is associated with the development planning of the Amazon region. Planning has often occurred top-down, lacking a balance of power among economic and political actors in the process of social and environmental regulations (Becker 2005). Various initiatives are highlighted as potentially viable and sustainable in the Amazonian context, such as prioritizing forest-based bioeconomy, promoting the provision of Reducing Emissions from Deforestation[3] credits - that is, an economy based on the forest - and biodiversity conservation as the primary paths for sustainable development in the region (Veríssimo 2023).

This research was conducted in the Anã Village, a small community located in the interior of Pará State, in the north of Brazil. In this regard, we sought to value the uniqueness of a territory where individuals, shaped by their history and local cultures, are challenged not only to express their perceptions but also to highlight their attitudes, actions, and responses to climate change. The geographic focus does not aim to isolate and disassociate this portion of the Amazonian territory from the significant challenges faced in this biome.

Divergent views exist regarding the logic of wealth production in the Amazon: one asserts that the denial of the ethnic diversity of Amazonian peoples is associated with the pursuit of expanding extractive economic frontiers (Malheiro, Porto-Gonçalves and

Michelotti 2021), while another argues that the Amazon is a region where civil society plays a leading role both in rural and urban areas, with active citizen participation in the advocacy process for public policies (Becker 2005). We fully align with this second perspective, and throughout this research, we will demonstrate that it is indeed achievable.

3.   **Methodology**

This research was a result of a partnership between the PRAXIS UFOPA (Federal University of Western Pará) group and the Climate-U project[4]. The research 'Challenges of an Ecological and Circular Bio-Economy in the Tapajós Arapiuns Resex: a Case Study in Anã Village' was held in 2022, and was organized in three steps: initial, intermediate and interactivity (see Figure 2, overleaf).

The principles and purposes of participatory action research (PAR) were used. Participation refers to making connections with members of a community or an organization, where all participants in the process are co-learners and co-producers of knowledge, and all are equally invested in, and responsible for outcomes. The action principle aims to transform relationships where people can share strength and power when discussing the question 'How can we improve the situation?'. The research principle in turn refers to the process of researching 'with' rather than researching 'on', with

---

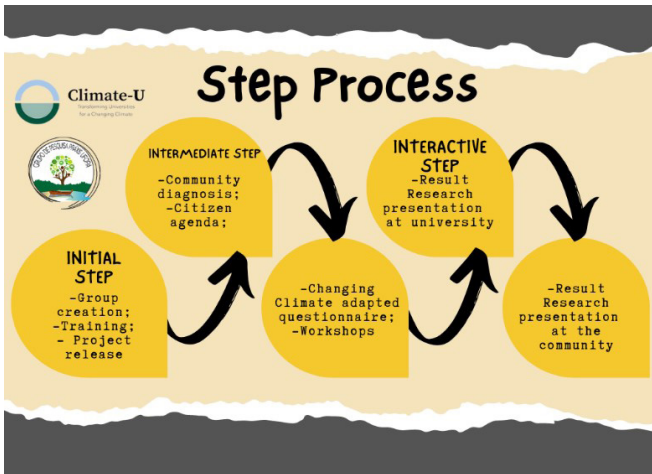3   See: https://unfccc.int/topics/land-use/workstreams/redd/what-is-redd

Figure 2: *Step process adopted in this report.*
Source: Created by authors (2023)

knowledge co-produced (Climate-U 2021). After studying and discussing PAR allied with the experience of research from UFOPA, the potential of this tool was understood for many reasons as it can enable the involvement of participants as actors in the process; people are not a simple objects of study but protagonists during the investigation process; PAR provides opportunities to work with and not on; and PAR aims to support transformation in the individuals, groups and institutions involved (Climate-U 2021).

3.1 Initial Step
3.1.1 Identification of the research impact location:

What were the criteria for choosing Anã Village? At UFOPA there is a Postgraduation Program (PhD) called Society, Nature and Development (PPGSND/UFOPA), in which there is research project on progress about knowledge management and innovation for sustainable development. This research project is being developed by one of the PRAXIS UFOPA researchers who has been working with this community for many years because of the NGO Saúde & Alegria.

The present research was developed in the community of Anã (see Figure 3), one of the important poles of the Tapajós-Arapiuns Extractive Reserve (Resex[5]), on the Arapiuns River in the western region of Pará. In the municipalty of Santarém there are more than 800 small communities along the Amazon, Tapajós, and Arapiuns rivers. Anã Village (or Anã, for those more familiar with it), is a community located in the Tapajós-Arapiuns Resex, on the banks of the Arapiuns River, in western Pará, with exclusive access by river, about 60 km from Santarém.

