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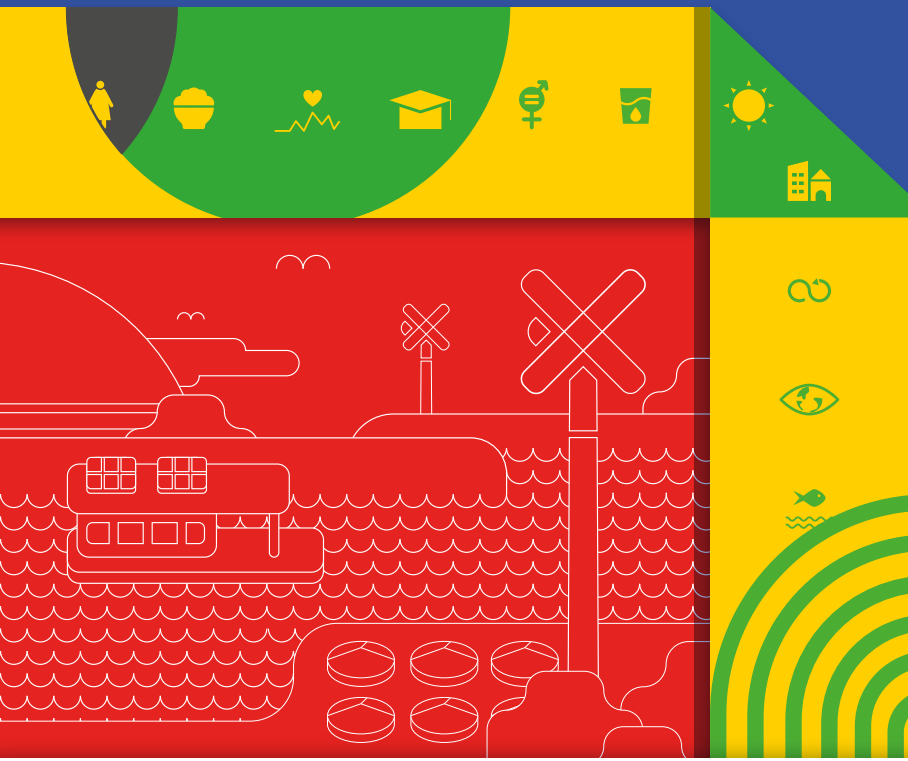
Volume 2

Sustainability Initiatives across Brazil's Federal Network of Professional, Scientific, and Technological Education



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Editors

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Sustainability Initiatives across Brazil's Federal Network of Professional, Scientific, and Technological Education

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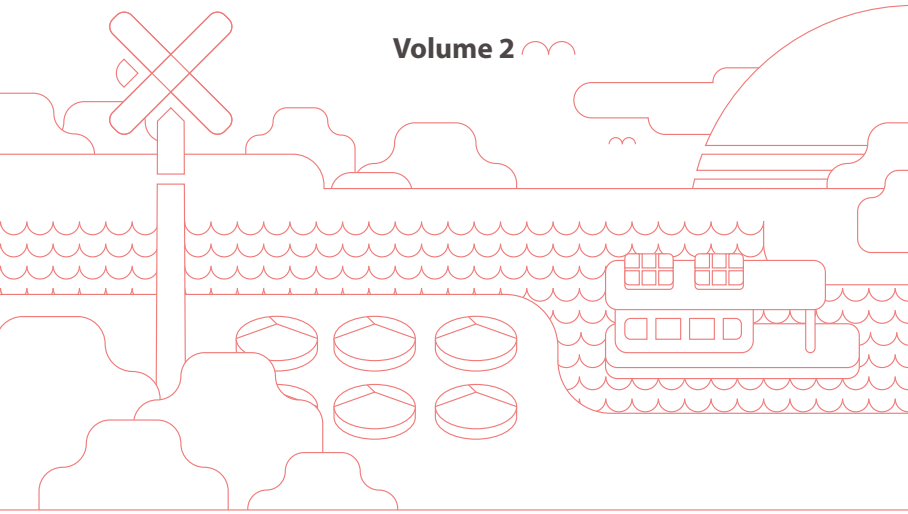

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Presentation

This publication emerges from a collective movement in favor of sustainability and innovation, at a moment of great significance: the 30th United Nations Climate Change Conference (COP30), held in Belém do Pará, Brazil. This global gathering symbolizes a shared commitment to building a fairer, more inclusive, and more balanced future. Within this context, the publication represents the concrete contribution of the Federal Network of Professional, Scientific and Technological Education to the international debate on sustainable development and socio-environmental responsibility.

Entitled *Sustainability Initiatives across Brazil's Federal Network of Professional, Scientific, and Technological Education: volume 2*, this book continues the series begun with Volume 1, published by the Federal Institute of Maranhão Press (Editora IFMA), which compiled experiences presented during the 1st Meeting on Sustainability Actions of the Federal Network, held in Poços de Caldas (MG) in 2023. Thus, this new volume consolidates and expands the record of institutional

practices aimed at sustainability, reaffirming the Federal Network's commitment to the continuity and strengthening of these actions.

The material brings together information, experiences, and results from 57 extension and innovation projects supported by a Public Call organized by the Federal Institute of Pernambuco (IFPE), in partnership with the Secretariat for Professional and Technological Education of the Ministry of Education (Setec/MEC) and the Institutional Development Forum (FDI) of the National Council of the Federal Network Institutions of Professional, Scientific, and Technological Education (Conif). These initiatives were presented at the 3rd National Meeting on Innovation in Professional and Technological Education (InovaEPT), held in Brasília in June 2025, and highlight how professional and technological education has been generating creative and transformative solutions to current challenges.

This movement results from the strategic and coordinated action of Setec/MEC, whose contribution has been decisive both in conceiving and managing sustainability-oriented initiatives within the Federal Network. By fostering structural public policies, promoting institutional collaboration, and supporting the implementation of innovative practices, Setec strengthens the integration of the pillars of teaching, research, extension, innovation, and institutional development. This coordinated approach has allowed

guidelines to be transformed into tangible practices with real impact on the territories and communities served by the Network.

More than a record of initiatives, this publication highlights the Federal Network's strategic role in connecting scientific knowledge, technology, and social commitment. The experiences presented here demonstrate, in an accessible and journalistic manner, how the axes of professional and technological education directly contribute to implementing the United Nations 2030 Agenda and the Sustainable Development Goals (SDGs).

The 57 projects featured were selected from more than 300 proposals submitted to Public Call REI/IFPE No. 11/2024, launched in March 2024. Each initiative reflects the diversity and reach of the Federal Network's work, evidencing its wide-ranging contributions. The projects address a broad spectrum of themes, including poverty eradication, sustainable agriculture, health and well-being, quality education, gender equality, clean energy, sustainable cities, climate action, life on land and below water, the reduction of inequalities, and institutional strengthening.

By systematizing these experiences, the publication reaffirms the relevance of the Federal Network as a space for integrating science, technology, and society, underscoring its commitment to civic education and

sustainable development. It offers a collective portrait of the transformative potential of professional and technological education when guided by the values of sustainability, innovation, and public responsibility.

Intended for students, teachers, administrators, researchers, policymakers, and the broader public, this publication seeks to inform, inspire, and mobilize. The joint effort behind its preparation illustrates the strength of the Federal Network when united around common goals. Each project presented here reaffirms that it is possible to build fairer and more resilient societies through knowledge, science, and innovation. May these pages inspire new actions and reinforce the conviction that global challenges can be met — and that education plays a decisive role in this process.

The preparation of this material was made possible through the dedication and collaboration of numerous individuals and institutions. We express our gratitude to Setec/MEC for its support and coordination of sustainability initiatives within the Federal Network. We also extend our acknowledgements to the Federal Institute of Pernambuco (IFPE), responsible for the Public Call that gave rise to the projects presented here, and to the communication and journalism teams that transformed technical information into accessible and inspiring narratives.

Special thanks are due to the proofreading and design teams for their dedication and commitment to the editorial quality of this publication, and to the coordinators and participants of the projects, whose effort and insight made it possible to present to Brazilian society and the international community the transformative role of the Federal Network in advancing sustainability.

Luciana Leal Pimentel Oliveira - IFPA
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October 2025

Preface

Over the past few years, sustainability has established itself as a guiding principle in the policies of the Federal Network of Professional, Scientific and Technological Education (RFEPCT). It conceives of education as a tool for promoting social transformation, while also encouraging innovation and sharing responsibility with future generations. In this context, the Federal Network reaffirms its commitment to civic education and sustainable development, grounded in robust actions that integrate both Teaching and Research, as well as Extension, Innovation, and Institutional Development.

Between 2023 and 2025, under the coordination of the Ministry of Education (MEC), through the Secretariat for Professional and Technological Education (Setec), such a subject has become the true base for the emergence of initiatives and projects within the Federal Network. This process has been taking shape through meetings, public calls, events, and publications that boost institutional leadership by developing practices which are aligned with the United Nations (UN) Sustainable Development Goals (SDGs).

It is important to highlight that, following the publication of this call, Brazil formally proposed and launched the 18th Sustainable Development Goal (SDG), aimed at promoting ethnic-racial equality. At the same time as the global framework of Sustainable Development Goals (SDGs) remains a set consisting of 17 objectives addressing universal challenges such as poverty eradication, zero hunger, health, education, and climate action, Brazil's 18th SDG adds an additional commitment, which focuses on eliminating violence against Black and Indigenous people, by promoting affirmative action policies, but also strengthening the rights of Afro-descendants and Indigenous peoples.

Despite being evaluated according to the 17 SDGs in effect at the time of the Call, the projects presented in this publication reflect the Federal Network's commitment to following and integrating future initiatives in line with new guidelines for sustainability and social justice.

This publication is the result of such a movement and is released at a singular moment: the upcoming COP30 in Belém (PA). The worldwide event focused on climate change highlights the shared commitment to building a fairer and more balanced future. On this matter, this material makes an effective contribution to the international debate on sustainability, innovation, and socio-environmental responsibility.

The publication gathers information, experiences, and outcomes from a Call for Proposals developed by the Federal Institute of Pernambuco (IFPE) and Setec/MEC.

These projects were presented during the 3rd InovaEPT, held in June 2025, in Brasília (DF). Each initiative highlights the strategic role of professional and technological education in developing solutions for the specific problems presented, combining scientific knowledge, technology, and social commitment.

Since the 1st Technical Meeting on Sustainability of the Federal Network, held in September 2023 in Poços de Caldas (MG) during the 20th National Congress on the Environment, the Federal Network has stepped up efforts to strengthen dialogue and collaboration among its member institutions. The meeting in question represented the beginning of a collaborative journey, which continued with the creation of the Group of Sustainability Experts (Geas); the 2024 Public Call for Sustainability Projects of the Federal Network; the 2nd Meeting on Sustainability Actions, held in Belém (PA); the 4th National Week of Professional and Technological Education; and the 3rd National Meeting on Innovation and Entrepreneurship in Professional and Technological Education (InovaEPT), all held in 2024.

In this process, the partnership with the National Council of the Federal Network Institutions of Professional, Scientific, and Technological Education (Conif) also stands out for its relevance. The Council has been a driving force behind the coordination, strategic planning, and consolidation of sustainable actions within the Federal Network, through the Institutional Development Forum (FDI). Such collaboration has become a qualified space

for collective construction, fostering the exchange of experiences among Federal Institutes and strengthening institutional policies focused on sustainability.

Continuous efforts contribute to consolidating both the dynamic of mutual support and the commitment to the responsible use of natural resources, as well as the promotion of social inclusion and environmental education. This publication represents more than just a collection of best practices; it stands as a record of institutional commitment, enhancing the Federal Network's role as an agent of transformation by connecting knowledge and practice.

The works featured here may inspire new initiatives, partnerships, and public policies focused on sustainability. This content is intended to contribute to raising the collective awareness of the strategic role of professional and technological education, in alignment with Brazil's global commitments within the framework of COP30.

We trust that this publication will serve as a valuable reference and source of inspiration for all those who believe in the transformative power of education and in the potential of the Federal Network to promote the establishment of a more just and sustainable world.

Marcelo Bregagnoli and Claudio Alex Jorge da Rocha
Secretariat for Professional and Technological Education (SETEC) of the Ministry of Education (MEC)
Brasília, October 2025

Potes Craftwork: a century-old tradition on the path to Geographical Indication

The quilombola craftwork of Potes seeks Geographical Indication to strengthen a hundred-year-old tradition

Craftwork from the Quilombola Community of Potes
Source: courtesy photo

The Quilombola Community of Potes is made up of 68 quilombola families, around 230 people living in a 112-hectare area.

In the rural area of São João da Varjota, 290 km from Teresina, the craftwork produced by the quilombola community of Potes preserves a cultural heritage handed down through generations by descendants of enslaved peoples. The clay pieces, shaped entirely by hand, retain unique forms, textures, and finishes that set this local production apart, earning recognition both within and beyond the state of Piauí.

The community was the focus of the project "Diagnosis and petition for the geographical indication of the craftwork of the Quilombola Community of Potes: a case study under the perspective of the SDGs". The initiative linked their traditional practice to the United Nations Sustainable Development Goals (SDGs) and assessed the potential of applying for Geographical Indication (GI), an official certification that recognizes a product's origin and adds value to it.

The study highlighted how this activity directly supports four SDGs: No Poverty (SDG 1), through income generation and social inclusion; Gender Equality (SDG 5), through women's leadership in the artisans' association; Decent Work and Economic Growth (SDG 8), through collective organization and formalization of activities; and Sustainable Cities and Communities (SDG 11), by valuing the quilombola identity and safeguarding cultural heritage.

Craft production is built on self-management: about 20 artisans, both men and women, share tasks ranging from extracting clay to finishing pieces and dividing profits equally. The material used, a fine, nearly pure clay, is sourced from a nearby deposit and mixed only with donkey manure,

an essential element that ensures the durability of the pieces, which can even be used for cooking.

This 100-plus-year-old community not only endures but strengthens itself through craftwork, which serves not just as a source of income but also as a bond between generations. The production process, carried out collectively in stages, brings families together and reinforces community ties.

Results achieved

- The diagnosis pointed to strong potential for recognition through Geographical Indication, whether by Indication of Origin (IO), given the community's long-established production, or Designation of Origin (DO), considering the human and cultural factors tied to the territory.

- Beyond valuing cultural heritage, the study strengthened community organization, outlined sustainable development strategies, and brought national visibility to this traditional know-how. The community now hopes to expand partnerships, improve logistics for marketing, and establish its production as a national benchmark in Brazil.

Interactions between IFPI's academic community and members of the Quilombola Community of Potes
Source: courtesy photo

"For us, having this connection with IFPI is of great importance. From the day of the first visit, when we welcomed IFPI into our community, it was a moment of joy. Since then, they have been helping us a lot with our projects and with communication. Today we are able to develop projects thanks to the professors at IFPI, and it makes us happy to share the achievements that came through the Federal Institute of Piauí, Oeiras

Campus. We also want to get closer to other IFPI campuses, because that will only add more and more to our projects, our work, and our struggles in the community".

Testimony of Maria Noelma, from Quilombola dos Potes Community

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Team: Wanessa de Sousa Gobbo Vieira (IFTM), Guilherme da Silva (IFPI), Ronan Barbosa de Lima (IFPI), Neurivânia Lopes Sousa (IFPI), Aritana Sousa Dutra de Melo (IFPI), Antonio Nilson Camelo (IFPI) and Ana Claudia Galvão Xavier (IFPI)

Family fish farming at IFMS generates income and strengthens agriculture in Mato Grosso do Sul

A pioneering project set up 36 fish-farming modules in three municipalities, providing families with training, healthy food, and new income opportunities

Tanks installed in a rural settlement
Source: courtesy photo

Each participating family earned about R$5,000 in just six months of production.

Between December 2021 and December 2024, the Federal Institute of Mato Grosso do Sul (IFMS) developed and implemented an innovative family-based fish-farming model. Fish farming, a branch of aquaculture, focuses on raising fish in controlled environments, ensuring healthy growth while

maintaining sustainable production. The project "Food, Social, Economic, and Environmental Empowerment in Family Farming through the IFMS Fish Farming Model" aimed at strengthening family farming through sustainable and technically advanced practices.

This trailblazing initiative in the state was aimed at family farmers and combines environmental sustainability, ease of management, and economic viability.

A total of 36 fish-farming modules were installed across three rural settlements in Mato Grosso do Sul: Bandeirantes (Miranda), Teijin (Nova Andradina), and Itamaraty (Ponta Porã), with 12 tanks at each site. The project also included technical training, ongoing production support, harvesting (removing fish at the ideal consumption stage), and assistance with commercialization.

The results were immediate: families gained access to high-quality food and secured an additional income of roughly R$5,000 every six-month cycle. The model also boosted the local economy, expanded family fish farming, and helped reduce poverty and food insecurity.

Low-cost, fast-return, and water-efficient, the system proved viable even in areas with sandy soil or limited water resources. Because it is closed, it also offers greater protection against diseases and predators.

With an initial investment of about R$15,000, each tank can generate a steady monthly income of over R$1,000 for the benefiting family.