5   The Tapajós-Arapiuns Extractive Reserve (Resex) was established by Decree on November 6 1998, with the objective of ensuring self-sustainable exploitation and conservation of renewable natural resources traditionally used by the extractive population in the area.
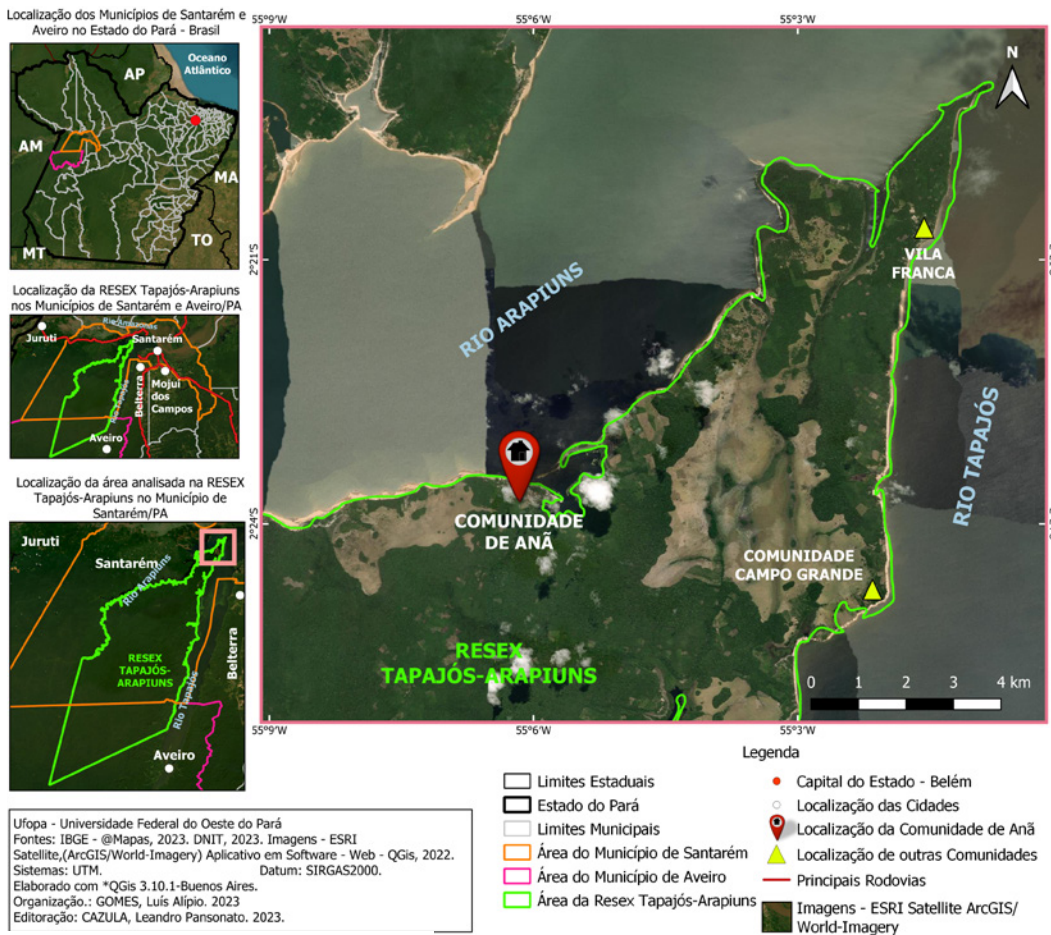

Figure 3: *Map of Anã Village, Para State, North of Brazil.*

Source: Organisation: Gomes, 2023. Publishing: Cazula, 2023.

So it was verify the possibility to articulate the research from PPGSND and Climate U because both converge in goals, methodologies and purposes. Some questions guided this choice, such as:

i) What was our motivation for doing this work?;
ii) What changes do we want to see? New mentalities of community organization and management, strengthening of innovative practices of co-creative activities by community members in this territory and replicability of these actions in other community spaces, the third sector, private and public institutions, schools and universities;
iii) Where do we want change to happen? And who did we want to involve? We would like it to happen in a conscious, reflective, critical and creative way, taking as main aspects the environmental, social and economic triad, in accordance with the Sustainable Development Goals (SDGs) of the 2030 Agenda (UN 2015) - mainly SDG 13, regarding the collective and individual empowerment of Anã community members regarding mitigation and adaptation to climate change.

As mentioned before, there was research in progress in a community and we asked a teacher from the community to provide names of some people who could represent the different sectors from the community, such as education, fishermen and agriculture workers.

3.1.2 Identification of research participants and definition of roles:

The research participants consisted of researchers, members of the PRAXIS UFOPA group, faculty and technical staff, graduates, undergraduate and graduate students of UFOPA, as well as teachers and elementary and high school students at Anã school, with the definition of names and functions along with the sub-project. These members were permanently interacting with the local coordination, with weekly meetings (face-to-face and online) and monthly meetings in the community for follow-up and training, having as a point of reference themes such as participatory action research and climate change. It is important to emphasize that both teachers and students supported by Climate-U/PRÁXIS UFOPA grants were invited to compose the research team, considering that they are actors involved in the 'place of impact'. In the day-to-day of the PAR in the community, scholarship students - identified in this PAR as "forest fireflies[6]" for having the function of being lights that flash and signal in the dense forest as environmental indicators, were accompanied by Professor Danilo Godinho.

At this stage, it was also necessary to define who should be involved in the activities of the groups that would participate in the PAR and how this involvement should occur, as there was an understanding that it was an essential and complex

---

6 Fireflies are small insects often found in the dark forest. The fact that a small light flashes is very significant, given there is no light. The researchers from the community are similar to fireflies because they illuminate the forest with their youth and dreams. They are potential researchers being formed.

process to carry out in the university-community relationship. This fact implied the development of strategies to involve groups considering the recognition of marginalized voices and perspectives. For this, a stakeholder analysis was carried out in order to map the various actors who assume a position of influence and are involved in the 'place of impact' of the PAR's activities. A 'stakeholder' is someone who has an effective 'share' in the community or an interest in the activities and 'impact' they seek to involve. However, the stakeholders are diverse, and have brought different forms of knowledge, power and influence to the groups participating in PAR. A letter of commitment was sent via email to representatives of the federal government working on environmental issues, university officials, representatives of social movements related to rural matters, and influential individuals in the Vila de Anã community. After the response a list of key stakeholders was compiled.

3.1.3 Theoretical and methodological training of research participants:

Once the team of researchers was formed, another moment followed related to the sharing of motivations and expectations for joining this group, with a view to initiating the prior preparation of the members of this team to develop PAR. A fundamental step was the process of collective training in order to enable immersion in the locus of the study. Thus, the first Training Meeting of the Climate-U Project - UFOPA was held in the NTB auditorium at UFOPA on 18th April 2022, where the objectives were presented, the methodology announcing the projection of the PAR cycle, the expected results and the schedule of project activities.

At that meeting, there was discussion about the many activities to be carried out by the PRAXIS UFOPA as required by Climate-U, such as a documentary about the experience in the Community of Anã. The research group understood the necessity of knowing the community better. Two questionnaires were analysed to check the possibility of this being applied in the diagnostic phase of the community.

3.2 Intermediate Stage

The launch of the Climate-U Project and its sub-project took place officially at the Anã village Community Centre. Elementary and high school students, teachers, technicians and the manager of the Municipal Elementary School Nossa Senhora de Fátima participated in this event. There was also significant participation of residents of Anã village, community leaders (among them the presidents of the Women Dreamers in Action Group and the Forest Tourism and Crafts Cooperative, respectively); representatives of fishermen, farmers and socio-productive chains (fish farming, meliponiculture, community-based tourism and handicrafts, family farming and artisanal fishing); and the participation of the staff management of the Resex Tapajós-Arapiuns. All the participants were extremely relevant and they asked several questions about the project. The launch had the following aims: the first, to explain the project; the second, have leadership permission to do the

research and the third to get their adhesion or involvement with the project.

The presentation was about the researchers involved and the objectives of the project. It was explained that the research was not *about* the community, but *with* the community. In this sense, the direct participation of the community members would be necessary, in particular, with the suggestion of students and a teacher to participate as project scholarship. It was indicated four students (from 15 to 17 years old) and a teacher (Art specialist) would work together with the team of researchers. All the students were from high school and there was a volunteer from elementary school (14 years old). The schedule of activities was explained and dates foreseen for their realization.

The activities carried out in the period were concluded with the participation of the Instituto Chico Mendes de Conservação da Biodiversidade (ICMbio)[7] team, which presented a project to obtain funds to improve the conditions of life in the community. For this reason, a community diagnosis was carried out in order to identify the main demands of the community to meet the criteria of the notice.

Figure 4: *Planning the future of Anã Village in partnership with ICMBio (Chico Mendes Institute for Biodiversity Conservation) Source: Archive of PRAXIS UFOPA Research Group (2022)*

At Anã there was a multimedia workshop, seeking to train Climate-U Scientific Initiation scholarship holders - PRAXIS UFOPA - on how to perform image and sound recordings with the use of cell phones to assist in the collection and production of PAR data. (See figure 5 above right).

Figure 5: *Cell phone recording workshop. Source: Archive of PRAXIS UFOPA Research Group (2022)*

3.2.1 Application of the Citizen Agenda questionnaire and Perceptions of Climate Change

Between June and August 2022, visits were made to Anã village to build a community diagnosis. The brief survey questionnaire was called Citizen Agenda[8] and it was used to collect information about the reality of residents and their living conditions.

Figure 6: *Questionnaire application. Source: Archive of PRAXIS UFOPA Research Group (2022)*

Allied to this survey, there was another questionnaire to survey the perception of the students from elementary and high school about climate change. The questionnaire about perceptions collected personal data and other information about school and community activities related to climate change. The questionnaire was answered by 50 students: 16 students (31%), aged 13 to 15 from the elementary school and 34 students (67%), aged 16 to 20 from high school. (See figure 7, overleaf).

---

7   The Chico Mendes Institute for Biodiversity Conservation (ICMBio) is responsible for managing, protecting, monitoring, and overseeing the 335 Federal Conservation Units (UC) throughout Brazil, and is linked to the Ministry of Environment and Climate Change.

8   Citizen Agenda is a questionnaire used as a Real Base discipline at UFOPA courses in all courses initially. The aim is to understand the reality of any community external to the university and most of the information is about personal data, education, the conditions of social living, water, sanitation and other issues.

Figure 7: *Meeting with scholarship from Anã Village. Source: Archive of PRAXIS UFOPA Research Group (2022)*

According to the Citizen Agenda questionnaire applied by researchers from the Climate-U PRÁXIS UFOPA Project, the community has approximately 84 families, the majority of the population being women (58.3%). Main occupations are: traditional extractives (37.5%), retirees (23 .4%) self-employed[9] (22.5%) and civil servants (13.8%). Most people are between 31 and 64 years old, with a population that considers itself mixed race (88.1%) and still a part that identifies itself as indigenous (8.3%).

As for education, most have incomplete primary education (32.1%), followed by complete secondary education (31%), with the majority attending public schools (97.6%). Most families have resided in the community for more than ten years (91.7%), with a family composition of 4 to 5 members (40.5%), consisting of father, mother and children (54.8%) , and family income of less than one monthly minimum wage (61.9%), from social programmes (29.8%), self-employed (27.4%) and retirement (26.2%), as well as from family farming, fishing and as river vessel helpers. All members of the community have their own homes, most of which are masonry (84.5%), but without registration documentation, since they live in an extractive reserve, in land considered *terra firme* (land that never floods), with toilets inside their homes (79.8 %).

The most used means of transport are bicycles (53.6%), *bajara*[10] and canoe (42.9%) and walking (39.3%), and some have a motorcycle (20.2%). With regard to electricity, Anã village does not have electricity supplied by the state, and 89.3% of the houses have electricity provided by a community diesel generator. Regarding the water they consume, the community has a water supply microsystem reaching all homes (70%), and of these, 27% use chlorinated and filtered water, with the rest without any type of treatment (3.%).

As for the destination of sanitary sewage, waste is thrown into a septic tank (71.4%); solid waste (garbage) produced by community members is placed in closed containers (64.3%) and open containers

(35.7%). Regarding the destination of this garbage, most residents burn their garbage (84.5%), others put it in vacant lots/dumps (16.7%) and the rest bury their own garbage (4.8%). Questioned about the reuse of garbage, the majority of respondents said they do (58.8%); for 61.9% there is no selective waste collection, where plastics, glass, organic material, and metal are separated in the community and there is no waste collection for 70.2 %.

The Anã village population is assisted by NGOs (95.2%), which are of national origin (67.1%) and international (24.1%), where 25.3% of residents believe that both provide assistance to the community. For most residents, fish farming, meliponiculture, handicrafts, and community-based tourism are considered socio-productive chains and they are considered innovative in the community (72%). Meliponiculture represents (52%), fish farming (36%), community-based tourism hostel (32%) and wood crafts (4%). The economy generated by socio-productive chains helps to keep the forest standing in the opinion of 94% of the respondents. Other benefits to socio-productive chains were identified: zero deforestation and burning (47.9%), in the types of work (29. 6%), use of local knowledge (14.1%), adaptation and mitigation of climate change (9.9%) and use of local technologies (4.2%), with 2.8% who did not know to respond. It is understood that the forest will only cease to be destroyed if it holds economic value to compete with logging, livestock, and soy cultivation. Achieving the sustainable capacity of the forest is a goal to be pursued. It is argued that the time has come to implement a 'scientific-technological revolution in the Amazon that establishes techno-productive chains based on biodiversity, from forest communities to advanced technology centers' (Becker 2005, p. 85).

Related to the quality of life, the residents responded that, in the last 12 months, most were affected by some type of disease. Mainly respiratory diseases related to Covid-19 (20.2%), diarrhoea (19%) and other viruses (17.9%), among others cited by community members as bone problems and heart problems. When affected by diseases, community members turn to the community health centre (85.7%) and the rest prefer home remedies (10.7%), public hospitals (3.6%) and private hospitals (2.4%).