Results achieved

- 36 modules installed in three rural settlements.
- Comprehensive technical training provided to producers.
- Average income of R$5,000 per family every six months.
- Strengthening of sustainable family farming.

Fish produced in the developed system
Source: courtesy photo

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Açaí biochar promotes sustainable agriculture and fights climate change in the Amazon

Ifam project transforms açaí agroindustry residues into biochar, improves soil fertility, increases productivity, and generates social, economic, and environmental benefits for rural communities

Biochar team with bean experiments in a greenhouse at INPA, Manaus-AM
Source: courtesy photo

Experiments indicate that açaí biochar reduces aluminum toxicity in the soil by up to 53% and increases corn and bean productivity in acid soils in Amazonas.

Between 2021 and 2026, the Federal Institute of Amazonas (Ifam), in partnership with the National Institute for Amazonian Research (Inpa), the Superintendence of the Manaus Free Trade Zone (Suframa), and the University of Lisbon, has been developing the project "Biochar: a path to agricultural sustainability and climate change mitigation". The initiative seeks to make family farming more productive and sustainable in the interior of Amazonas using biochar, a type of charcoal made from the controlled burning of organic waste, produced from residues of the açaí agroindustry.

The project serves family farmers, Indigenous, riverside, and quilombola communities in municipalities such as Manaus, Itacoatiara, Manacapuru, Iranduba, and Maués. In addition to improving soil fertility, reducing acidity, and increasing nutrient availability, biochar contributes to carbon sequestration and climate change mitigation.

The methodology involves producing biochar in low-cost ovens, agronomic trials with crops such as corn and beans, and Teaching, Research, and Extension activities, including field days, technical visits, and lectures in the communities. This integration promotes the training of students and

teachers, encourages the replication of the technology, and strengthens the Amazon bioeconomy.

Results achieved

- Biochar reduced aluminum toxicity in acidic soils by up to 53% and increased phosphorus availability by 1.6 times, improving corn and bean productivity.
- Four doctoral theses and several scientific articles on the agronomic effects of biochar are in progress.
- Over 200 farmers and students participated in field days and technical visits, learning biochar production and application techniques.
- The project strengthened partnerships with local and international institutions, fostering research and extension networks.
- The initiative promoted interdisciplinary training for students and teachers, expanding opportunities for Teaching, Research, and Extension focused on sustainability and climate change mitigation.

The project demonstrates how innovative, simple, and low-cost technologies can transform family farming, generate income, reduce environmental impacts, and increase food security in remote regions of the Amazon.

"I never imagined that the açaí seed could become something so important for farming. Biochar improves our soil and helps production".

Testimony of a family farmer from Itacoatiara-AM

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Urban agriculture strengthens education and health in the outskirts of Porto Alegre

Project started in 2019 has already built and revitalized nine community gardens, benefiting more than 1,200 people

Garden implemented at CAPSad III
Source: courtesy photo

The cultivation of gardens goes beyond food production. It is an instrument of education, community bonds and food sovereignty.

The “Urban Agriculture in Restinga” project, developed by the Federal Institute of Rio Grande do Sul (IFRS) - Restinga

Campus since 2019, has been transforming the reality of schools, social centers and communities in the Restinga neighborhood, on the outskirts of Porto Alegre. The proposal is simple and effective: to implement organic gardens that serve as spaces for environmental education, healthy food production and even therapeutic support.

In schools, the gardens have become living laboratories, where theory and practice meet in pedagogical activities involving students and teachers. In the Psychosocial Care Centers for Alcohol and Drugs (CAPSad), vegetable cultivation has taken on a therapeutic dimension, helping users in the process of care, reflection and strengthening of mental health.

Since 2019, the project has expanded its activities on two fronts. Internally, it was carried out with the creation of the EcoLabTinga Innovation and Entrepreneurship Habitat, which includes a fruit tree orchard, a community garden, a meliponary (a space dedicated to the breeding and management of stingless bees), agroforestry, a seedling greenhouse, a spiral of medicinal herbs, a worm farm, composters and even a bioconstruction for workshops. Externally, agroecological gardens were implemented and managed in nine schools and social centers in Restinga.

The workshops held in these spaces covered everything from preparing beds and seedlings to composting techniques using organic waste generated in kitchens and school meals. The material, which would have been discarded in landfills, is now transformed into a nutrient-rich fertilizer for

the gardens themselves. All activities follow the principles of organic farming, without pesticides or synthetic fertilizers, prioritizing sustainable practices such as crop rotation, green fertilization and biological pest control.

The results are already visible. More than 1,200 people were directly benefited, with the active participation of 20 scholarship students. Nine community gardens were built or revitalized. The environmental impact is evidenced in the reduction of organic waste sent to landfills, which began to be reused in the gardens. The social impact is expressed in community strengthening in a region of high vulnerability, encouraging the creation of family gardens and promoting food sovereignty.

Direct contact with production has helped improve eating habits and expand nutritional security for families. Many participants report that, inspired by the workshops, they began to cultivate gardens at home, bringing food they grew themselves into their kitchens. What began as an extension initiative is now recognized as a transformative action for education, health and sustainability in Restinga.

Target audience and results achieved

- Target audience: more than 1,200 people including students, teachers, technicians and the local community.
- Environmental results: use of organic waste through composting, reduction of landfill disposal and production of pesticide-free vegetables.

- Social results: community strengthening in highly vulnerable areas, encouragement of home food production and promotion of environmental education for children and adolescents.

Garden implemented at Street Clinic
Source: courtesy photo

Coordination: Jovani Zalamena – Federal Institute of Rio Grande do Sul (IFRS) – jovani.zalamena@restinga.ifrs.edu.br

Team: Tadeu Luis Tiecher (IFRS)

"Quiama": chemistry and agroecology in a network for the environment

Project from IFRJ connects science, ancestral knowledge and community to promote environmental education, income generation and sustainable innovation

Agroecology in the Favela course – Natural Cosmetics module
Source: courtesy photo

Created in 2019 at the Federal Institute of Rio de Janeiro (IFRJ) - São Gonçalo Campus, the project "Quiama: environmentally friendly chemistry" has been consolidating itself as an educational, scientific and community initiative that brings

together chemistry, agroecology and bioeconomy. The project established and maintains a 300-square-meter agroecological garden, where native species, fruit trees, vegetables, non-conventional food plants, medicinal plants and green manure plants are cultivated.

In the space, students and partners develop sustainable soil management practices, composting and agroforestry, in addition to processing the harvests into products such as extracts, dyes, functional foods and natural cosmetics. Part of this production is sold at fairs to support the project, while another part is donated through social actions and partnerships with institutions that serve vulnerable populations.

The project places women, youth, family farmers, artisanal fishers, and traditional communities at the center of its activities, building partnerships across São Gonçalo and neighboring municipalities. Women's movements, such as Mulheres da Parada and the Movimento de Mulheres em São Gonçalo, foster income generation, agroecology, and female entrepreneurship on the city's outskirts. Espaço Gaia also focuses on reproductive rights, popular education, and environmental justice, while cultivating urban agroforests.

Quilombola communities, including Quilombo do Feital, in Magé, bring together around 100 families. In the cultural and environmental fields, Agradim links art, artisanal fishing, and environmental education in São Gonçalo. Agroecological groups, such as the Associação de Produtores Rurais da Fazenda Engenho Novo and the Chalé Agroecológico, promote food security and safeguard traditional knowledge.

Among urban movements, Ressuscita São Gonçalo emerges as a key partner, dedicated to public policy, community mobilization, and strengthening territorial identity.

Results achieved

Since 2019, Quiama has involved more than 400 students and direct volunteers and served over one thousand people in its activities. Among the main results are:

- Cultivation of more than 100 plant species, with a current collection of 40 species in the agroecological garden.
- Development of more than 30 plant extracts and dyes, as well as 15 natural cosmetics and functional foods.
- Creation of a mobile and ecological exhibition of native seeds with more than 80 varieties.
- Offering of more than 20 courses, workshops and trainings.
- Training of 30 women in the Natural Cosmetics module in partnership with the Mulheres da Parada Association, resulting in the creation of the cooperative and brand Cheiro da Terra.
- Participation in academic, cultural and environmental events in different institutions and territories.

- Institutional recognition: in 2023, IFRJ - São Gonçalo Campus became a signatory of the Schools for Climate Movement.

- Awards: in 2024, it won the Brazilian Service of Support to Micro and Small Companies (Sebrae) Young League Challenge with an innovative natural repellent and won gold at the international World Federation of Colleges and Polytechnics Awards in the Sustainable Development Goals category.

Quiama shows that science, tradition and community can walk together to transform territories and create sustainable pathways for the future.

"The course gave us a humanized and sustainable approach, inspiring us to adopt healthier and more conscious practices. We learned to produce natural cosmetics such as soaps, deodorants and ointments, using plants like hibiscus, chaya and rose pepper. These products were very well received, especially the hair gel, which is soft and fragrant, and the barbatimao soap, which was a success. We are very satisfied with the results and eager to continue learning and applying the knowledge we have acquired".

Marta Almeida de Medeiros (external student of the Natural Cosmetics course – module of the Agroecology in the Favela course)

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Biofortification strengthens family farming and fights hunger in Pernambuco state

The "Nas Ramas da Esperança" project has already distributed more than 850,000 seedlings of biofortified sweet potatoes, reached 100,000 farmers in 12 states, and generated more than R$40 million in income

Training in the field: family farmers in practical training on social technologies
Source: courtesy photo

Under the intense sun of the Pernambuco backlands, a simple sweet potato vine came to symbolize something greater than food: hope. From it, the project "Nas Ramas da Esperança" (lit. "In the Vines of Hope"), created in 2010 at the Federal Institute of Sertão Pernambucano (IFSertãoPE), has become a consolidated initiative in the fight against hunger and extreme poverty in Brazil.

The project was born from applied research linked to the BioFORT Network and grew by articulating science, extension programs, and community participation. Its purpose is not

only to guarantee food security but also to ensure food sovereignty, the right of communities to produce, choose, and consume their own food, while respecting local culture and the sustainability of the territory.

Over the course of its trajectory, the project has delivered impressive results. More than 850,000 seedlings of biofortified sweet potatoes have been distributed and 45 tons of nutritious food have been donated to families in situations of vulnerability.

Agri-food Productive Units have been set up with gardens, solidarity kitchens, and productive yards, along with the structuring of a bank of biofortified seeds and seedlings, which has become a reference for farmers and schools in the region. Another highlight has been the training of farmers, students, women, and young people in sustainable practices of cultivation, nutrition, solidarity economy, and water management, combined with the use of accessible social technologies, such as efficient irrigation, organic composting, and the full use of food.

The beneficiaries are broad and diverse, including families in social vulnerability, family farmers and agrarian reform settlers, public-school students, traditional peoples and communities, women, young people, and civil society organizations. Expanding the model to other states has further increased the territorial reach of the initiative, making it a replicable experience in different contexts in Brazil.

The impacts are significant: more than R$40 million in income generated, reduced food insecurity, strengthened productive autonomy, and consolidated community networks of sharing and solidarity. National and international accolades reinforce the legitimacy of the work, such as the Certification of Social Technology in 2024 from Banco do Brasil Foundation, the 6th Public Spirit Award in the Social Development category, and the Pact Against Hunger Award in 2023 finalist.

More than just food distribution, Nas Ramas da Esperança has built a model of social transformation that combines science, social technology, and community participation.

> "Before the project, our community suffered from a lack of diverse and healthy foods. Today we have this benefit, we learned to grow and cook better, and our children have what to eat. The project is hope that brought us dignity".
>
> *Marlene Joana – Beneficiary farmer from the Assentamento Água Viva community, Petrolina-PE*

Cultivation of biofortified sweet potato 'CIP-BRS-NUTI'
Source: courtesy photo

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Vila Pirituba faces food desert marked by ultra-processed foods

Mapping study reveals the predominance of ultra-processed products and reinforces the urgency of public policies and food education

Vila Pirituba region as seen on Google Maps, with some of the cataloged commercial establishments
Source: courtesy photo

The study used georeferencing software to map the food supply in São Paulo's Northwest Zone and revealed a troubling scenario for public health.

The term *food desert* refers to areas where residents struggle to access affordable and nutritious food, a problem that can affect both urban and rural communities. The concept is not tied to fixed income levels, as the cost of living and wages vary across regions. Researchers identified this reality in Vila Pirituba, a district in São Paulo's Northwest Zone, through the study "Analysis of the supply of minimally processed and ultra-processed foods in the Vila Pirituba region".

Between April and December 2023, the study surveyed the food landscape in the district and uncovered a situation typical of a food desert, marked by a severe lack of establishments offering minimally processed products. Researchers used georeferencing tools such as Google Maps and QGIS to map local businesses and classify the food supply. The findings reveal that 80 percent of establishments in Vila Pirituba mainly sell ultra-processed foods, while only two types of outlets, such as green groceries and meat shops, prioritize minimally processed options.

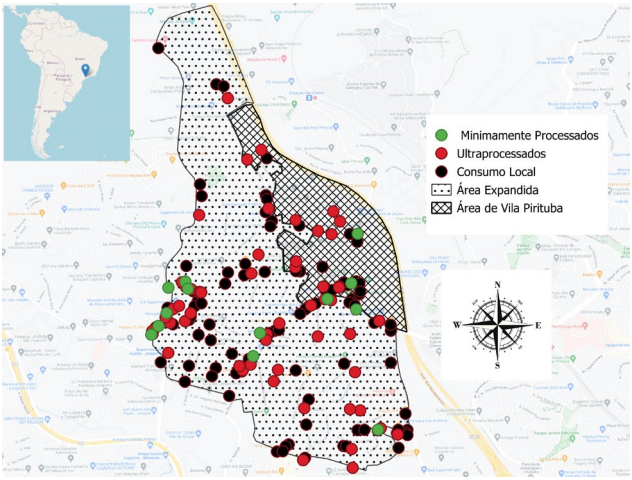
The team concluded that the district faces a significant shortage of establishments offering nutritious options. This finding points to the need for public policies to expand access to healthier foods. Developing effective strategies is

essential to encourage positive changes in the community's eating habits. Government and community initiatives can play a key role in diversifying the local food supply, while educational programs help residents understand the value of balanced diets and advocate for better choices.

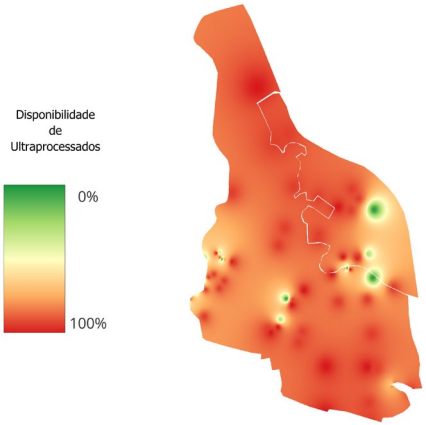
The case of Vila Pirituba reinforces the urgency of municipal and state public policies to ensure equitable access to quality food. Actions should combine food education, support for local markets and fairs, and subsidies for fresh products in peripheral regions.

Main data

- 80 percent of establishments in the district primarily sell ultra-processed foods.
- Only two types of establishments prioritize minimally processed foods.



Map showing the location of businesses that provide minimally processed foods, ultra-processed foods, and foods for local consumption
Source: courtesy photo



Heat map indicating the concentration of establishments offering minimally processed and ultra-processed products
Source: courtesy photo

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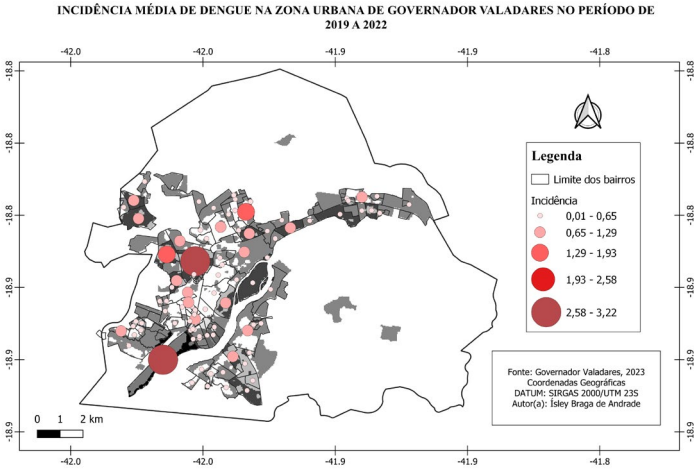
Research in Minas Gerais maps areas most susceptible to dengue fever using geotechnology tools

IFMG initiative aims to connect disease cases with geographic, environmental, and socioeconomic factors, supporting more effective public health management and planning



Average Incidence Map (2019 to 2022) in the urban area of Governador Valadares (MG)
Source: courtesy photo

The QGIS software was used to generate the map, validated by comparison with the average incidence of dengue cases recorded in each neighborhood over the past four years.

Across Brazil, many areas provide ideal conditions for disease-carrying vectors like the *Aedes aegypti* mosquito, which spreads dengue fever and other arboviruses. Population growth and unplanned urbanization have led to irregular land use, negatively impacting environmental balance.