Regarding activities carried out in the community, residents stated that health care is the most important (64.3%), the quality of teaching (16.7%) and also professional qualification courses (9.5%). As for services, water supply (73.8%) is indicated as the most important, followed by urbanisation of streets (13.1%) and garbage collection (6%). About the place where they live, residents reported that public security does not exist, and that cleaning streets and land are more important (66.7%), as well as leisure areas (16.7%) Another approach also considered very important was regarding good air quality (61.9%), green areas (16.7%), and street trees (8.3%).

When problems arise in the community, most turn to community leaders (89.3%) and public authorities (municipal, state or federal) (8.3%) to solve them. As for social capital, all community members said they liked where they live. And regarding their coexistence, most residents reported that it is very good (89.3%), or satisfactory (10.7%).

In the evaluation of community members, the association of residents

---

9   Self-employed individuals, who are not public servants, engage in activities related to the sale of fish or agricultural products.

10   A canoe with an outboard motor attached.

is very important (66.7%), for others the social action of churches (16.7%), social projects (9.5%) or social movements (6%) has more importance.

Another survey question was about the socio-productive chains that residents found most innovative and considered most important. In first place was meliponiculture (48.2%), followed by the Anã Hostel (26.5%), then fish farming (18.1%) and wood crafts (7.2%). As for the participation of families in activities carried out in the community through associations of residents, NGOs, groups and mutirões (a collectively performed task aimed at providing free assistance seeking improvements within the community, particularly in rural areas), residents stressed that they participate most of the time in actions (52.4%), sometimes (45.2%) and others never participate (2.4%). When asked if they would participate in future projects that would benefit the community, most said yes (83.1%).

Finally, participants were asked about the sources of access to information they usually seek to stay informed about climate change. The majority of people of Anã village listen to local radio stations in their homes, and 84.5% said they have television with a broadcasting channel that is available for free to the public, or internet (26%). Other sources were also presented, such as community meetings. Our goal was not to evaluate the quality of the information received; nevertheless, understanding the impact of the media on people's lives is crucial, considering its prevalence in most households. It means that media has an effect on people perceptions on environmental issues (Keinonen et al. 2016).

Students were asked about their perceptions of learning about climate change. For education and communication strategies to be effective in their approach to climate change, they must take into account the perceptions and beliefs of individuals (Gubler, Brügger and Eyer 2019). 17% of students are satisfied in 'learning about climate change' at school, 65% said they are learning but would like to learn more, and 16% of students said they are not learning but would like to learn. 2% did not respond. When asked about the importance of the role of education in relation to climate change, 49.02% thought education occupies great importance in the approach to climate change, 21.57% consider it of significant importance, and 13.73% of medium importance. Little importance and no importance obtained respectively 5.88% and 9.80%.

The next topic to be presented will be activities with involvement of the community members, following the PAR procedures.

3.2.2   Meetings and Events

Specific meetings were carried out for each theme raised and treated for reflection together with the community as follows.

3.2.2.1   Meeting on bioeconomy of socio-productive chains

On July 15, 2022, a bioeconomy meeting was carried out, with the facilitator-researcher Adriane Gama, and the participation of leaders and representatives of the socio-productive chains: family farming, meliponiculture, fish farming, wood crafts and community-based tourism, in addition to of the four scholarship researchers from Anã and the teacher, at Pousada Paraíso de Anã.

The aim of the meeting was to dialogue on the main concepts and perspectives of global bioeconomies, highlighting the contributions and challenges of ecological bioeconomy with principles of circularity in the region of forests and rivers. Other topics addressed were the planetary environmental crisis, impacts of climate change, mitigation and adaptation to the Amazonian reality and climate justice. In the end, the Mandala Knowledge technique was applied.

The concept of circular ecological bioeconomy emerges from a new paradigm linked to sustainable development proposed by Mohammandian (2000), addressing the deficiencies of a linear and exploitative neoclassical economy known as bioeconomy. It emerges as an interdisciplinary science, holistically outlined, explaining the interactivity of biological systems and nature with the economy and society.

According to Zúniga-González et al. (2014, p.16):

> "bioeconomy in adaptability and mitigation of climate change is the potential for rural development where biomass is abundant and easily convertible for a scalable economy".

However, critiques from scientific literature indicate that the concept of bioeconomy is conceived quite differently from various stakeholder perspectives, raising questions about how it can truly achieve and obtain contributions from the development of an innovative and sustainable bioeconomy.

Bugge, Hansen and Klitkou (2016) emphasize that the essence of bioeconomy is, above all, to promote a profound understanding of ecosystems, enabling new and sustainable solutions with the knowledge and technologies that support them. In analyzing views of biology-based economy, the authors consider

> "[…] the perspective of Bioeconomy, Green Economy, and Ecological Economy projecting as the new epistemological paradigm more linked to sustainable development in the face of deficiencies of classical economy." (p. 10).

Considering these major contributions from the scientific community, this study aimed to explore projections of inclusive, bioethical, and sustainable bioeconomies for the Amazon. Among them, we advocate the proposal of a biomodel for circular ecological bioeconomy from a bioecological perspective based on Georgescu-Roegen (1975), traversing the critical perspective of ecological economy and principles of circular economy, seeking to implement strong sustainability through four pillars: scientific knowledge, indigenous wisdom, appropriate technologies, and circular innovation.

According to Becker's (2005) perspective, the Amazon is a region where civil society plays a leading role both in rural and urban areas, primarily through citizenship claims. We think that a
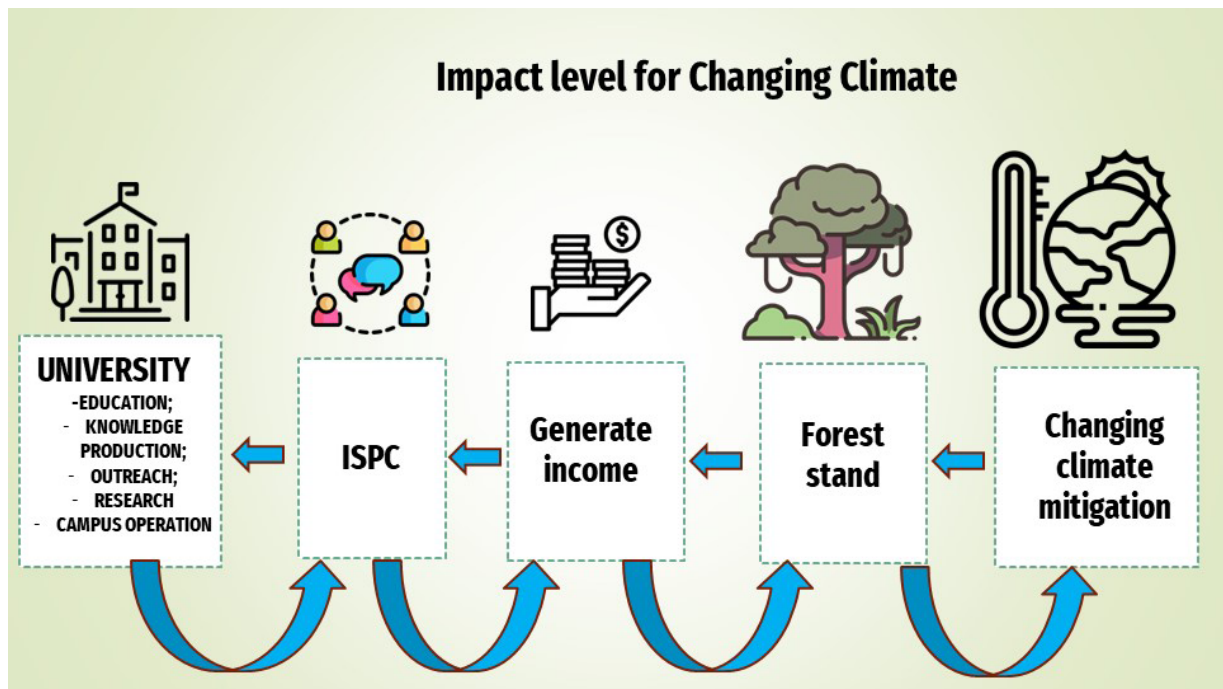
Figure 8: *Understanding the impact of climate at Anã Village. Source: Created by the authors (2023)*

circular ecological bioeconomy can bring benefits not only for the community but also for climate action.

Socioproductive chains or socio-biodiversity product chains refer to the work of using and valuing native species, based on the principles of agroecology and solidarity economy. Among these principles are the use of sustainable techniques in extraction, production, and processing; the socio-productive inclusion of family farmers, indigenous peoples, and traditional communities, promoting their leadership in defending their interests; the valorization of the traditional knowledge of these producers; the connection between producers and consumers; and the establishment of transparent and collaborative relationships among all links in the chain" (Ramos et al. 2018, 110).

This concept encompasses various areas of knowledge such as agronomy, animal science, geography, administration and production engineering, social sciences, and economics. When considering production chains, complexities and challenges escalate, given that the mission of surveillance is to analyze and intervene in processes that generate harm to the environment and the health of the population, including workers. Thus, new chains of processing raw materials based on biological sources are emerging with the aim of substituting fossil fuel based raw materials (Bugge, Hansen; Klitkou, 2016)

3.2.2.2 Mandala of Knowledge

The Mandala of Knowledge took place in the Bioeconomy Meeting in Anã, by the facilitator-researcher. It is a pedagogical proposal of articulation, integration and interaction of knowledge. In this research, it includes information from traditional knowledge shared between the community, school and socio-productive

chains, in order to find solutions based on good practices of circular ecological bioeconomy that contribute to community autonomy and the balance of territories of forests and rivers in the Amazon.

The Mandala of Knowledge, as a methodology, is a scientific tool inspired by the community integration mandala (Pascali 2012), the Comprehensive Education Reference Centre mandala (CERC, 2016), and Freirean thought with an emphasis on popular education (Freire 1987). Additionally, a pedagogical implementation of this Amazonian mandala was carried out by the researcher through the Community Networks School of 'Projeto Saúde e Alegria' (PSA).

The use of the method named the 'Mandala of Knowledges', within the scope of the Climate-U PRAXIS UFOPA Project, aimed to generate a database to support processes related to circular ecological bioeconomy. In this case, the Knowledge Mandala acted as a pedagogical proposal for community articulation and interaction, encompassing information from traditional community knowledge, schools, socio-productive chains, and scientific knowledge. The goal was to find innovative socio-economic and socio-environmental solutions based on good practices within the socio-productive chains.

Being a symbolic representation with a systemic approach, it serves the purpose of community mapping based on political, economic, social, cultural, environmental, and climatic axes in its territory. Within the Climate-U PRAXIS / UFOPA Project, the Mandala of Knowledges aimed to map the main activities of socio-productive chains adopted by the community members in their river and forest territory in Anã. The intention was to assess and diagnose the challenges and strengths of a circular ecological

bioeconomy and collaboratively find sustainable and inclusive bioeconomic strategies in this community. Figures 9 and 10 below present the structural model of the dimensions of this Mandala.

This methodology, through a symbolic representation and a systemic approach, under Freire's perspective, consists of five elementary circles symbolizing the following guiding questions: subject of rights, knowledge of the territory, problematic situations of their reality, experiences of chains socio-productive strategies and ideas, practices and activities.

Figure 9 and 10: *Working with the Mandala of Knowledge. Source: Archive of PRAXIS UFOPA Research Group (2022)*

The Mandala is a very interesting technique to discuss in small groups. In the first step the participants need to design a symbol that represents their territory (bird, tree, river, animals). These symbols of the community should be designed in middle of the circle. In other circles the participants should design or write about the problems they face in their reality: deforestation, forest burning, garbage, pollution on water, poverty and others. And the external circle they should write of possible solutions for each problem. The last step is to share the Mandala in group and explain the words or symbol inside the circles.

3.2.2.3 Mediativism and Community Communication Workshop

The workshop took place on July 13 and 14 2022, starting at the Pousada de Anã and ending at the community telecentre, with the participation of students and a teacher and mediated by researcher and educator Adriane Gama. The objective of the workshop was to discuss the importance of digital culture and community communication in the Amazon region. At the end of the explanation, the students and teacher decided to create an Instagram page. They understood this social media could help to enhance the Amazonian culture and encourage, in particular, the engagement and autonomy of youth to understand and discuss issues of community interest. This process involved the production of collaborative media developed locally such as Anã's daily activities, the school's socio-environmental actions and good practices in socio-productive chains. In this workshop, despite the difficulties with internet connectivity, a profile was created for the Anã community on Instagram, which will be managed by students ('forest fireflies'). Globally, young people are at the forefront of climate change activism. They have the ability to engage on climate change but it depends on the opportunities they have and level of their knowledge (Kutywayo et al. 2022).