As an attempt to contain this serious public health problem, especially in vulnerable urban areas, the Federal Institute of Minas Gerais - Governador Valadares Campus ran the project "Determination of spatial susceptibility to dengue in the urban area of Governador Valadares (MG)", using the integration between geographic information systems (GIS) and multicriteria analysis. The action was carried out between October 2022 and September 2023, serving the local population.

The project used geotechnology tools to map the areas most likely to experience dengue outbreaks. By linking reported cases to geographic, environmental, and socioeconomic factors, the initiative sought to offer technical guidance to improve disease control and public health planning in the municipality.

The work involved literature review, construction and processing of the spatial database, preparation of the susceptibility map through multicriteria analysis using the Analytic Hierarchy Process method, validation and analysis of the map.

In order to build the database, the team gathered information from the local city hall, the Brazilian Institute

of Geography and Statistics (IBGE), the National Institute of Meteorology (Inmet), and the Department of Information and Informatics of the Unified Health System (DataSUS). Rainfall, land cover, temperature, flood areas, altitude, and socioeconomic factors that favor the spread of the mosquito were ranked by importance. Free, open-source, and cross-platform software QGIS was used to generate the map, validated through comparison with the average incidence of dengue cases recorded in each neighborhood over the past four years.

Main results

- Analysis of Arbovirus Epidemiological Bulletins from 2019 to 2022 revealed that the areas with the highest disease notification rates in urban Governador Valadares coincide with the identified susceptibility zones.
- Areas at risk of dengue occurrence were mapped within an increasing range of vulnerability.
- Densely populated regions with poor infrastructure, such as Altinópolis and Santa Rita, as well as riverside neighborhoods frequently affected by floods, show higher propensity for dengue cases.
- Neighborhoods with better infrastructure are also subject to the disease, although with fewer reported cases.

"The research stands out for enabling more efficient vector control actions and for serving as a reference for future studies in the health field".

Isley Braga de Andrade, IFMG

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Technology for good: Northeastern innovation advances precision in breast cancer diagnostics

Federal Institute of Sergipe uses mathematical tools to improve digital imaging in mammography exams

Record of mammography image processing software
Source: courtesy photo

The research results were promising: of the 125 digital mammography images studied, 87.5 percent showed enhanced visualization of radiological structures.

Studies indicate that 10 to 30 percent of findings in mammography exams go unnoticed by radiologists during routine practice. This is concerning data, as breast cancer is one of the most common malignant neoplasms worldwide.

Mammography is recommended as the first-line diagnostic tool for disease early-stage detection, with a cure rate reaching up to 95 percent.

Research in software development is increasingly aimed at helping physicians interpret mammograms. Against this backdrop, the Federal Institute of Sergipe (IFS) launched the project "Enhancing Mammographic Images Using Haar Wavelet Transform and Anisotropic Diffusion Filter". The initiative ran from 2015 to 2020 and targeted radiologists and women undergoing mammography exams.

The study analyzed 125 digital mammography images taken from the Mammogram Mastery database. This collection, sourced from Sulaymaniyah, Iraq, includes 745 original images and 9,685 augmented images, featuring both patients diagnosed with breast cancer and those without the disease. In order to increase contrast, reduce noise, and enhance shape details, the team applied the Haar Wavelet Transform, a simple, fast, and efficient mathematical tool developed by Alfréd Haar for signal and image processing.

In addition, the team used two anisotropic diffusion filters to minimize irregularities and preserve visual details: the You & Kaveh Filter and the filter proposed by Barcelos et al., both based on partial differential equations. These techniques aimed to make diagnoses more precise, as the methods demonstrated strong results in medical image processing. The mathematical tools were deployed using the Python programming language, selected for its versatility, user-friendly nature, and open-access availability.

Results achieved

- 87.5 percent of the images studied showed improved quality compared to the originals, especially in visualizing radiological findings.
- The Haar Wavelet Transform showed the lowest performance, with 67.5 percent visual improvement.
- the Barcelos et al. filter showed significant improvement through the use of the PSNR (Peak Signal-to-Noise Ratio) metric.

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Smile, tick: low-cost technology monitors urban pests

Prototype with artificial intelligence identifies rats, cockroaches, and scorpions in real time, offering a sustainable and affordable solution for environmental control and public health

Product prototype
Source: courtesy photo

Automated system uses Raspberry Pi and integrated camera to alert users about the presence of pests in homes and institutions, reinforcing the prevention of accidents and diseases.

The rise in scorpion-related accidents and the constant presence of urban pests such as rats and cockroaches inspired the development of the project "Smile, tick, you're on camera!". The initiative created an automated system that combines affordable hardware, artificial intelligence, and local storage to monitor and identify pests in real time. Equipped with a Raspberry Pi 4, a 12-megapixel camera, and a 3D-printed structure, the prototype continuously captures images, processes data with an AI model trained on more than 17,000 images, and sends alerts directly to the user's smartphone.

The system was developed through many stages, from pest biology and behavior literature to field testing in high-risk environments, such as industrial kitchens. In low-connectivity situations, the data is locally stored and periodically updated, ensuring data integrity. The AI training, based on the YOLOv11 architecture, enabled high accuracy in species identification, achieving a success rate above 85% in initial tests.

The system's effectiveness was evaluated based on technical criteria such as pest identification accuracy, average response time between image capture and alert delivery, device autonomy in the field, and reliability of data storage. The collected information was used to make incremental adjustments to programming and the device's physical design, consolidating the system's viability as a tool to support environmental management and urban pest control.

In addition to technical efficiency, the project prioritizes sustainability and accessibility: the prototype costs approximately R$1,200, operates autonomously, and reduces reliance on traditional chemical pest control methods. The system also has an educational component, making it suitable for use in schools and public institutions to promote awareness of environmental health, accident prevention, and urban vector management. Future plans include expanding the database to include new species, such as ticks, and integrating georeferencing and environmental sensors to further broaden the system's reach.

Main data

- Species monitored: rats, scorpions, and cockroaches.
- AI trained with 17,726 images (5,283 rats, 7,849 scorpions, and 4,594 cockroaches).
- Initial accuracy rate: over 85%.
- Estimated prototype cost: R$1,200.
- Application: homes, schools, and public institutions.

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Braided knowledge: Mathematics teaching project engages with elements of indigenous education

The Federal Institute of Roraima proposes actions which aim at valuing traditional knowledge and strengthening contextualized pedagogical practices

Texts being created by teachers from the Raposa and Baixo Cotingo communities
Source: courtesy photo

"Having the SDG Education Seal implies in the recognition that teaching Macuxi literacy means resisting and building a future of belonging for our children".

Adnelson Jati Batista, Vice-Rector of IFRR

Imagine creating bilingual teaching materials that combine basic mathematical concepts and community experiences through authentic cultural elements such as songs, nursery rhymes, stories, games, and traditional practices. Such is the essence of the project "Brading Mathematics teaching with elements of indigenous school education, cultural roots and sustainability in the Raposa Serra do Sol region", carried out between August 2023 and December 2024 by the Federal Institute of Roraima (IFRR).

The innovative proposal was collectively developed based on ethnomathematics—a concept that considers mathematical knowledge as influenced by different cultures, that is, by human relationships with the world. The initiative integrates concepts of preschool mathematics and knowledge of Macuxi culture, focusing both on valuing the mother tongue and preserving cultural identity.

The project directly benefited 75 Indigenous teachers and three preschool and elementary school classes at Macuxi schools in the Raposa and Baixo Cotingo regions of Normandia, Rio Grande do Norte. Among the target audience are children in the literacy phase, teachers, who are also students from the Indigenous Education Department, besides their communities, and also families and local residents.

The result of this work was the creation of the book Ko'Ko Rutî – Grandma Jamanxim, in which five fictional characters – Makanaru, Caruskaimî, Ari'ku, Karisiya and Apen – interact with children's daily lives, in order to make the

learning process more attractive. Besides, the work helps to strengthen young readers' self-esteem, expands student empowerment, encourages community participation, and also provides innovative teaching tools.

The process directly involved the IFRR's Indigenous Education Technical Course, in which the teachers, who were also students, contributed to the development of the material. The process stages included workshops on ethnomathematics; discussion groups with teachers; working groups to develop content, mathematical problems, recording songs, recreational activities, and illustrations; content analysis and socialization of activities; testing through modeling lessons and the application of prototypes with Indigenous students, monitoring interactions and collecting feedback; as well as community meetings and cultural events.

The results, in addition to reinforcing the initiative's impact on promoting Macuxi culture, contribute to strengthening indigenous identity and pedagogical innovation in mathematics teaching.

Results achieved

- Production of 1,000 copies of the bilingual book Ko'Ko Rutî – Vovó Jamanxim (Macuxi-Portuguese): intended primarily for pedagogical use in schools in the region and for indigenous communities.

- Public recognition: 1st place with the SDG Education Seal, an award granted by the Roraima National SDG Movement, as a contribution to the promotion of inclusive and quality education.

"Seeing my grandson reading and singing in Macuxi, inspired by the pandoms we wrote, made me feel that the language and culture of Raposa will not be forgotten: this book is restoring our pride".

Member of the Macuxi community, from the Raposa Serra do Sol territory

"Participating in the production of Vovó Jamanxim was an enriching experience. The work symbolizes our identity and our deep connection with nature".

Eitiane Silva dos Santos, Indigenous teacher and author

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“Ecotech”: innovative methodology integrates schools, communities and nature

The project uses interpretive trails and digital technologies to incorporate environmental education into school curricula, promoting sustainability and youth empowerment

Marisqueiras River – river route Pacatuba/SE
Source: courtesy photo

Both trail app, QR code signs, and also teacher training strengthen environmental education in mangroves and sandbanks, by integrating scientific and traditional knowledge.

The "Ecotech: a replicable methodology for curricula aligned with Law 14.926/2024" is an environmental education project launched in 2021, during the pandemic, with the motto "Knowing to Belong," which seeks to bring schools and communities closer to nature. Based on interpretive trails within mangrove and restinga ecosystems, the project functions as an open-air laboratory, which offers educational experiences that integrate curricular content, ancestral knowledge, and digital technologies. Ecotech's main deliverables include mapping and signage of the trails, installing interpretive signs with QR codes that provide access to interactive content, developing a trail app, creating the Fisherman's Network to connect artisanal fishermen with consumers, and publishing the book "Environmental Education for Basic Education: Formative Paths," a reference for teacher training in active methodologies.

The project's target audience includes students from the basic education network, teachers in continuing education, and traditional communities, such as shellfish gatherers (women who fish and collect shellfish) and fishermen, who actively participate in the trails, workshops, and experiential tourism activities. The methodology encourages youth leadership by encouraging students to map, mark, and guide trails,

while teachers receive training in outdoor learning, critical environmental education, and the integration of curricular content through local socio-environmental practices.

The results achieved by Ecotech are impressive and are constantly expanding. The interpretive trails are already included in the official ecotourism itinerary of the municipality of Estância, in the state of Sergipe, which strengthens local income generation, as well as experiential tourism. The trails app and the Fisherman's Network expand sustainable production chains, in addition to bringing students, communities and consumers closer together. The project contributes to the implementation of the National Environmental Education Policy (Pnea) and Law No. 14,926/2024 (Law No. 9,795/1999, amended by Law No. 14,926/2024), by promoting environmental education in school curricula and teacher training. The initiative also expands its reach to new municipalities, such as Indiaroba and Santa Luzia, in addition to forging strategic partnerships with agencies such as the Federation of Trade in Goods, Services (Fecomércio) System and the Chico Mendes Institute for Biodiversity Conservation (ICMBio), a federal agency linked to the Ministry of the Environment that aims to protect Brazil's environmental heritage. Nationally recognized by the Criativos da Escola + Natureza Award and also present at international preparatory events for COP30, Ecotech has established itself as a benchmark among environmental education, socio-environmental innovation, and the integration of science, local culture, and sustainability.

The initiative also expands its reach to new municipalities, such as Indiaroba and Santa Luzia, besides establishing strategic partnerships with agencies such as the Federation of Trade in Goods, Services (Fecomércio) System and the Chico Mendes Institute for Biodiversity Conservation (ICMBio), a federal agency linked to the Ministry of the Environment that aims to protect Brazil's environmental heritage. Nationally recognized by the Escola + Natureza Creative Awards, in addition to being present at international preparatory events for COP30, Ecotech has established itself as a reference in environmental education, socio-environmental innovation and integration among science, local culture and sustainability.

> "As a teacher at this unit, I feel deeply touched and grateful to be part of this movement that not only reconfigured pedagogical practices but also revived in us, educators, a commitment to transformative education, which is based not only on caring both for life and the earth, but also on caring for each other".
>
> *Teacher at the partner school*

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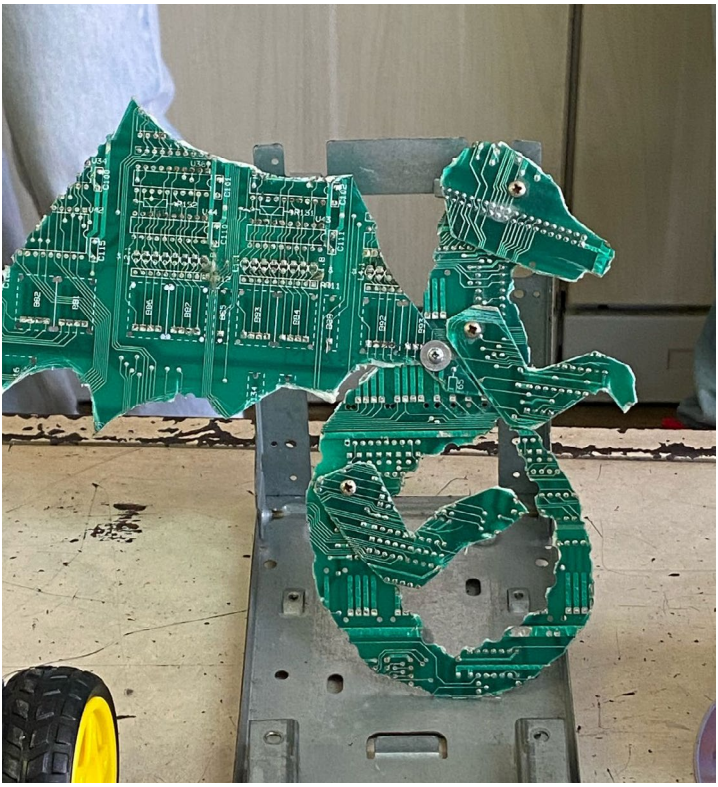
"Earth Project" raises awareness in Pará about the disposal and reuse of electronic waste

Developed at IFPA, this work minimizes negative impacts on the environment and public health, in addition to encouraging the production of artistic and educational materials



Dragon built from printed circuit boards
Source: courtesy photo

The initiative educates students on the culture of recycling, by covering proper waste disposal, the circular economy, electronics through sustainable robotics, and the creation of handmade books.

One of the biggest environmental problems nowadays is the growing production of waste and its incorrect disposal. This action, when carried out in a disorderly manner, has negative effects on the population's health and on the preservation of the environment. Classic examples of this action are electrical and electronic equipment, which generate waste known as electronic waste (e-waste). Proper recycling of these devices allows for the recovery of valuable metals such as gold, silver, and copper, which reduces the need to mine these resources.

With this in mind, the Federal Institute of Pará (IFPA) carried out, from March 2024 to March 2025, the "Earth Project: using electronic waste as a tool for developing environmental awareness, through the production of artistic and educational materials". The aim of the project was to raise awareness among IFPA students and the academic community about this issue, in addition to enabling the use of waste as raw materials for the development of other projects.

Throughout the year, the following activities were undertaken: training for the students involved; collection and sorting of electronic waste (donation from the Federal Highway Police in Pará); development of artistic artifacts and robotic projects

from the collected material; and production of handmade books – in Portuguese and English – on the project's theme, in partnership with the Brazil-United States Cultural Center (CCBEU).

In addition, the team visited six public and private schools in the municipality of Belém in order to share the acquired experience from the initiative. The meetings included lectures, workshops and an exhibition of the materials produced. The "Earth Project" included students from the following courses at the Belém Campus (IFPA): Control and Automation Engineering, Technology in Systems Analysis and Development, Integrated Technician in Electronics, Sanitation, Interior Design, Buildings and Systems Development.

Results achieved

- Raising awareness of environmental issues, circular economy, development and sustainable robotics.
- Social and educational impact on students who benefit from the project, both in the schools visited and in the academic community.
- Implementation of conscious disposal culture and its benefits.
- Improvement of the English language, due to the use of bilingual material.

Main deliverables

- Teaching material on electronic waste, reuse and environmental impacts.
- Six artistic artifacts.
- Six robotic systems
- 36 handmade books on this topic, in Portuguese and English, produced based on students' experiences.
- Workshops offered in six public and private schools.

Artistic artifacts made from CDs and keyboards
Source: courtesy photo

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Mandacaru Tech: Accessible Education 4.0 in the Paraíba Backlands

Initiative maximizes social impact by strengthening digital inclusion in public schools with limited connectivity

Huawei Innovation Competition Award
Source: courtesy photo

Bringing together digital inclusion and training in skills for the Economy 4.0 with a focus on public schools with reduced technological infrastructure: this is the main goal of the Mandacaru Tech project, an initiative of the Federal Institute of Paraíba (IFPB), Campus Patos.