Figure 11: *Mediativism Workshop. Source: Archive of PRAXIS UFOPA Research Group (2022)*

3.2.2.4 II Environmental Citizenship Seminar:

The event was promoted by the Nossa Senhora de Fátima School, part of the Culture and Environment Project of the Santarém Municipal Department of Education (SEMED), with the main themes: climate change, integrated fire management and Biodiversity Monitoring. It took place on August 4 and 5 2022, at the Anã community headquarters and had the participation of socio-environmental partners such as: Coletivo Tapajônico, Saúde e Alegria Project, Sinprosan, Community Brigadistas

Figure 12: *Speech about citizenship at the seminar. Source: Archive of PRAXIS UFOPA Research Group (2022)*

Figure 13: *Applying the Affective Map Generator Instrument (AFGI). Source: Archive of PRAXIS UFOPA Research Group (2022)*

de Anã and ICMBIO and Climate-U PRAXIS UFOPA Project. Researchers Adriane Gama, and Vagalumes da Floresta and tutor Danilo Godinho were invited to give an interactive lecture on Bioeconomy, Climate Change and Environmental Justice.

3.2.2.5   Fiscal and Environmental Education Seminar - Community of Maripá

The seminar was held on August 27, 2022, being an environmental event at the school level, as part of the Culture and Environment Project promoted by SEMED[11], with the objective of promoting socio-environmental knowledge in the territories of forests and rivers. The guests were the same partner institutions - ICMBIO, Sinprosan, Projeto Saúde e Alegria, Coletivo Tapajônico and Climate-U/PRAXIS UFOPA. In this seminar there were speeches about the importance of monitoring taxes. The public who participated in this seminar were students and teachers from elementary school.

3.2.2.6   Application of the Affective Map Generator Instrument (AMGI):

In August and September 2022, the AMGI[12] was applied in Anã Village, with the participation of 28 people. The dynamics of the event involved the formation of five groups with an average participation of around seven community members. The application took place in the school shed, with the presence of two researchers. The AMGI is presented by Bonfim (2010), based on his first studies on affectivity from the perspective of the Social Environmental Psychology (SEP). This instrument is divided into two parts: quantitative (production of place estimation) and qualitative (production of affective maps). In the quantitative part, statements about feelings related to the community are presented and the evaluation is carried out using a Likert scale, with a total of 41 statements. Operationally, estimate (e) is calculated by subtracting the sum of individual Factor I scores from the sum of

individual Factor II scores. That is, the place estimate is obtained by the formula e = Factor I – Factor II (BOMFIM et al. 2014).

3.3   Interactivity stage and final events
3.3.1   Research dissemination meeting at UFOPA.

This was held in the UFOPA auditorium on December 14, 2022, with a focus on the dissemination of the research results. All those involved in carrying out the project participated in order to know and hear a little about the experience carried out. At first, the results related to the application of the Citizen Agenda, Climate Change and the Instrument for Generating Affective Maps were presented. Then, the 'fireflies of the forest', which are the young researchers, together with the tutor, presented their research related to fish farming, meliponiculture, community-based tourism and handicrafts. This research sought to demonstrate the existence of a bioeconomy that helped to keep the forest standing and, therefore, contribute significantly to the reduction of carbon emissions in nature and to the balance of the climate.

Figure 14: *Knowledge dialogue: research disseminating meeting at UFOPA). Source: Archive of PRAXIS UFOPA Research Group (2022)*

---

11   In Portuguese - *Secretaria Municipal de Educação*, or Education Department from Santarém municipality.

12   The AMGI was conducted by Psychologist Dr Klaudia Sadala and Adriane Gama, both members of Climate-U PRAXIS UFOPA.

3.3.2 Research dissemination meeting at Anã Village:

During the launch of the project the community representatives established one condition for the project: return the research results for use of the community. Since other research experiences did not observe this criterion, it was an obligation to Climate-U/ UFOPA research group to assume this responsibility. The leadership also requested something that could be visualized physically about the partnership between university and community.

The research was returned to the community on February 14, 2023. Representatives of traditional production chains (fishing and agriculture), innovative production chains (fish farming, meliponiculture, community-based tourism and handicrafts), community leaders, residents, public school teachers, students, in addition to the research project team participated. Composing the present team was the Pro-Rector of Culture, Community and Extension of UFOPA.

Knowledge exchange took place in three stages. In the first stage, there was the participation of the 'forest fireflies', who reported the results of their research. Listening to and giving prestige to researchers from the community itself was a fantastic experience for the participants of the event, since they approached the subjects with great ownership due to their origins. In the second stage, the results of the Citizen Agenda and Climate Change survey were presented. The results were confirmed by the people who were present, demonstrating that they were related to that reality. In the third and last stage there was the interaction that, despite being in the last sequence, also occurred throughout the event. At that moment, the Sustainability Bingo was held, with words marking instead of numbers. The words were related to the presentations made and an attempt was made to understand what the meaning and reactions were produced. The launching of the construction of the Sustainability Square, with the planting of a tree, marked the end of this moment of interactivity.

To symbolize the partnership between the university (Climate-U/ UFOPA research group) with the support of the Project, the construction of a small Sustainability Square was started to mark the memory of Anã Village and its commitment to the issue of sustainability and climate change.

3.3.3 Interactivity: production of social media

The production of videos was requested that portrayed the following themes: environmental impacts, methodologies, types of partnership, counter-hegemonic initiatives and impact sites. As a result, four videos were produced. The final events were organized in three different stages:

i) Visiting Anã Village to know about the Climate-U PRAXIS UFOPA Project;
ii) Participating in a seminar at a private university;
iii) Participating in an event at UFOPA.

On 19th June, 2023 the trip to Anã Village started very early in the morning by a speed boat to guarantee calm water and weak waves during the navigation in the Tapajós River. The group of researchers were received by the villagers with indigenous dancing. After that, they got to know some activities developed by the community and discussed with them their sustainability and their contribution to preserving the Amazon Forest.