The initiative, which integrates Teaching, Research, Extension, and Innovation, enabled the development of a low-cost

educational Computer Numerical Control (CNC) machine that functions as a plotter, router, and laser. A CNC is a computer-controlled machine that follows commands (G-code) to cut, draw, or assemble pieces with high precision. In Mandacaru Tech, it was adapted for use in schools: easy to assemble, safe, and able to operate even with no internet access.

In addition, an Artificial Intelligence (AI) platform was created to help teachers prepare lesson plans, activities, and projects aligned with the National Common Curricular Base (BNCC). The tool connects subjects such as programming, automation, and digital manufacturing with school curriculum disciplines.

Mandacaru Tech won first place worldwide at the Huawei ICT Competition 2024 by developing an impactful and pre-incubated business model.

The methodology combines agile management, interactive hardware and software development, and educational validation in real contexts. The process involved adopting tools and strategies for technical development, pedagogical application, product management, market entry strategy, and replicability. This pathway demonstrated scalability potential, recognized even in an international competition that awards students with innovative technology projects.

The initiative enhances student engagement and performance in Science, Technology, Engineering, and Mathematics (STEM), while also strengthening teacher training for the pedagogical use of enabling technologies, with replicability through maker labs, municipal departments, and the Federal Network of Professional, Scientific, and Technological Education (RFEPCT).

Main deliverables

- Three low-cost CNC models adapted to the school context.
- Two AI models for teaching support and reduced computational effort.
- Educational application.
- Multidisciplinary teaching materials.
- Testing and workshops in partner schools.
- Software registrations.

The target audience includes basic and professional education students and teachers in the Alto Sertão region of Paraíba, with emphasis on municipal and state public schools, as well as IFPB students, staff, and members of the local community. The territorial focus supports the principle of digital inclusion

by addressing contexts with lower infrastructure, maximizing social impact through modular and low-cost equipment.

Results achieved

- Real tests: pilot implementation in public schools.
- Broad participation: 130 participants, including students in vulnerable situations.
- Technological development: functional educational CNC models, prototyped and validated in labs and schools, with modular low-cost structure adapted to classrooms.
- Accessible technology: functional CNC machines adapted for classroom use.
- Practical digital solutions: user-friendly software and app supported by AI.
- Teaching support: platform with updated lesson plans and content.
- Recognition: award, participation in events, and support from partners.
- Business model: creation of an educational startup.
- Replication: project expanding to other campuses and municipalities.
- Contribution to the SDGs: focus on quality education, digital inclusion, and future skills.

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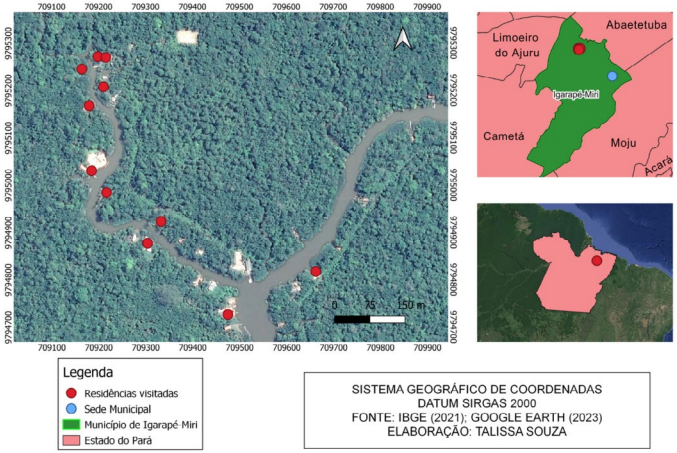
Menstrual poverty still affects riverside women in Pará

Study identifies the existence of health, sanitation and social taboos challenges in the Cotijuba River community, in Igarapé-Miri



Geographical location of the Cotijuba River community.
Source: courtesy photo

IFPA research in the Amazon reveals precarious sanitation, lack of access to drinking water, and lack of knowledge about menstrual health, factors that increase gender inequalities in the region.

The study developed at the Federal Institute of Pará (IFPA) Campus Belém, entitled "Studies on menstrual poverty, social technologies in sanitation and sustainability objectives in the Amazon", investigated, in its first stage, the reality of menstrual poverty in the riverside community of the Cotijuba River, located in the rural area of the municipality of Igarapé-Miri, in the state of Pará. The survey, conducted between 2022 and 2023, revealed that factors such as the lack of sanitation infrastructure, low income and the persistence of cultural taboos directly impact the health and dignity of residents.

Of the 19 women interviewed, the majority were between 18 and 39 years old. More than half (52.6%) did not complete elementary school. In terms of occupation, 36.8% declared themselves housewives, the same percentage were fisherwomen, while 21% were students and only one was a farmer. All lived on an income of up to one minimum wage.

Housing conditions reinforce the vulnerability of the interviewees: most families (80%) have a wooden "little house" (used as a bathroom) outside their residence, with sanitary facilities in precarious conditions, without roofing, lighting or water. Only 20% have a bathroom inside their homes. Among the toilets found, 60% were improvised, and almost 80% of them were in poor condition. In most cases, bathing is done inside the "little house" itself (52.6%), but some of the interviewees still bathe in the river (26.3%).

The menstrual experience reported by women reveals both material and social limitations. Many associated the cycle with pain, discomfort and restrictions imposed by

their husbands based on beliefs that women should not make strong efforts during this period. Regarding hygiene, difficulties are frequent: collecting water from the river is mandatory when there is a power outage, even when the water quality is affected by the tide, which makes it unsuitable at certain times.

Regarding care, most people use disposable pads, which are purchased in the city or at local stores and paid for later. In cases where there is no absorbent pad, they resort to alternatives such as a cloth or toilet paper, which are burned as a form of disposal.

The study also highlighted men's refusal to talk about the topic, whether out of shame or contempt, reinforcing the idea that menstruation continues to be seen as a "women's issue only."

The results reinforce the need for public policies focused on menstrual health, which enable access to sanitation, promote sexual education and provide decent housing, thus reducing gender inequalities and guaranteeing basic rights, in line with the Sustainable Development Goals (SDGs).

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Ribeirão das Neves, in Minas Gerais, is the focus of a statistical study on surface water quality

IFMG initiative connects analytical skills in tables and graphs to skills focused on environmental awareness and the promotion of critical citizenship

Diagnosis of sections one, two and three of Ribeirão das Neves
Source: courtesy photo

Ribeirão das Neves, a body of water located in the municipality of the same name in the Metropolitan Region of Belo Horizonte (MG), is facing serious changes in its course and surroundings, as well as sewage pollution. Especially in urban areas, waterways have been undergoing significant changes due to human activities. Seeking a monitoring initiative, the Federal Institute of Minas Gerais (IFMG) created the project "Statistical Analysis of the Quality of Surface Waters in Ribeirão das Neves," which will run for 12 months starting in February 2024.

The research focused on the use of statistical tools to analyze and interpret inspection data on the conditions of the stream's surface waters. This study was carried out using the statistical software R, as a complement to the learning of statistics in scientific initiation projects.

It's worth noting that statistics are essential in basic education, as they foster scientific thinking and the development of critical citizens. In high school, the National Common Curricular Base (BNCC) emphasizes skills in analyzing tables and graphs, in addition to emphasizing environmental education as responsible for fostering skills focused on environmental conservation. In this sense, students have the opportunity to address real-world problems—such as the lack of sewage collection and treatment in Brazilian cities, which results in a significant pollution burden on water bodies. The project's target audience included young researchers and high school scholarship recipients, as well as the general community.

The methodology for this study initially involved preprocessing information provided by the Minas Gerais Water Management Institute (IGAM), which was quantified using parameters commonly measured at monitoring stations. For the water quality analysis, were selected the following parameters, which make up the Water Quality Index (WQI): phosphorus, biochemical oxygen demand (BOD), dissolved oxygen (DO), turbidity, pH, temperature, total suspended solids, and thermotolerant coliforms.

After tabulating the data, the selected parameters were analyzed using measures of central tendency, dispersion,

correlation, graphs, and box plots. The percentages of violations of water quality standards were calculated. Three stretches of the Ribeirão das Neves were selected for a rapid assessment protocol.

In computational modeling, artificial neural networks (ANNs) were used to simulate the AQI. The developed model was consistent with the results provided by IGAM, which simplified the index calculations and eliminated the need for complex equations and graphs.

The research indicated a state of severe degradation of this stream. Of the three sections analyzed, two are classified as altered and one as impacted, reinforcing the need for environmental management.

In order to expand the access to the results, an interactive dashboard was developed: the panel allows dynamic exploration of the data, including statistics, graphs, comparisons between dry and rainy seasons, and AQI simulations using ANNs. This tool makes visualization more accessible to researchers, managers, and the community.

Main deliverables

- Interactive dashboard: dynamic and accessible visualization.
- Scientific submissions: papers presented at scientific conferences.

- Academic production: full and expanded abstracts; scientific article submission.

"The methodology, which integrates statistics, artificial neural networks, and interactive dashboards, can be applied to other contexts, expanding the scientific, educational, and social impact of the initiative".

Gabriela Oliveira, coordinator

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Northern Region: project analyzes the impacts of climate change on waterborne diseases

Developed by the Federal Institute of Amazonas, the study seeks to relate environmental conditions and epidemiological data in Amazonian communities

As a practical application, interactive dashboards were created using the Power BI data analysis platform. This initiative provides transparency and public access to the research indicators.

The Federal Institute of Amazonas (Ifam) completed, between 2024 and 2025, the project "Analysis of the impacts of climate change on waterborne diseases in the North region of Brazil: a data science-based approach". Over the course of almost two years, the research sought to analyze the interactions between climate variables, sanitation indicators and epidemiological data related to the following diseases: dengue, chikungunya, Zika, leptospirosis, viral hepatitis, leishmaniasis, schistosomiasis, malaria, yellow fever, diphtheria and acute diarrheal diseases (ADD).The study was funded by the Ministry of Health and CNPq, within the scope of the following call "Data Science: Climate Change and Impacts on Health"' (2023).

The main objective was to understand the magnitude of the association between environmental factors and epidemiological outcomes, focusing on climate-sensitive diseases. The analyses combined exploratory and inferential statistics, spatial modeling (Moran and Lisa indexes), and regressions, as well as climate interpolation in the GIS (Geographic Information System) visualization environment, using the QGIS application.

The research adopted a multidisciplinary approach by combining environmental statistics, data science and geospatial analysis. To this end, data from 2002 to 2022 were integrated from the Notifiable Diseases Information System (Sinan), the Epidemiological Surveillance Information Systems (Sivep-Malaria and Sivep-DDA), the Ministry of Health's Indigenous Health Secretariat (Sesai-MS), in addition to climate and sanitation information from the National Institute of Meteorology (Inmet), the Brazilian Institute of Geography and Statistics (IBGE) and the Trata Brasil Institute.

The results showed that poor basic sanitation is the main factor behind the increased incidence of dengue fever among indigenous peoples in Amazonas. Climate variability, particularly precipitation and temperature, directly influenced the dynamics of diseases such as leptospirosis and ADD.

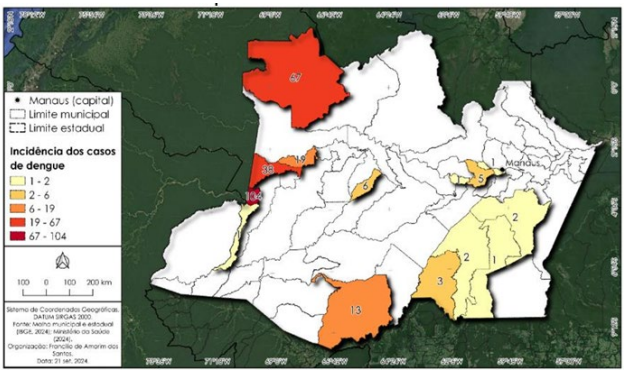
The integration of data science, environmental statistics, and geotechnologies can provide robust evidence to support public policies aimed at mitigating the impacts of climate change on the health of Amazonian populations. As a

practical application of the project, interactive dashboards were created using the Power BI data analysis platform (available at www.climadovhi.com). This initiative provides transparency and public access to the indicators.

The project benefited riverside populations and indigenous peoples of the Amazon, characterized by high socio-environmental and health vulnerability. Furthermore, the initiative benefited municipal, state, and federal health managers and professionals, as well as undergraduate and graduate students, through scientific initiation, extension, and technical training.

Results achieved

- The incidence of dengue fever among indigenous peoples was highly concentrated in municipalities such as Tabatinga, São Gabriel da Cachoeira and Santo Antônio do Içá, which were marked by the lack of sanitary infrastructure and sewage collectio.



Incidence of dengue cases among indigenous peoples of Amazonas (2012 to 2023)
Source: courtesy photo

- Municipalities with higher rainfall volumes did not necessarily have higher dengue rates; that is, structural precariousness plays a more decisive role than isolated climatic factors.

- The correlation matrix between climate, sanitation and health variables demonstrated a robust negative pattern between the treated sewage index and the incidence of hospitalizations, as well as between sewage treatment and mortality.

- The lack of sewage collection is directly related to hospitalizations and mortality, a fact that highlights sanitation as key to mitigating waterborne diseases.

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IFMG, along with other institutions, proposes a solution for domestic sewage in Cachoeira do Brumado

The project seeks to reduce the impact of wastewater discharge into the stream and help restore the bathing conditions of the waterfall, a tourist landmark in the Minas Gerais district

Evapotranspiration Tank (TEvap) or ecological septic tank
Source: courtesy photo

The project "Participatory sanitation: protecting health and generating jobs and income in rural communities of the district of Cachoeira do Brumado, municipality of Mariana (MG)" was launched in response to a call for interinstitutional projects on the impacts of Covid-19 and the Fundão Dam collapse. The two-year initiative led by the Federal Institute of Minas Gerais (IFMG), in partnership with the Federal University of Ouro Preto (Ufop), and the Federal University of Viçosa (UFV), was concluded in 2022.

The selected project was funded with resources from a fine imposed on Samarco Mineração by the Ministry of Labor, with a focus on actions contributing to the achievement of the Sustainable Development Goals (SDGs). The proposal established domestic sewage treatment systems using ecological septic tanks built with recycled materials by linking the degradation of water resources, poor sanitation conditions in the region, and the impacts on the local economy.

The district's waterfall, once a draw for tourism, has become unsuitable for bathing due to untreated sewage discharge thus creating health risks for residents and visitors. In 2015, authorities closed the site to visitors, a measure that affected the local economy by driving tourists away. Activities such as soapstone handicraft sales and family farming were severely impacted by the decline in water quality.

The project supported the development of a self-management model for basic sanitation in the Ribeirão do Brumado sub-basin. Among the alternatives considered, the ecological septic tank or Evapotranspiration Tank (TEvap) was adopted

for its low cost, aesthetic quality, and the advantage of producing no liquid waste. Working alongside the community, the team sought strategies to reduce wastewater discharge into the stream and contribute to restoring the waterfall's bathing conditions.

The concept of ecological sanitation is based on separating domestic waste streams into two cycles: one for water and another for nutrients and energy. A key principle is to treat excreta as material to be recycled rather than discarded. Instead of a linear model, as seen in traditional sanitation, a closed-cycle system was proposed. Once disinfected, excreta can be safely used as fertilizer, promoting sustainable food production.

The project methodology included weekly meetings to evaluate and plan actions, meetings with community associations, training for both the team and local residents, hiring local labor for construction, identifying and using renewable local materials, building and monitoring ecological septic tanks, monitoring water quality, educational activities in schools, and financial resource management.

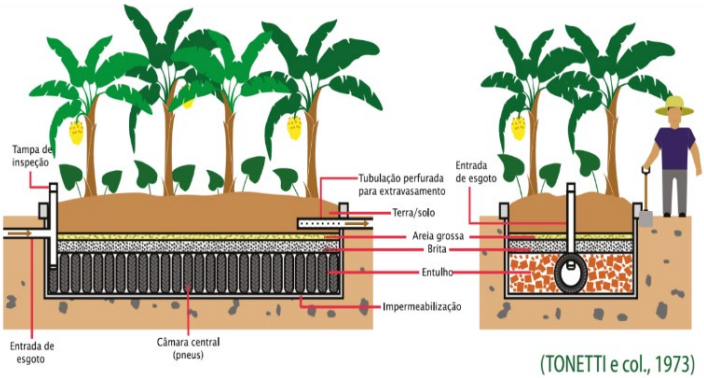
It also involved students from all three participating institutions. At IFMG, participants included vocational school students in Environmental Studies at the Ouro Preto campus. The project also engaged residents and tourists.

Results achieved

- Construction of ecological septic tanks, leading to improved public health for residents and visitors.
- Use of renewable local materials, with community adoption of construction techniques and improved quality of life.
- Strengthening of family settlement in the area, integrating housing with the environment.
- Community training, raising awareness of the importance of sewage treatment for restoring the waterfall and boosting the local economy and tourism.
- Application of the project's methodology in other institutions' research, teaching, and extension initiatives, supported by the high rates of untreated sewage discharge into streams and rivers, the low cost of implementation, and the availability of recyclable materials.

"The project demonstrates the importance of sewage treatment for promoting the health of residents and visitors. It is a seed planted in the district that has grown and continues to work well two years after its implementation".

Juracy Eleutério, local resident of Cachoeira do Brumado



Evapotranspiration Tank (TEvap) or Ecological Septic System
Source: courtesy photo

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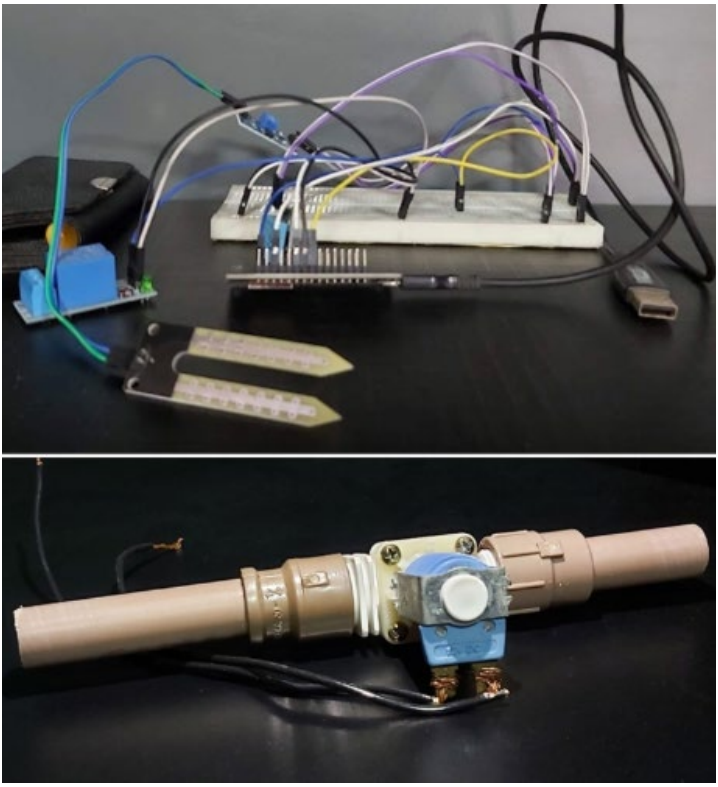
Irriga+: an app that automates irrigation and promotes efficiency in family farming in the Amazon

Tool developed at Ifap allows real-time control of fruit seedling irrigation, reducing water waste and simplifying management



Prototype of automated irrigation system with soil and air sensors
Source: courtesy photo

Low-cost technology connects small farmers to innovative solutions, increasing productivity and sustainability in the use of water resources.

Ensuring adequate irrigation is one of the biggest challenges for family farming, a practice that requires time, physical effort, and high water and energy consumption. To address this challenge, researchers at IFAP Campus Porto Grande developed the Irriga+ app, which, integrated with soil moisture, air temperature, and humidity sensors, is capable of automating the irrigation process and making management more efficient.

The system uses the MIT App Inventor platform, communicating via Bluetooth and internet with an Arduino UNO. Irrigation is automatically triggered when predefined moisture levels are reached, but the user can also manually control the system. Tested at IFAP's experimental farm, the app demonstrated a significant reduction in water waste and greater control over the management of fruit seedlings.

The target audience includes smallholder farmers from Porto Grande, AP, who were able to validate the tool in the field and see how accessible technologies can facilitate daily work, reduce costs, and increase productivity. Furthermore, Irriga+ has potential for application in other family farming systems in the state, by bringing rural communities closer to innovative and sustainable solutions.

Developed with technologies such as programming, the Internet of Things (which connects physical devices to the internet for remote monitoring and control), electronic prototyping, and robotics, the application allows online control of water flow through a solenoid valve (a device that releases or blocks the flow of a fluid), also monitoring the temperature and humidity of the environment. Its functions include turning irrigation on and off, setting schedules and customizing parameters, ensuring that each farmer can adapt the system to their specific needs.

Field testing of the application with family farmers in the municipality of Porto Grande, in Amapá
Source: courtesy photo

The project "Irriga+: an app for an automated irrigation system for fruit tree seedlings in the Amazon" represents an innovative alternative to simplifying daily irrigation tasks, promoting

greater productivity and profitability for rural producers. Demonstrating these practices to the local community also encouraged the adoption of technologies in subsistence farming, strengthening the connection between science, technology, and rural communities, in addition to contributing to the more sustainable use of the region's natural resources.

> "The app makes our work in the fields much easier by saving water and time. I never thought it would be possible to use a cell phone to manage irrigation".
>
> *Farmer participating in the test*

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Federal Network's Sustainable Innovation Hub invests in environmental practices and community engagement

A project at the Federal Institute Fluminense implements the Environmental Agenda in Public Administration (A3P), promoting efficient resource management, sustainability, and integration with the community of Barcelos (RJ)

Presentation of the project at the 17th Scientific Initiation Congress (Confict) of the Federal Institute Fluminense (IFF) Guarus Campus
Source: courtesy photo

The initiative aims to establish the Innovation Hub as a benchmark in sustainable practices and environmental education, engaging employees, students, and community members alike.

In April 2024, the Federal Institute Fluminense (IFF) launched the "Federal EPT Sustainable Innovation Hub," a project set to run until 2028. The initiative focuses on implementing the Environmental Agenda in Public Administration (A3P) through a comprehensive assessment of natural resource use, waste management, energy efficiency, and workplace quality of life. The plan also calls for mapping expenditures and reviewing existing programs, using tools such as interviews, surveys, document analysis, and field observations.

The Campos dos Goytacazes Innovation Hub (PICG), accredited by the Brazilian Company of Industrial Research and Innovation (Embrapii) in 2015, has consolidated itself as a transformative agent in developing Cleaner Production technologies. The hub works across sectors such as energy, waste, and water, striving to balance technological innovation with socio-environmental responsibility. The approach seeks to boost industry competitiveness while safeguarding natural resources.

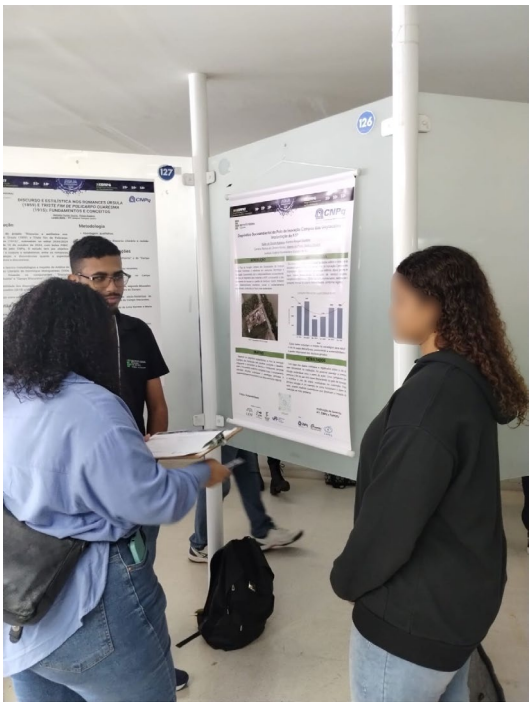
Beyond internal management, the initiative also focuses on community engagement. Workshops, lectures, and educational campaigns are planned with the school community of Raimundo Magalhães State School, in the district of Barcelos, in São João da Barra (RJ). The goal is to bring residents and students closer to sustainable practices, encouraging active participation and strengthening the local environmental culture.

A sustainability report, prepared under Global Reporting Initiative (GRI) standards, provided the first assessment of PICG. Covering the period from October 2024 to March 2025, the study reported an 80.5 percent drop in organic waste

generation and fluctuations in common waste. It also noted that monthly consumption of disposable cups reached 3,600 units, while bottled water use rose by 47.5 percent.

After organizing the collected data in spreadsheets, the project is moving into its implementation phase. This stage will introduce proposals to enhance water, energy, and waste management, while performance indicators will be established to track social, environmental, and educational impacts both within the hub and across the surrounding community.

In addition to driving structural changes, the project contributes to the training of new professionals. The participation of undergraduate research fellows ensures that the knowledge generated translates into academic and professional training, preparing future environmental managers committed to sustainability and regional development.



Presentation of the project at the 2024 Congress of Teaching, Research, and Extension (Conepe) of the Federal Institute Fluminense (IFF) Guarus Campus
Source: courtesy photo

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Basic Sanitation: Minas Gerais Initiative Implements Public Policies in the rural area of Florestal

Project aims to launch a pilot experience in the dispersed and urbanized territory of the municipality, evaluating indicators such as water supply, sanitation, and population health

Main façade of the Living Center in Education Rural Sanitation in Florestal
Source: courtesy photo

So far, the project has reached approximately 500 rural households, corresponding to around two thousand residents of Florestal (MG). Indirect beneficiaries are estimated to reach 30 million.

Rural populations often lack measures that ensure essential conditions for human development, such as access to food, health, education, transportation, and basic sanitation. Based on this context, the project developed by the Center for Teaching and Agrarian Development of Florestal (Cedaf) of the Federal University of Viçosa (UFV), titled "Ações e estratégias visando à implantação da primeira experiência piloto sobre saneamento rural: desafios e oportunidades no território de Florestal (MG)", aims to evaluate the implementation of public sanitation policies and their impact on the quality of life of residents in the municipality's rural areas.

Developed since 2019 and set to conclude in December 2025, the initiative represents the first pilot project dedicated to implementing measures from the National Rural Sanitation Program (PSBR). The project intends to produce a situational assessment of rural sanitation in Florestal, establishing a model that can be replicated in other regions of Brazil.

Currently, approximately 500 rural households are included, both isolated and urbanized, representing around two thousand residents of Florestal. Indirect beneficiaries are estimated to reach 30 million in the rural area. The urbanized rural community includes the districts of Gameleira and Cachoeira de Almas, while the dispersed areas include Fazenda Velha, Japonês, Marinheiro, Ribeirão do Ouro, Tapera, Valentim, Mata do Cedro, and Zicuta.

The methodology begins with a situational assessment of the area, including interviews with those responsible for

managing basic sanitation services, field visits to the rural territory, and consultations with the local community. The project also includes proposals for rural sanitation actions and evaluations of public policies during the pilot. Indicators for water supply, sanitation, solid waste management, and population health are used to identify progress and potential setbacks in basic services.

The results directly impact teaching, research and extension activities at the participating institutions, as the knowledge generated is incorporated into classroom instruction and shared at events outside the academic community.

Ongoing actions

- Pilot project involves a situational diagnosis of sanitation for Florestal's dispersed and urbanized rural territory.
- Rural sanitation serves as a driver for the formulation, planning, and decision-making of public actions.
- Public policies guide government initiatives toward universal access, sustainability of services, and social participation and oversight.
- The Living Center in Education Rural Sanitation is established as a reference for technological solutions, management models, and transparency.

- Education promotes courses, training, and knowledge exchange about the particularities of rural and community environments.

Rainwater collection cistern painted with natural dyes
Source: courtesy photo

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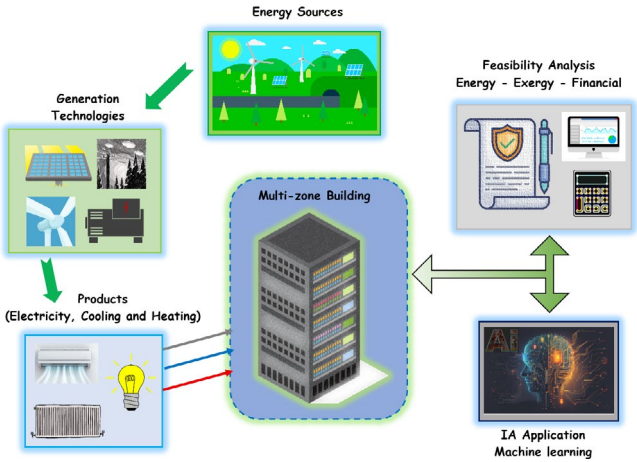
Smart Energy: advanced polygeneration systems combine science, innovation, and sustainability

Project investigates the integration of renewable sources, artificial intelligence, and energy optimization to meet multiple electricity, cooling, and heating demands



Thermo-exergo-economic optimization of polygeneration systems in multizone buildings: modeling and machine learning.
Source: courtesy photo

Researchers are developing methodologies to make polygeneration systems more efficient, sustainable, and economically viable, with direct impact on residential, commercial, industrial, and government sectors.

The simultaneous production of electricity, heating, and cooling is the focus of the research project "Applied Studies on Polygeneration Systems: Integration, Evaluation, and Optimization of Efficient and Strategic Intelligent Configurations." Launched in March 2023, the project explores innovative solutions to address the challenges of the energy transition.

The initiative leverages sustainable sources such as solar, wind, biofuels, and even wave energy to power polygeneration systems capable of meeting diverse energy demands. Among the technologies under study are Organic Rankine cycles, a type of thermodynamic cycle that efficiently converts heat into electricity, hybrid solar collectors, phase change materials, and advanced storage systems.

Another distinguishing feature is the use of artificial intelligence techniques. Through machine learning, researchers simulate scenarios and optimize operational strategies to increase the overall efficiency of systems while reducing financial and environmental costs.

Beyond technological advances, the project contributes to the training of qualified human resources in engineering and sustainable energy. Undergraduate, master's, and doctoral students participate actively, enhancing scientific output and strengthening collaboration between universities, industry, and government agencies.

Expected impacts extend beyond academic innovation. The implementation of intelligent polygeneration systems

promises increased energy efficiency, reduced emissions, and better utilization of renewable sources, paving the way for large-scale applications in homes, businesses, and industries.

Results achieved to date

- 31 articles published in indexed journals (26 in Qualis A, 5 in Qualis B).
- 16 articles presented at national and international conferences.
- 12 software registrations at the National Institute of Industrial Property (Inpi).
- Completed advisements: two master's dissertations and two Institutional Scientific Initiation Program (Pibic) projects.
- Ongoing advisements: nine doctoral theses and three master's dissertations.

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Applied Metagenomics: Brazil's northeast semi-arid becomes a testing ground for sustainable biotechnologies

By reusing industrial and agricultural waste, the initiative showcases the potential of manipueira as a sustainable resource capable of generating positive impacts in the region

Flour mill: (A) flour production during toasting; (B) cassava pressing to obtain manipueira; (C) flour production residues – cassava peels; (D) flour production residues – manipueira
Source: courtesy photo

Studies show that the isolated bacterial strains have biomedical, pharmacological, and zootechnical relevance, particularly as probiotics that can boost animal productivity.

Abundant in Brazil's semi-arid northeast, manipueira is a liquid byproduct of cassava flour production. It holds strong biotechnological potential as an organic fertilizer and insecticide. However, it contains hydrocyanic acid (HCN), a toxic compound that requires neutralization.

To tackle the issue, the Federal Institute of Paraíba (IFPB) launched the project "Metagenomics Applied to the Reuse of Industrial and Agricultural Waste for the Prospecting of Sustainable Biotechnologies and Renewable Energies in the Northeastern Semi-arid Region". The initiative aims to use metagenomic analysis to identify microorganisms present in cassava flour residues, pinpoint the strains capable of neutralizing cyanide, and explore their possible applications.

Samples of manipueira and cassava peels were collected at a flour mill in Princesa Isabel, Paraíba. Microbial DNA was extracted and 16S rDNA genes were amplified using the Polymerase Chain Reaction (PCR) technique for sequencing and bioinformatics analysis. This approach made it possible to characterize microbial diversity and identify potential uses in biotechnological processes. The resulting technologies have been shared with local communities through the extension programs Sala Verde and Cactus, both run by IFPB.

The project reaches IFPB undergraduates, cassava farmers, producers, and local entrepreneurs. Results indicate that the microbiota of manipueira is less diverse and adapted to the acidic conditions of the residue, consisting mainly of lactic acid bacteria. The genus Leuconostoc was found predominantly in manipueira, while Weissella was more

common in cassava peels. These strains have biomedical, pharmacological, and zootechnical applications, with strong potential as probiotics.

The research also supports silage testing to produce high-quality forage. Future plans include a biodigester prototype to assess the anaerobic digestion of manipueira mixed with poultry farm waste, producing biogas. Parallel studies will isolate microorganisms to evaluate their effectiveness as animal probiotics.

Results achieved

- Identification of predominant bacterial genera in the samples, compared with other sequenced microbiotas using public databases of corn cob and cassava leaf residues.
- Biotechnological applications: isolated strains show biomedical, pharmacological, and zootechnical potential, especially as probiotics that increase animal productivity.
- Construction of two experimental silos using manipueira as a microbial inoculant to evaluate benefits in grass silage production, combined with cassava vines and tubers.
- Local outreach: presentations at farmers' fairs and the Cassava Festival, in partnership with Cactus and the Sala Verde project.