The activities can be summarized in four types: keeping of honeybees (meliponiculture), fish farming, handicrafts (see, figure 16, overleaf) and community-based tourism. All these activities have the potential to generate income for the local people and can contribute to maintain the forest. This kind of economy can be considered ecological and circular bioeconomy, and it is currently being studied by a PhD student who is part of the Climate-U / PRÁXIS UFOPA Research Group.

Figure 15: *Knowledge dialogue: research disseminating meeting at Anã Village. Source: Archive of PRAXIS UFOPA Research Group (2022)*

Figure 16: *Visiting the handcraft workshop. Source: Archive of PRAXIS UFOPA Research Group (2022)*

4.   Reflections about the participatory action research

The PAR activities contributed to:

- Bringing traditional and innovative production chains closer together;
- projection of new community leaders such as teachers and students;
- interconnection of chains;
- the fish farming chain is helping artisanal fishermen, such as the issue of feed that is given to fish that attract other species;
- the approximation of the university with the community in view of its socio-environmental responsibility.

Due to this approximation, there was a demand from the community for the university to meet in terms of access to higher education. The possibility of distance education modality in partnership with an international institution (for instance, the Open University of Portugal) was discussed, provoking good articulation with the school and community segments, and establishing a relationship of trust.

These successes are related to the following points: satisfactory execution in relation to the activities foreseen in the schedule; meetings to systematically articulate actions; external funding for the research was essential to cover the costs of travel, food, materials for carrying out the events and payment of scholarships; support from stakeholders (for example the possibility of borrowing a speedboat from ICMBio with fuel in return for help with the displacement process); good reception by the community regarding the researchers holding meetings with the entire Climate-U team to share guidelines.

Some limitations can be pointed out: connection difficulty in remote regions of the Amazon, which makes the process of communication and data transmission difficult. Although Vila de Anã has a telecentre, it sometimes proves to be deficient in meeting the need for connection. There was difficulty in involving the public sectors responsible for environmental policies at both the municipal and state levels to promote public policies to benefit the community. It would be beneficial to have a longer period for assessing the impacts of the implementation of actions outlined in the PAR.

The questionnaires on climate change were decisive for Anã community members to be able to express their impressions and perceptions of climate change, as well as allowing them to express the mitigation actions already carried out and the activities which potentiate the processes of coping with the changes in weather. The questionnaires were adapted to the reality of the community and the school, ensuring that they had a voice to express their perceptions about the theme and the concept they built over time. Stakeholder participation was essential for achieving the research objectives. The activities developed by the stakeholders brought significant impacts on the development of the research. With regard to ICMBio, as it is the managing body of the Tapajós-Arapiuns Resex, it is under the responsibility of this body to issue prior authorization in order to gain access Anã Village.

The epistemic injustice leads us to think that some can judge themselves as the holders of knowledge, and that therefore, they are the only ones who have the competence to produce knowledge. This becomes very clear when one thinks of the place where the research will be carried out as a mere supplier of information, data that, after being processed and treated, generate scientific results. One can even ask what the difference in the attitude of the logger or prospector from a group of researchers is? In other words, while the former extract their plant wealth from the forest (logger), ores from the rivers and earth (*garimpeiros* – gold miners) leaving a trail of destruction, the latter can extract information, knowledge, knowledge for scientific purposes and leave traces: abandonment, usurpation, profiteers. The marks can be worse because it is in people's imagination that such researchers left after fulfilling their objectives and did not bring any return to the community. Through PAR, the Climate-U Project sought to make a difference in doing research by conceiving that the production of knowledge is not exclusive to the university. The exchange of knowledge and the participation of community members in the knowledge construction process was noticeable. In researchers' training meetings, in moments of research with community members, the epistemic injustice was overcome by providing research activity with the responsibility of researchers from the community itself and not just from the university. Leaving the academic environment, stepping on the community's ground to develop the research was something quite significant and can be summarized in the trips carried out in the field on the following dates and with the development of the following actions.

Another way to alleviate the epistemic injustice was to carry out a knowledge exchange activity for the partial results of the research

at the university itself. It was a moment to occupy the university's premises, and put the auditorium and equipment historically used by qualified researchers at the service of participants from Vila de Anã. There was a new way of sharing the research: the community, the target of the research, played a leading role in the research dissemination meeting.

5.   Challenges to the University

The Federal University of Western Pará (UFOPA) has the following mission: To produce and share knowledge, contributing to citizenship, innovation and development in the Amazon. Its vision is to be a reference point in the production and dissemination of scientific, technological and interdisciplinary knowledge to contribute to sustainable regional development through the training of citizens. Due to the mission and institutional vision of UFOPA, we believe that there is potential for the results of research that used PAR as a methodological tool to influence its functions and activities. A concrete example is due to the participation of the Pro-Rector of Culture, Community and Extension (PROCCE) of UFOPA in an event held in Vila de Anã.

Some departments at university (Pro-Rector of Culture, Community and Extension for instance) are responsible for defining policies and setting goals for the academic community, culture and outreach at the institution's headquarters and campuses. Its objectives are to plan, execute, coordinate and evaluate community engagement and cultural actions, promoting the integration of teaching, research and outreach. In this sense, by providing the visit of such an important pro-rector there is a clear intention of bringing the community closer to the university and seeking to encourage outreach projects aimed at a differentiated methodology such as PAR. In the field of research, there is the possibility of deepening debates and training with the institution's research groups on the conceptualization and operationalization of the PAR. Holding scientific events on the theme of participatory action research together with the academic community is another way of influencing the institutional environment.

There is a need to establish a new model for carrying out research with people. Today there is an instance that looks after ethical issues regarding research with human beings (Ethics Committee). However, it is important to go further. It is not enough to know if this or that research offers risk and benefits for the participants, it is not enough to guarantee the repair mechanisms, only. Finally, it is not enough just to change terms or nomenclature. It is necessary to somehow find mechanisms, ways and strategies to involve people. Several actions are already underway at the university with the aim of promoting climate justice.

6.   Conclusion

Regarding the factors that can enhance this capacity, it would be the implementation of multidisciplinary and interdisciplinary scientific research projects using the methodology provided by PAR. This type of initiative would help to overcome the idea that PAR is an exclusive methodology of arts. humanities and social sciences. Other areas of knowledge should appropriate and make use of this tool. The holding of lectures, seminars, workshops, and other events are strategies to disseminate and carry out a fruitful debate on PAR.