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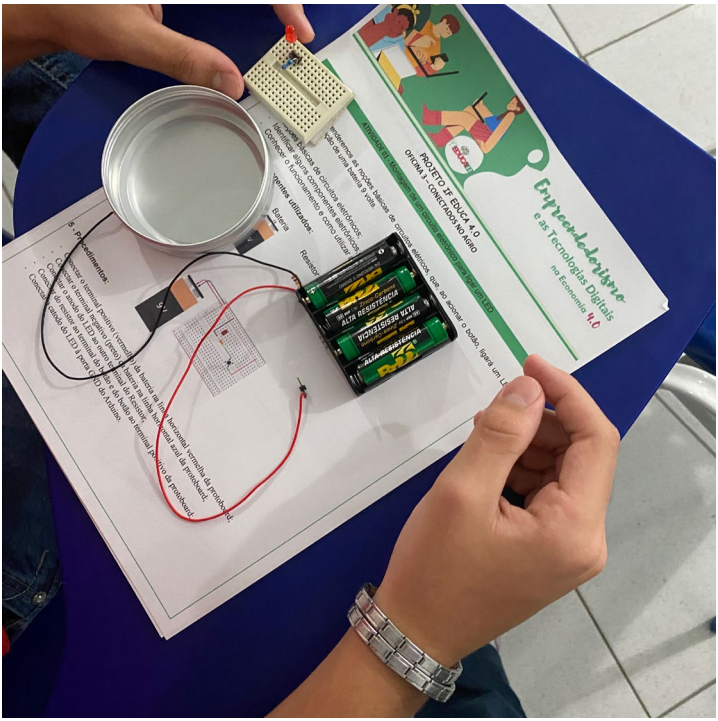
Project brings digital innovation and entrepreneurship to public schools in Petrolina

An IFSertãoPE initiative certified 339 middle school students and reached more than 2,000 community members through workshops, events, and extension activities



Hands-on activity assembling a circuit to power an LED, carried out by students in the IFEduca4.0 project, focused on applied learning in basic electronics
Source: courtesy photo

A total of 339 middle school students earned certificates in courses of up to 160 hours, expanding access to digital knowledge, innovation, and sustainable solutions in the São Francisco Valley region.

The project "IFEduca4.0" (lit. "IFEducate4.0") was designed to introduce teenagers to new digital technologies and foster an entrepreneurial mindset. Led by the Federal Institute of Sertão Pernambucano (IFSertãoPE), it ran between January 2021 and April 2024 in partnership with the Municipal Departments of Education and Innovation and Technology of Petrolina, in the state of Pernambuco. Workshops included themes such as entrepreneurship and innovation, artificial intelligence, computer programming, agricultural technologies, and maker culture, using hands-on and active learning approaches.

The project directly benefited students from the 6th to 9th grades in municipal and state public schools in Petrolina, who took part in the extension course "Entrepreneurship and Digital Technologies in the Economy 4.0". The wider community was also indirectly impacted: 2,397 people

engaged with the project's activities through fairs, lectures, workshops, and exhibitions.

Some notable results are:

- Certification of 339 teenagers in digital inclusion courses.
- Development of prototypes such as smart traps, rain gauges, solar-powered recyclable cars, and automated irrigation systems.
- Production of two e-books and participation in several scientific and technological events.
- Two awards at the XVII Scientific Initiation and Extension Journey (Jince).
- Creation of the extension hubs IFEduca4.0 and IDEIIAR, along with the startup Cyber Agro and the initiative Maker Inclusivo.
- Development of games and apps focused on innovation and social impact.

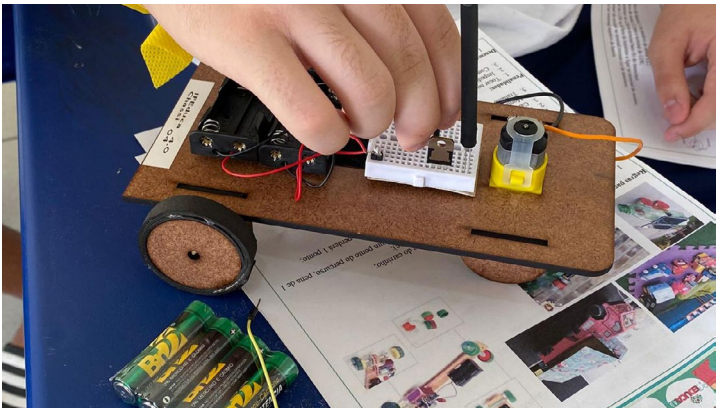
Another direct outcome was the growing interest of students in the technology field. In the 2022 IFSertãoPE admissions process, 17 students who had taken part in the project's activities enrolled in courses at the Petrolina and the Petrolina Zona Rural campuses. The result highlights the initiative's relevance in spreading knowledge and opening

new perspectives for youth. One of these students is now working as a junior research fellow.

Even after its official conclusion, the project continued to generate results. It strengthened the IFEduca4.0 Technological Extension Hub, led to the creation of the IDEIIAR Hub, and spurred the development of the Cyber Agro startup, Maker Inclusivo, and new digital games and applications. These initiatives consolidated IFSertãoPE's role within the community, expanded the innovation network, and opened new opportunities to connect different stakeholders in regional development.

"It was a transformative experience for me. I was able to understand the impact that technological education can have on people's lives, sparking curiosity, creativity, and confidence in their own abilities. 'IFEduca4.0' meant personal and professional growth. I learned that teaching is also learning and that every challenge brings an opportunity for evolution".

Henrique Breno Felix do Amaral, Agronomy student at IFSertãoPE Petrolina Zona Rural Campus and project fellow in 2023



Prototype of a solar-powered car developed by students during "IFEduca4.0" workshops, integrating concepts of electronics, renewable energy, and technological innovation
Source: courtesy photo

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Maintenance and breeding center for tambaqui in Amazonas uses water recirculation systems

Innovative project by the Federal Institute boosts regional fish farming, female entrepreneurship, and technology transfer while promoting efficient use of water resources

Induced breeding
Source: courtesy photo

Launched in mid-2023, the project "Maintenance and Breeding of Tambaqui in Water Recirculation Systems: Training, Research, Female Entrepreneurship, and Technology Transfer" marks a significant advance in the induced reproduction of rheophilic fish, species that live in flowing waters and need to migrate to reproduce, particularly tambaqui, in Amazonas.

Funded by the Amazonas State Research Support Foundation (Fapea,) in 2022, the proposal by the Federal Institute of Amazonas (Ifam) led to the creation of a center for production, distribution, and training of tambaqui fry (newly hatched fish) in the state's interior. The center produced post-larvae and fry using water recirculation systems, an innovative method in Brazil. Reproduction was induced using synthetic hormones, and oocytes were fertilized using dry fertilization techniques.

Experiments were based on parameters such as spawning success rate, fertilization and hatching rates, larval survival in recirculation, and data on feed consumption and conversion of the tambaqui broodstock.

Another highlight of the initiative is the training of riverside women, quilombola women, and students from the Federal University of Amazonas (Ufam) and the Federal Institute of Amazonas (Ifam). The center also organized technical visits for rural producers and aspiring entrepreneurs.

The project, completed in June 2024, demonstrated that tambaquis can be maintained in small-volume tanks without water waste, combined with intensive vegetable production in aquaponic systems. Reproductive efficiency was comparable

to traditional large-pond methods but with lower water consumption and effluent generation. The method required 90 percent less area and produced 50 percent higher productivity compared to conventional systems.

The project trained 40 people, benefited 22 local producers with fry and post-larvae, and provided species to educational and research institutions for practical classes and courses. Participants were guided in creating business models using the Business Model Canvas tool. The effectiveness of the initiative was confirmed as it helped diversify the economic base of riverside communities and generate new business opportunities.

Results achieved

- Analysis of the efficiency of the water recirculation system for maintaining and inducing tambaqui reproduction.

  Reproduction data:
  - Average reproductive efficiency – 77 percent
  - Average fertilization rate – 90.5 percent
  - Average hatching rate – 84.5 percent

- Development of social technologies applied to the economic and social advancement of the middle and lower Amazonas region.

- Donation of approximately 25,000 juveniles and 150,000 tambaqui post-larvae for research purposes to the National Institute for Amazonian Research (Inpa), Ifam,

the Brazilian Agricultural Research Corporation (Embrapa) Western Amazon, Nilton Lins University (UNL), and local producers in Itacoatiara and surrounding areas.

- Training of quilombola and riverside women in fish farming: courses on female entrepreneurship, Business Model Canvas as a business tool, and reproduction of rheophilic fish.

"It is a historic milestone in the reproduction of native fish, not only in the Amazon region but throughout Brazil. In addition to developing low-cost tanks with regional inputs, we brought hope to small producers. They can meet the growing demand for fry in remote regions of the country, undertaking business using the techniques described in the project".

Rondon Yamane , team member

"It represents the economic and social autonomy of women in Itacoatiara and surrounding communities. The work helps strengthen female participation in the entrepreneurial ecosystem and promotes sustainable economic and social development".

Daiane Medeiros , project coordinator

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Team: Rondon Tatsuta Yamane Baptista de Souza (Ifam), Sarah Ragonha de Oliveira (Ifam) and Sandro Ferronato Francenner (Ifam)

IFSP project democratizes sommelier training and opens doors to the job market

Free course has already certified 350 participants and is becoming a reference in training new professionals for the wine industry

Wine tasting event organized by the "Wine Sommelier" extension course at the IFSP Campus São Miguel Paulista
Source: courtesy photo

In addition to classroom lessons, participants take part in tasting sessions, technical visits, and pairing practices that bring learning closer to real-world market experiences.

The Federal Institute of São Paulo (IFSP) has gained recognition with the "Wine Sommelier" project, which provides free, high-quality training for adults over 18 who want to enter the wine sector or refine their professional expertise. By opening the doors of a field traditionally seen as elitist, the initiative removes economic barriers and creates equal opportunities for those pursuing a career shift or reentry into the job market.

The project reaches a wide audience, from young adults seeking their first job to professionals in gastronomy and hospitality looking to specialize. Offered both in person and online, the IFSP program extends its impact nationwide, drawing participants from São Paulo as well as northern and northeastern states, where such training is less accessible.

The results so far underline the project's importance. Since 2023, more than one thousand people have applied, and 350 have earned certification. Some graduates have secured positions as sommeliers in São Paulo restaurants, while others have started their own businesses, such as wine consulting and guided tastings. Together, these achievements show the project's direct contribution to employment and to the growth of wine culture in Brazil.

The teaching methodology combines theory and practice. Students learn the fundamentals of viticulture, winemaking, sensory analysis, and food pairing, while also engaging in tasting sessions with wines donated by partners, technical visits, and case studies. This combination ensures robust, applied training that mirrors professional practice.

More than training specialists, the initiative boosts regional wine tourism, supports local producers, and fosters new ambassadors for Brazilian viticulture. By being free and accessible, the course demonstrates how public education can democratize knowledge, create jobs, and transform lives through wine culture.

Wine Sommelier in numbers

- More than 1,000 applications since 2023.
- 350 students certified.
- Graduates working as sommeliers in restaurants or running their own businesses.
- Free course, both in-person and online, accessible across different regions of Brazil.

Class of the "Wine Sommelier" course at the IFSP Campus São Paulo
Source: courtesy photo

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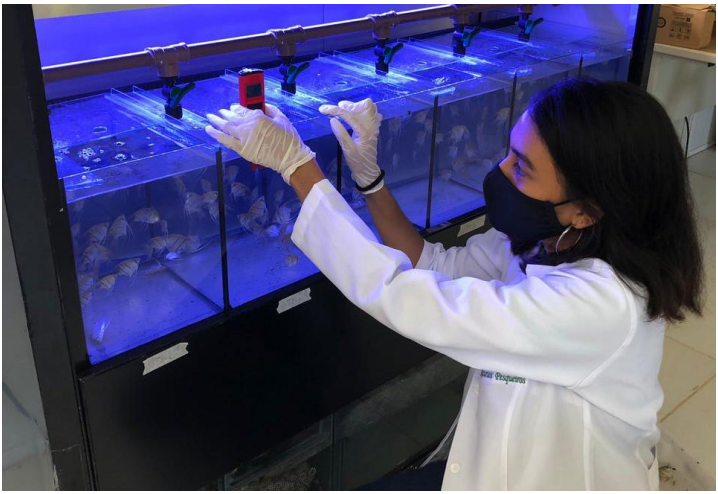
Ornamental aquaponics combines Amazonian fish and vegetables in Manacapuru

Ifam project develops mini-systems integrating Amazonian ornamental fish and vegetables, bolstering Teaching, Research, and Extension



Scholarship student from the Institutional Scientific Initiation Scholarship Program (Pibic) monitoring physical and chemical water parameters in an experiment with ornamental fish
Source: courtesy photo

The initiative achieved productive and pedagogical results, training students and demonstrating the economic viability of ornamental aquaponics.

The integration of aquaculture and hydroponics gained momentum in the town of Manacapuru (AM) through the project "Ornamental aquaponics: technological innovation in the production of Amazonian ornamental fish and vegetables," developed by the Federal Institute of Amazonas (Ifam). The initiative pursued sustainability by valuing the resources of this city in the Metropolitan Region of Manaus, whose economy is centered on fishing and agriculture.

The system consisted of 18 interconnected aquariums, totaling 450 liters of recirculating water, each containing 12 fish. The structure integrated a hydroponic bed for 90 vegetable seedlings, combining Amazonian ornamental species such as angelfish (Pterophyllum scalare), discus fish (Symphysodon aequifasciatus), cardinal tetra (Paracheirodon axelrodi), and rummy-nose tetra (Hemigrammus rhodostomus), with lettuce cultivation.

The results showed the productive potential of the model. Lettuce reached an average fresh weight of 150 g to 200 g per plant, totaling more than 12 kg over six monitored cycles. Fish showed consistent growth with ornamental market demands, particularly discus and angelfish, which reached averages of 3.5 g and 4.2 g, respectively. Water quality remained stable, ensuring good sanitary conditions and low mortality rates.

From a pedagogical perspective, the demonstration unit installed at Ifam's Manacapuru Campus was incorporated into the practical classes of the Fisheries Resources technical course, providing students with direct engagement in the

project's activities. In addition, system data were used in scientific initiation projects, reinforcing the integration between teaching and applied research.

Extension activities expanded the technology's reach to the community. Two 80-hour Initial and Continuing Education (FIC) courses trained 47 participants, including fish farmers, students, and local residents. The initiative demonstrated that ornamental aquaponics can become a technological and economic alternative for the region, combining innovation, sustainability, and professional training.

Ornamental aquaponics: sustainability and education

- Alternative to overfishing of Amazonian species such as angelfish (Pterophyllum scalare), highly demanded in the international market.
- Combines ornamental fish farming with pesticide-free plant cultivation, using less water.
- Generates income for local producers and provides demonstration units for education and scientific extension.
- Contributes to environmental conservation and reduces the impacts of intensive extractivism in the Amazon.

Indoor aquaponics system with Amazonian ornamental fish and hydroponic lettuce
Source: courtesy photo

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Team: Lorenzo Soriano Antonaccio Barroco (Ifam) and Valeria da Rocha Sobral (Ifam)

Innovation in açaí products strengthens bioeconomy and sustainability in the Amazon

Project develops fruit leather, carbonated beverage, and smart sensor, boosting community income and reducing dependence on the cold chain

Minimum Viable Product (MVP) of the carbonated beverage developed during the project
Source: courtesy photo

The initiative benefits producers, companies, and consumers while promoting environmental preservation and technology transfer.

The project "Technological innovations in the production of açaí-based products: smart pH indicator sensor, fruit roll (fruit

leather), and carbonated beverage" developed new ways to use the fruit along with a smart pH sensor for fish packaging. The proposal focused on creating foods that can be stored at room temperature, reducing the need for refrigeration, and expanding the range of products derived from Amazonian biodiversity, fostering sustainability and the local economy.

In order to achieve these goals, the team worked on developing formulations and prototypes, producing and validating the biosensor with açaí bioactive compounds, and conducting stability and safety tests. The project also involved partnerships with supplier communities and açaí processing companies, ensuring access to raw materials and promoting integration between science, the market, and society.

The initiative reached a wide range of groups: indigenous, traditional, and extractive communities, which saw greater demand for the fruit and increased income; processing companies, which gained new product alternatives and reduced logistical costs; consumers, who had access to safe foods and smart packaging; and the academic community, through the dissemination of methodologies, processing flowcharts, and technical publications.

Key results include the creation of three açaí-derived products, reduced dependence on the cold chain, and the strengthening of the Amazonian bioeconomy, with new business opportunities and higher income for producers. The project also earned scientific and technological recognition, receiving awards at events such as Elos da Amazônia – Açaí Edition 2021, Forint 2023, Pitch Day Roraima Idesam 2025,

and the ODS Seal 2024, raising the visibility of Roraima and its innovative initiatives.

Besides the economic impact, the project supported environmental sustainability by proposing alternatives to reduce food waste and losses of perishable goods. At the same time, it promoted technology transfer and strengthened local capacities, combining innovation, education, and preservation of the standing forest.

> "Our commitment is to ensure the continuity of these actions, guaranteeing that the outcomes of this work contribute to science, society, and the Amazon region".
>
> *Project coordinator*

Initial prototype of the fruit roll produced
Source: courtesy photo

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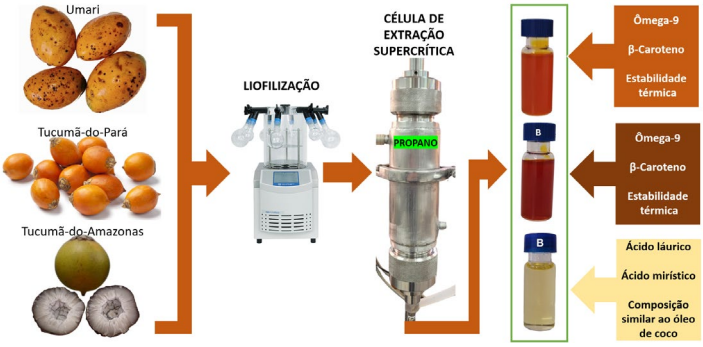
Green extraction technologies boost the Amazon bioeconomy

Using pressurized propane increases yields while preserving bioactive compounds in native Amazonian fruits



Graphic summary of the results obtained for each species
Source: courtesy photo

From the forest to the lab, umari and tucumã oils reveal their potential to transform the regional bioeconomy.

The project "Green Extraction Technologies: A Path to the Development of the Amazon Bioeconomy" explored sustainable methods to obtain oils rich in bioactive compounds from native species such as umari pulp

(*Poraqueiba sericea Tul.*), tucumã-do-Pará pulp (*Astrocaryum vulgare Mart.*), and tucumã-do-Amazonas kernel (*Astrocaryum aculeatum*). Through the use of pressurized propane — a clean and efficient technology — the project achieved yields equal to or higher than those of conventional methods.

In the case of umari, propane extraction yielded up to 29.2%, with notable levels of β-carotene — a precursor of vitamin A — and oleic acid (omega-9). Beyond its valuable nutritional profile, the oil showed strong antioxidant activity and good thermal stability — features that broaden its potential uses in the food, cosmetics, and pharmaceutical industries. These findings highlight the repositioning of umari — an underutilized and undervalued fruit — as a strategic resource for the Amazon bioeconomy.

Tucumã-do-Pará also stood out, reaching yields of up to 33.9% with green extraction. The process preserved β-carotene concentrations up to 21 times higher than those obtained with the Soxhlet method, where the compound undergoes thermal degradation. In addition, the fatty acid profile proved similar to that of umari oil, reinforcing its consistency as a raw material of industrial interest. In this way, tucumã-do-Pará emerges as a value-added alternative, benefiting both the production chain and local farmers.

Tucumã-do-Amazonas recorded the highest yields in the study, reaching 35.9%. Its oil stood out for its richness in lauric and myristic acids, exhibiting a profile similar to coconut oil, thereby broadening its potential applications in cosmetic, pharmaceutical, and food formulations. In addition

to its high antioxidant capacity and significant flavonoid content, this fruit — often discarded as an agro-industrial byproduct — gains new value when sustainably integrated into the bioeconomy, generating income and opportunities for extractive communities.

Taken together, the results from all three species demonstrate the potential of green extraction technologies as a tool for sustainable regional development. By combining technological innovation, environmental preservation, and the valorization of native fruits, the project contributes to establishing the Amazon as a global reference in bioeconomy, transforming previously underutilized resources into high-value products, as well as strengthening the integration between local communities, the production sector, and academia.

"I believe the greatest legacy of this project is showing that the forest can be an ally in development, as long as it is managed responsibly and with respect for traditional communities. The results achieved demonstrate that science can provide technological solutions that add value, promote social inclusion, and strengthen the Amazon bioeconomy".

Project coordinator

Amazonian Raw Materials - A: Tucumã-do-Pará; B: Tucumã-do-Amazonas; C: Amêndoa de tucumã-do-Amazonas; D: Umari
Source: courtesy photo

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Team: Felipe Richter Reis (IFPR)

From forest to market: Amazon mushrooms become a new supply chain in Roraima

Project combines science, Innovation, and family farming to turn palm oil waste into a sustainable source of income in the state's south

Seed production in liquid culture medium
Source: courtesy photo

Over a ton of agroindustrial waste has already been reused in cultivation, benefiting five rural families and boosting the Amazonian bioeconomy.

The project "Technological Innovation and Sustainable Development in the Production and Commercialization of Amazonian Mushrooms: From Molecular Isolation to the Structuring of the Cogu Amazon Business"' is revolutionizing food production in southern Roraima. Launched in January 2024 and running for one year, the initiative combines science, tradition, and innovation to establish a new production chain based on native edible mushroom species from the Pleurotus and Auricularia genera, turning Amazonian biodiversity into a source of income and sustainable development.

The methodology covers everything from the molecular identification of mushrooms to their cultivation in family-run facilities. In this process, so-called inoculum seeds are produced-grains treated with beneficial microorganisms that are responsible for initiating the fungus's development. Palm oil agroindustrial waste, previously discarded, is now used as a substrate for mushroom fruiting. The process includes inoculation in a controlled environment, fruiting, drying, and finally vacuum packaging, with all stages adhering to the quality standards required by Brazilian law.

The impact can already be measured across multiple dimensions. Environmentally, over 1.2 tons of palm oil waste have been repurposed. Socially, five families in Vila Novo Paraíso, in Caracaraí (a municipality in southern Roraima) received training and production facilities, counting on the support of academic scholarship holders from the Federal Institute of Roraima (IFRR), two species of Amazonian mushrooms with food potential were scientifically identified,

and 240 kg of inoculum seeds were technologically developed in order to expand production.

Climatic challenges, such as the impact of El Niño (a natural phenomenon marked by abnormal warming of the Pacific Ocean that alters rainfall patterns and can intensify droughts in various regions) and the early onset of dry season in Roraima, required innovative solutions. To maintain humidity in the cultivation facilities, humidifiers and micro-sprinkler systems were installed.

Despite the challenges, the project met its goals, launched the startup Cogu Amazon, and gained regional recognition. It was awarded by the Federation of Industries of Roraima (Fier), securing second place overall in the Roraima Technological Innovation Grant Program (Biterr 2025), and was also selected to represent its region at the 'Northern IFs' event during the 2025 United Nations Climate Change Conference (COP30).

> "Nowadays, mushroom consumption in Brazil is dominated by varieties such as shiitake, shimeji, and champignon, which are produced in other regions or even imported. Our mushroom, besides being nutritious, is grown locally, generating income and wealth for southern Roraima".
>
> *Project coordinator*

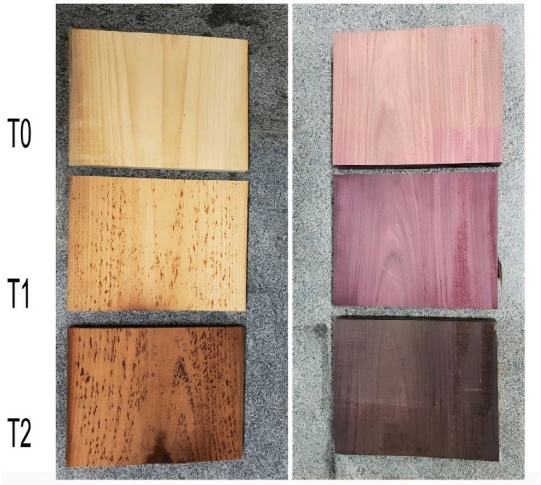
Handling of cultures in the biosafety cabinet
Source: courtesy photo

Coordination: Pierre Pinto Cardoso – Federal Institute of Roraima (IFRR) – pierrepinto@ifrr.edu.br

Team: Cleiton de Paula Soares (IFRR), Valdinei Moreira dos Santos (IFRR), Mônica Voss (IFRR) and Larissa Paiva Viégas (IFRR)

Acoustic evaluation of musical instruments made with thermo-densified wood

The IFB project researches sustainable alternatives to reduce pressure on native species used in musical instrument manufacturing



Pine and roxinho woods before and after thermal treatments
Source: courtesy photo

The project "Acoustic Evaluation of Musical Instruments Using Thermo-Densified Wood", developed at the Samambaia Campus of the Federal Institute of Brasília (IFB), has opened new perspectives for the musical instrument industry. This research investigated the potential of tropical woods subjected to thermo-densification in instrument manufacturing, providing a sustainable alternative to traditionally exploited species such as mahogany, Brazilian rosewood, and pau-brasil.

This technique involves applying heat and pressure to modify the physical and acoustic properties of wood. Species such as marupá, jequitibá, and roxinho were subjected to temperatures of 160°C and 200°C. The results showed that even under milder conditions, significant improvements in sound propagation and resonance stability can be achieved without compromising the integrity of the material.

Thermal treatment of Brazilian woods has shown acoustic results comparable to traditional species, offering both innovation and sustainability to the musical instrument industry.

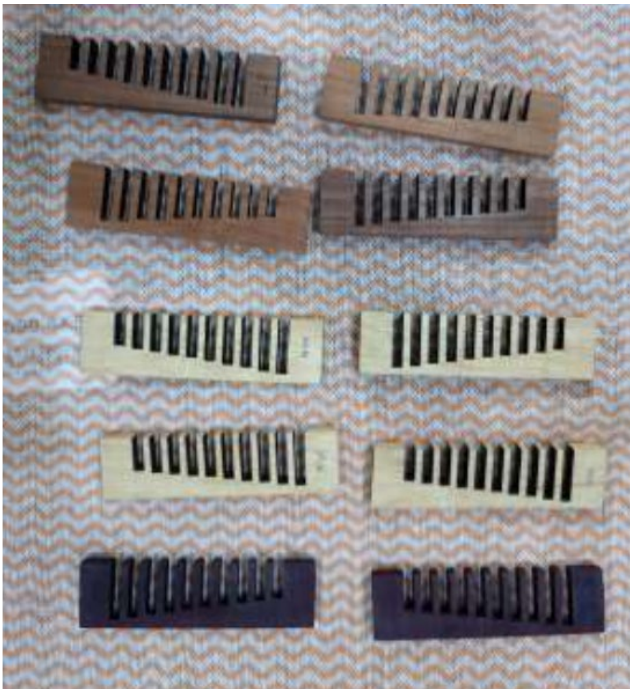
In the practical phase, researchers produced prototypes of instruments such as pandeiro, tamborim, xylophone, and diatonic harmonica (a small wind instrument typically with 10 holes). These pieces were evaluated by professional musicians, who highlighted their good tone, ergonomics, and satisfactory musical performance.

The survey also mapped the timber market in the Federal District, identifying low species diversity and a heavy reliance on suppliers from the North Region. The research emphasizes that thermo-densification can expand the use of local woods, reducing costs and creating new opportunities for the production chain.

By generating social, environmental, and economic impacts, the project helps reduce pressure on threatened tree species, adds value to domestic production, and makes quality musical instruments more accessible by lowering production costs.

Project stages

- 1. Selection and Classification of Woods: Tropical woods were selected based on availability in the timber market of the Federal District.
- 2. Thermal Treatment (Thermo-Rectification): Controlled heating in ovens (160°C and 200°C) for 30 minutes, followed by cooling.
- 3. Acoustic Testing.
- 4. Musical Instrument Manufacturing and Evaluation: Instruments were assessed on construction, finish, aesthetics, color, weight, proportion, and symmetry, as well as tone, note definition, tuning, and playability.



Results of the musical instrument manufacturing process (pandeiro)
Source: courtesy photo

Coordination: Ricardo Faustino Teles – Federal Institute of Brasília (IFB) – ricardo.teles@ifb.edu.br

Nature-Based Solutions (NbS) inspire projects in urban communities and favelas in Espírito Santo

A study by the Federal Institute of Espírito Santo investigates the scope and limits of this concept in five municipalities, with a social, cultural and political focus

Ifes students take action in the Jaburu Community (ES)
Source: courtesy photo

Nature-Based Solutions (NbS): This is a concept that has been on the rise over the last two decades and aims to operationalize public policies. With the debate on the rise, given the volume of resources potentially generated through it, the Federal Institute of Espírito Santo (Ifes) proposed the study "Nature-Based Solutions in Communities on Urban Peripheries," which has been in effect since 2023 and will continue until October 2027.

The project aims to analyze the scope and limits of the concept of NBS, based on social, cultural, and political understandings. The geographic scope included urban communities and favelas in five municipalities in the Greater Vitória Metropolitan Region (RMGV) in Espírito Santo: Vitória, Vila Velha, Serra, Viana, and Cariacica. According to the IBGE (Brazilian Institute of Geography and Statistics), this state has one of the highest rates of residents in such areas in the country.

This study indicates that the poorest population suffers most from environmental disasters. This is primarily due to the lack of housing, infrastructure, and service policies, as well as urban cost-of-living dynamics. Furthermore, the vast majority of residents in urban communities and favelas in Brazil are Black and Brown, with a rate reaching 72.9%. Debates surrounding the concepts of environmental racism can help us understand layers of reality that are often hidden from common sense.

To achieve the proposed purpose, the study involved a bibliographic survey and case studies of peripheral social mobilizations around environmental issues in Brazil; as well as interviews with social, political, and religious leaders from the target audience. Among the actions implemented in the communities and favelas, there were the implementation of productive backyards, maintenance of community gardens, healthy eating workshops, installation of compost bins, planting of fruit trees, walks to promote environmental education and community-based tourism, clean-up campaigns, encouragement of graffiti (urban art) and holding of scavenger hunts with children.

The data show that environmental discourse is not dissociated from political components, with regard to the demand for public actions to strengthen what is understood as the environment/nature. The results also confirm that the concept of NBS remains under discussion, as an essential point to ensure that there is no political neutrality regarding this term.

Results achieved

- A high number of inhabitants from the outskirts of the Greater Vitória Metropolitan Region settled in the region in the 1950s, 1960s, 1970s and 1980s. Urban expansion attracted descendants of slaves or indigenous peoples.
- Highlighting the tradition of potters who produce their artifacts from clay and tannin extracted from the mangrove, which was elected Intangible Heritage by Iphan in 2022.
- Community-based tourism practices, focusing on scenic environmental beauty and combining them with local cultural traditions: Morro Tour, São Benedito route, and boat trips through the Vitória mangroves, with views of the Cariacica mangroves.
- Tourist attractions generate financial resources for residents through environmental awareness and are therefore considered NbS.

- Relationship of ambiguity: nature (human dimension) is seen as both a solution and a problem for populations.
- Negative impact of nature: disease vectors such as mosquitoes, occurrence of concentrated rainfall that, combined with human actions, causes flooding.
- Proposals based on NBS, in urban communities and favelas, require a review of humanism.
- A greater number of fruit trees were observed in areas on the urban periphery, a factor that attracts other forms of life, such as insects, birds, fungi and flora species, in addition to affective components linked to childhood (playing in trees) and food memory.
- Some communities have a positive tree-per-capita ratio. This means that carbon sequestration in these areas tends to be greater compared to urban centers.
- The knowledge that circulates in communities, if leveraged, can contribute to actions to combat climate change.

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Social metamorphosis: IFMG launches a project for inclusion and economic development in the town of Piumhi

Sustainability initiative reintegrates inmates into the labor market through food production and native tree planting, focusing on donation and reforestation

Seedbeds in production in the town of Piumhi
Source: courtesy photo

Developed at the Federal Institute of Minas Gerais, the project "Sustainable IFMG: Toward a Social Metamorphosis" designed to rehabilitate, train, and qualify inmates in the town of Piumhi. By promoting decent work, the initiative involves producing coffee seedlings, native trees, and growing fruits, vegetables, and roots.

The nonprofit socio-environmental initiative focuses on the well-being of people deprived of liberty, their families, and society as a whole. In addition to producing food and

planting, the project offers training for inmates to help them reintegrate into the labor market. Qualification, in this context, goes beyond teaching useful skills: it also fosters social and economic inclusion.

The program involves convicts in the town serving open or semi-open sentences, preferably with penalties that require community service. Activities began in 2022 and will continue until 2027.

Direct beneficiaries include families facing socioeconomic challenges such as low income, unemployment, and food insecurity. Local organizations supported by the initiative include the Association of Parents and Friends of Exceptional Children (Apae), the Abrindo Caminhos project, Sinhana Eva Association, non-profit organizations São Francisco de Assis children's home and São José day care, and the Reconstruindo Vidas project. Nearly 4,000 tons of food have already been distributed to these institutions, helping improve nutrition and reduce hunger. These donations strengthen local organizations' operations while fostering sustainable and environmental development.

The project began with the construction of irrigation systems, greenhouses, earthworks, restrooms, and a storage facility. Implementation included setting up seedbeds, fertilizing the soil, and planting trees. The greenhouse covers about 1,500 square meters and is designed to hold 34 seedbeds.

Achieved results

- Reintegration: 10 inmates employed in community service programs.
- Food security: 3,900 tons of food delivered to local institutions.
- Urban afforestation: donation of 1,500 native tree seedlings.
- Environmental education: activity on World Water Day (2024), with 1,000 seedlings planted in a municipal park by local schoolchildren.

"The initiative contributes to the recovery and preservation of the existing water source, increasing water availability at the headwaters of the São Francisco River".

Rotary Club of Piumhi and Diocesan Caritas of Luz

"The project creates jobs and income for families. In addition, several collaborators with a history in the prison system have the chance for reintegration, which helps ease the pressure on the prison system".