Researchers from different areas of knowledge should engage with research experiences using PAR, understand its conception, as well as deepen the debate around this methodology. It appears, on the other hand, that one of the factors that may condition the capacity of the PAR initiative is related to the need for research funds that could contemplate this research practice. This working paper explored the importance of PAR as a valuable tool in the search for sustainable solutions to the climate crisis. It was possible to see how participatory action research promotes the integration of scientific knowledge with local wisdom, involving communities and stakeholders in the creation of effective strategies like meliponiculture, handicrafts, fish farming and community-based tourism.

The theme of climate change has an eminently interdisciplinary character and, in this sense, requires funding for projects that use PAR as one of their methodological approaches. It will be essential to develop training within universities in order to understand and take ownership of PAR.

Acknowledgments

References

Becker, B. (2005). Amazônia: nova geografia, nova politica regional e nova escala de ação. In: *Amazônia sustentável: desenvolvimento sustentável entre políticas públicas, estratégias inovadoras e experiências locais*, Coleção Terra mater, orgs. Rio de Janeiro, Brazil.

Bonfim, Z. (2010). *Cidade e afetividade: estima e construção dos mapas afetivos de Barcelona e de São Paulo*. Edições UFC: Fortaleza.

Bonfim, Z.; Nobre, B.; Ferreira, T.; Araújo, l.; Feitosa, M.; Martins, A.; Farias, N. (2014). Affective maps: validating a dialogue between qualitative and quantitative methods. In: Mira, G. and A. Dumitru, A. (Eds.) *Urban Sustainability: Innovative spaces, vulnerabilities and opportunities*. (pp.131-147). Coruña: Institute of Psychosocial Studies and Research.

Bugge, M., Teis H., and Klitkou, A. (2016) What Is the Bioeconomy? A Review of the Literature. *Sustainability*. 8(7): 691.

Climate-U. (2021) *A Protocol for Participatory Action Research into Climate Justice: Principles and Tools*. Transforming Universities for a Changing Climate Working Paper Series, No. 3.

Comprehneisve Education Reference Center (Centro de Referências em Educação Integral. (2016) *How are the pedagogical practices from the perspective of comprehensive education?* Available at : www.educacaointegral.org.br/especiais/praticas-pedagogicas. Accessed: October 13, 2023.

Georgescu-Roegen, N. (1975) Energy and Economic Myths. *Southern Economic Journal*. 41(3): 347.

Gubler, M.; Brügger, A.; Eyer, M. (2019) Adolescents' Perceptions of the Psychological Distance to Climate Change, Its Relevance for Building Concern About It, and the Potential for Education. In *Climate Change and the Role of Education*. (pp.129–47). Leal Filho, W. and Hemstock, S. (Eds). Springer Cham.

Keinonen, T.; Palmberg, I; Kukkonen, J.; Yli-Panula, E.; Persson, C.; Vilkonis, R. (2016). Higher Education Students' Perceptions of Environmental Issues and Media Coverage. *Discourse and Communication for Sustainable Education* 7(1): 5–22.

Kutywayo, A.; Chersich, M.; Naidoo, N.; Scorgie, F.; Bottoman, L.; Mullick, S. (2022) Climate Change Knowledge, Concerns and Experiences in Secondary School Learners in South Africa. *Jàmbá Journal of Disaster Risk Studies* 14(1).

Lastres, H and Martins, M. (2024) Pandemia, aprendizados e a necessidade de um pensamento apropriado a Amazonia (pp.75 - 100) in: *Tensões e vivências afirmativas na Amazônia brasileira*. Monteiro, R and Iadanza, E. (Eds.) Ediciones Universidad de Salamanca.

Loureiro, V.R. (2010) Introdução aos Estudos Amazônicos. In: *Módulo Interdisciplinar Estudos Integrativos da Amazônia* (Eds.) Moura, J. and Farias, D. Santarém - PA: Gráfica UFPA.

Malheiro, B.; Porto-Gonçalves, C.; Michelotti, F. (2021). *Horizontes amazônicos: para repensar o Brasil e o mundo*. 1st edition. São Paulo, SP: Fundação Rosa Luxemburgo : Editora Expressão Popular.

Marengo, J; Nobre, C.; Chou, S.; Tomasella, J.; Sampaio, G.; Alves, L.; Obregon, G.; Soares, W.; Betts, R.; Kay, G. (2011) *Riscos das Mudanças Climáticas no Brasil: análise conjunta Brasil-Reino Unido sobre os impactos das mudanças climáticas e do desmatamento na Amazônia*. CCST/INPE and Met Office Hadley Centre.

Nobre, C.; Sampaio, L.; Salazar, L. (2007) Mudanças climáticas e Amazônia. *Ciência e Cultura* 59(3): 22–27.

Pereira, E.; Barros, O.; Hage, S; McCowan, T. (2023). A Amazônia na rota da colonialidade global: a Hidrovia Araguaia-Tocantins, confiltos de projetos, pluralidade de vozes/narrativas e perspectivas educativas. *Revista Española de Educación Comparada* (43): 174–94.

Rolemberg, I.; Lacerda, P. (2022). Violências contemporâneas contra lideranças na Amazônia brasileira: enquadramentos morais, legais e associativos. *Anuário Antropológico* (v.47 n.1): 87–106.

Veríssimo, A. (2023). *Amazônia 2030: Bases para o Desenvolvimento Sustentável*. Belém, PA: Instituto do Homem e Meio Ambiente da Amazônia.

Zúniga-González, C.; Palomares, R.; Duran, O.; Sánchez, A. (2014). *Estado del arte de la bioeconomía y el cambio climático / Red de Bioeconomía y Cambio Climático*. Nicaragua: Universidad Nacional Autónoma de Nicaragua-León Editorial Universitaria.

Climate-U
Transforming Universities
for a Changing Climate

About Transforming Universities for a Changing Climate

Climate change is the most significant global challenge of our time, and many of its effects are felt most strongly in the poorest communities of the world. Higher education has a crucial role to play in responding to the climate crisis, not only in conducting research, but also through teaching, community engagement and public awareness. This study contributes to our understanding of how universities in low and middle-income countries can enhance their capacity for responding to climate change, through a focus on the cases of Brazil, Fiji, Kenya, Tanzania, India and Indonesia. In doing so, it contributes to the broader task of understanding the role of education in achieving the full set of Sustainable Development Goals.

Our partners