Ana Laura Belo, team member

Food donation to the "Reconstruindo Vidas" project
Source: courtesy photo

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Healthy riverside housing: innovation and tradition in the Amazon

The Ribeirizar Project consists of an invitation to inhabit the Amazon through a dialogue that unites tradition, science and sustainability, as well as celebrates the strength and diversity of riverside knowledge

Virtual model perspective of the experimental module in the ilha das onças community
Source: courtesy photo

Ribeirizar has produced architectural designs for experimental healthy housing modules, which are planned for implementation in the community and on the Belém Campus. With the collaboration of student volunteers, physical and virtual models of the project were produced. The initiative has been gathering attention at national and international scientific events, at the same time it has been establishing itself as a benchmark for healthy housing in the Amazon.

The project 'Ribeirizar: Promoting Healthy Riverside Housing in the Amazon,' developed by the Federal Institute of Pará (IFPA) in partnership with universities and Amazonian communities, aims to transform the lives of riverside families through sustainable architectural solutions. The initiative integrates traditional knowledge and scientific innovation, using riverside culture as a premise for the development of healthy and sustainable housing, through the establishment of a dialogue with the climate and environmental conditions of the Amazon.

The initial stages of the project included participatory socio-environmental assessments in the communities of Ilha das Onças, in Barcarena, and Porto Ceasa, in Belém, both located in the state of Pará. Through workshops, interviews, and discussion circles, the project gained insight into housing, sanitation, and production conditions in these communities, while valuing traditional knowledge and local ways of life as essential elements for developing the proposed solutions. In parallel, an extensive literature review on healthy housing and social technologies was conducted, providing the foundation for developing architectural proposals suited to the riverside context.

Among the results achieved are the development of the Experimental Healthy Riverside Housing and the Porto Ceasa Community Center projects, as well as the creation of physical and virtual models that served as tools for communication and validation alongside the communities. The project was also presented at scientific events and received awards, thereby increasing its academic and social visibility.

Another highlight was the integration of Teaching, Research, and Outreach, which enabled the active participation of IFPA students and faculty in all stages of the project. This integration strengthened practical academic training and brought the scientific community closer to the real needs of the Amazon region. The project is currently in the fundraising phase to enable the implementation of experimental modules and the monitoring of the proposed solutions. The first units are expected to be built on Ilha das Onças and at the Belém Campus of the Federal Institute of Pará, serving as living laboratories to evaluate thermal comfort, the effectiveness of social technologies, and the potential for replication in other riverside communities.

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Community and technology work together to reduce flood risks in Amarantina and Cachoeira do Campo

IFMG project alongside Civil Defense identify areas susceptible to flooding and together contribute to disaster prevention

Measuring the flow of Maracujá river tributaries in Minas Gerais
Source: courtesy photo

The maps generated by the project provide strategic tools for urban planning and risk management, thus helping to protect communities vulnerable to flooding.

Floods are natural phenomena, and their impacts worsen when they strike residential areas. In 2021, the districts of Amarantina and Cachoeira do Campo, in Minas Gerais, experienced severe flooding, highlighting the need for a better understanding of the risks and damages caused by such events.

To strengthen flood prevention, the Federal Institute of Minas Gerais (IFMG), in partnership with Ouro Preto's Civil Defense, is carrying out the project 'Mapping Flood-Prone Areas in the Urban Perimeter of the Districts of Amarantina and Cachoeira do Campo. The initiative aims to identify the areas most vulnerable to flooding, providing support for planning actions that enhance public safety and reduce the risk of future disasters.

One of the distinguishing features of this project was the direct involvement of the community. By gathering residents' accounts, the team was able to create detailed maps highlighting the most affected areas. Residents helped create so-called 'spoken maps,' identifying escape routes, risk areas, and even families that should be prioritized in rescues due to health conditions. As a result, the maps became valuable tools for Civil Defense, as they reflect the community's real needs.

In addition to community participation, technology played a key role. The use of drones and digital elevation models enabled more accurate analyses of water behavior during floods. This information supports both urban planning and the development of emergency response strategies.

The next step of the project is to install a real-time hydrological monitoring system. The data, transmitted via radio, will make it possible to predict floods more quickly and guide immediate Civil Defense responses. The expectation is that this combination of science, technology, and community participation will help save lives and reduce losses in future extreme events.

Teaching the flooding process in public schools in the affected district
Source: courtesy photo

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Economic valuation transforms sustainable farming practices of family agriculture in southern Minas Gerais

Federal Institute project creates a methodology to capitalize socio-environmental services, generating new income sources and encouraging corporate policies

VALORAÇÃO ECONÔMICA
DA SUSTENTABILIDADE

VES logo
Source: courtesy photo

The results achieved so far highlight the importance of the project for Minas Gerais, the world's largest coffee-producing state.

Scheduled for completion in December 2026, "Economic valuation of sustainable practices of family farmers in southern Minas Gerais" is a project focused on developing a methodology to quantify, price, and market socio-environmental services, in a way similar to carbon credits.

Services provided by farmers adopting organic and sustainable methods play a crucial role in environmental preservation and food security. Beyond offering pesticide-free alternatives, these practices deliver essential benefits such as biodiversity maintenance and climate regulation. Yet many of these farmers see little financial return, often not enough to cover their basic costs.

The project was born out of the need to properly value small producers and create conditions that allow them to thrive. It seeks to design an innovative model that not only rewards farmers but also encourages corporate policies through the commercialization of socio-environmental credits.

The initiative, which serves cooperatives and associations of farmers in southern Minas Gerais, is being developed in partnership with renowned institutions. It builds a knowledge-sharing network through workshops and relies on a digital platform to manage and track credits. The initial validation focuses on coffee production, with plans to expand to other crops and regions. The mission is to strengthen ecologically sustainable and socially just productive actions while opening new income opportunities for hundreds of family farmers in the region.

Results achieved

- Partnerships: Federal Institute of Southern Minas Gerais (IF Sul de Minas), Federal University of Alfenas (Unifal), Instituto Origem, Municipal Infrastructure, Sanitation and Water Supply Service (Sisam), Rede Simasa, Instituto Ambienta, Orgânicos Sul de Minas Participatory Conformity Assessment Body (Paco), Family Agricultural School of Cruzília, Federal University of Santa Catarina (UFSC), Federal Superintendencies for Agrarian Development of Minas Gerais and São Paulo, Foundation for the Development of Agribusiness Research (Fundepag).

- Seminars: Sustainable agriculture and environmental credits (Poços de Caldas) and Environmental credits in southern Minas Gerais agriculture (IF Sul de Minas).

- Outputs: participation in national and regional congresses and preparation of a scientific paper.

- Interviews: 30 coffee growers in southern Minas Gerais to document socio-environmental responsibility practices.

Goals

- Identify environmental and social liabilities/assets in agriculture.
- Identify, measure, and price sustainable practices in coffee farming.
- Standardize the Social and Environmental Balance Sheet for agriculture.
- Develop a customized app for the economic valuation methodology.

Photo 1 – Training session. Photo 2 – Field survey with the Family Farmers' Cooperative of Poço Fundo. Photo 3 – Participatory development of the Multicriteria Sustainability Index. Photo 4 – Project team
Source: courtesy photo

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“Saco Verde” connects sustainability and income generation in the interior of São Paulo

IFSP proposal transforms discarded banners into material for recycling collection, thus promoting environmental awareness and encouraging local cooperatives

Distribution of bags in a condominium in Boituva
Source: courtesy photo

Guided by environmental preservation and the reuse of materials, the project “Saco Verde: encouraging the separation of recyclables and connecting people for a sustainable future” was developed between 2016 and 2025 at the Federal Institute of São Paulo (IFSP).

The idea was born in Boituva (SP), from the realization that, every year, thousands of canvas banners used in events, as

well as advertisements and advertisements, ended up being accumulated and discarded. Because they are difficult to recycle, the material can take approximately five hundred years to decompose, according to the research.In parallel with this fact, the Boituva Recycling Cooperative (Coopera Boituva) expressed the need to acquire green bags for distribution to city residents, with the aim of encouraging the separation of recyclable material. The action would increase the cooperative's income. The "Saco Verde" was born from the combination of these two demands.

This proposal sought to increase the income of collectors by making bags from banners. The process included training workers to produce the bags and distribute them to the population, as well as raising awareness about the correct separation of waste and creating a model that can be adopted in other municipalities.

The methodology developed included a collection system using electric vehicles powered by renewable energy sources. A mobile app, for Android and iOS platforms, and monitoring software were also created. These apps, which, through the geolocation of distributed bags, allow the cooperative to generate reports and optimize collection routes.

Results achieved

- Project "Development of 'green bags' for the Recycling Collectors Cooperative through the reuse of canvas banners" (2017).

- Creation of a bag model that supports upto 40 kg of weight.

- Project "Professional training for women at Coopera Boituva" (2018).
  - Preparation of Pedagogical Plan for FIC course in Sewing Assistant (160h).

- Donation of a collection truck to Coopera Boituva.

- "Saco Verde" Project: reuse of canvas banners to produce ecobags (2018).
  - Production of 1,000 ecobags by reusing banners.

- Increase in cooperative income by an average of R$6,000 per month.

Main deliverables

- 32 people benefited

- R$91,500 increase in cooperative members' income.

- 111.6 tons of material collected, including:
  - 45% paper/cardboard
  - 25% plastic
  - 10% metal
  - 20% glass

- 4,420 collections per electric car between 2022 and 2023, with 21 tons, 580.63 km driven and a reduction of 324.8 kg in CO_2 emissions.

"It was rewarding to be part of this journey. The project opened doors for my academic and professional career. Through it, I discovered my affinity for environmental management, and today, I have a degree in Biology and am pursuing a postgraduate degree in Environmental Sciences".

Bárbara Oliveira Miakbom, scholarship recipient

Project team visits the "Coopera Boituva" waste pickers' cooperative
Source: courtesy photo

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Pigments from the Amazon: Federal Institute of Rondônia develops safe and sustainable natural paints

Project transforms plant extracts into pigments with high yield and fixation, combining educational practices with the promotion of the local bioeconomy

Visitor applies pigments on a community painting
Source: courtesy photo

The project "Production of pigments from Amazonian species for natural paint development," carried out by the Federal Institute of Rondônia (IFRO), began in 2022 and is set to

conclude in December 2025. It focuses on producing paints from plant extracts while determining the most effective techniques for extracting and stabilizing the pigments.

The project was born out of the need to reduce the indiscriminate use of widely applied synthetic pigments, responding to guideline restrictions of the World Health Organization (WHO). Formulated through chemical reactions with high toxicity and contamination levels, synthetic pigments pose risks to users' health. In this way, the initiative seeks to revive ancient human practices by developing improved techniques that provide higher yield, stability, and adhesion of natural pigments.

In order to achieve the desired colors, plant compounds were produced in the institution's laboratory using different raw materials, obtained both from mother plants and directly from local producers. The process included preparation of the plant matrix, pigment extraction, and color evaluation.

The team prepared paints during non-timber product management classes, and the resulting preparations were applied in art lessons. The initiative also promoted workshops on the extraction process during the 10th Rondônia Rural International Fair, as well as canvas painting with natural pigments during the 3rd National Week of Professional and Technological Education.

Over three years, the project engaged diverse audiences. Within the institution, students from the Forestry technical course and the Forest Engineering course participated.

Extension activities reached a wider public, including event visitors, children, youth, and adults attending workshops. The initiative also involved socially vulnerable groups, such as students supported by Fundação Jicred in Ji-Paraná (RO) and patients from Basic Health Units (UBS), who use natural pigment painting as part of occupational therapy.

Results achieved

- Training of scholarship recipient students and students from the Forestry technical course and Forest Engineering course in handling, drying, and extracting natural pigments.
- Participation in events with the external community, promoting knowledge transfer and experience exchange on the use of natural resources.
- Alignment with ODS 12 through responsible consumption and production and reduction of pollutant emissions.
- Planned continuity through the institutional project "Bioeconomy in the multiple uses of teak for the social and economic development of Rondônia".

"Besides learning extraction and application techniques for natural pigments, I understood the importance of developing sustainable alternatives that reduce environmental impacts. It is possible to value forest resources efficiently and responsibly. This experience reinforced my commitment to act ethically and consciously as a future forest engineer".

Student participating in the project

"I never imagined it would be possible to make paint from plants from our region. It was a different, fun experience that taught me a lot".

Workshop participant

Scholarship students sharing experiences with visitors at the booth
Source: courtesy photo

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Sustainable Cocoa: "Chocolate School" promotes farm revitalization in the state of Rondônia

Initiative focuses on seedling production and distribution, reuse of residues for fertilization, and workforce training, strengthening the regional value chain

Soil sampling
Source: courtesy photo

Revitalizing cocoa farming fosters sustainable land management and helps preserve local biodiversity through the use of native species.

Since 2023, the Federal Institute of Rondônia (IFRO) has been carrying out the project "Chocolate School: revitalization of cocoa farming in the state of Rondônia" to strengthen cocoa cultivation, modernize agricultural practices, and boost farm productivity.

Revitalizing cocoa cultivation promotes sustainable land use and helps conserve biodiversity through native species. Adding value to the crop also raises farmers' incomes, as fine cocoa can reach up to three times the market price of commodity cocoa. Strengthening the value chain, therefore, supports farmers in staying on their land, fosters fairer income distribution, and enhances the quality of life for their families.

The project integrates Teaching, Research, and Extension activities through seedling production and distribution, composting of cocoa husks for fertilizer, and workforce training for cocoa farming in Rondônia. The initiative involves rural producers, students, and professionals in the Agrarian Sciences field. Activities are scheduled for completion in December 2026.

Clonal seedling production follows several steps: implementation of a nursery unit at Ji-Paraná Campus;

identification and selection of eligible families for receiving the material, with donations taking place at the beginning of the rainy season; and use of cocoa husk residues. Farmers from five municipalities in central Rondônia benefit from the seedlings and are responsible for implementing the new plantations. A screening process is also conducted to assess each property's fertilization needs.

Organic composting uses agro-industrial residues such as cocoa husks, manioc, cupuaçu, Brazil nut shells, and sugarcane bagasse, discarded by processing industries in the Ji-Paraná region. Classified as "Class A," these composts are produced exclusively from plant-based raw materials originating from extractive, agricultural, and agro-industrial activities, in full compliance with standards for solid organic fertilizers.

Results achieved

- Supply: production of 10,000 clonal cocoa seedlings per year, donated to rural producers in central Rondônia.
- Research: development of high-quality organic fertilizers, rich in nitrogen, potassium, phosphorus, calcium, and magnesium, through composting of agro-industrial residues (cocoa, manioc, and cupuaçu husks, elephant grass, sugarcane bagasse).
- Extension: training of professionals, students, and farmers; service provision; field days in each city

to showcase. the production process; soil sample collection in 150 rural properties targeted for cocoa planting.

- Teaching: clonal seedling and organic compost production processes based on cocoa husks are incorporated into IFRO courses.

"I was able to contribute through courses and seedling donation initiatives, bringing innovation and sustainability to cocoa farming in Rondônia. I am proud of this project that revitalizes cocoa cultivation and strengthens the families who depend on this crop, so essential to our region".

Scholarship recipient in the project

Cocoa seedlings on nursery bench
Source: courtesy photo

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"LabSol Women Entrepreneurs: Sustainable Crafts" transforms lives in Birigui

A professional training course has empowered 70 women in vulnerable social situations, promoting productive, social, and educational inclusion through sustainable crafts

Project Coordinator and Participants
Source: courtesy photo

Workshops, fairs, and partnerships promote a solidarity-based economy, create income opportunities, and boost the self-esteem of women in the region.

The project 'LabSol Women Entrepreneurs: Sustainable Crafts' ran from March 1 to July 1, 2024, serving 70 women living in 14

neighborhoods surrounding the Birigui Campus of the Federal Institute of São Paulo (IFSP), areas that face high economic vulnerability.

Focusing on educational, productive, and social inclusion, the professional training course provided instruction in sustainable crafts using solid waste, encouraging participants to engage either as individual micro-entrepreneurs (MEI) or through women's associations.

The project's training program was structured into three modules, totaling 160 hours. In the civic education module, participants studied topics related to citizenship, gender, women's rights, ethics, human relations, basic biosafety, women's health, quality of life, food and nutritional security, as well as public speaking and verbal and body expression techniques.

The basic skills module covered reading and writing, applied mathematics, financial literacy, and digital inclusion aimed at fostering active citizenship.

The technical module covered professional and technological training, with a focus on sustainable crafts, production processes, pricing, and marketing tools, along with hands-on workshops. Participants also learned about entrepreneurship, cooperativism, solidarity economy, and workers' rights and responsibilities, equipping them to enter the market in a sustainable and independent manner.

In addition to professional training, participants engaged in complementary activities, including lectures, workshops, technical visits, as well as short courses on socio-environmental education and sustainability.

The project prioritized women in vulnerable social situations, selected from communities such as Conjunto Habitacional Margareth Del Bianco Vargas, Jardim das Oliveiras, Portal da Pérola 1 and 2, among 14 other neighborhoods near the Birigui Campus, located in the city of the same name in the state of São Paulo. Participants were selected through active outreach, coordinated with Social Assistance Reference Centers (Cras), community movements, and local partners.

Results achieved

Among the main impacts of LabSol, the following stand out:

- Enhancing self-esteem among participants, reinforcing their personal recognition and potential.
- Generation of income and earnings through sustainable crafts made from milk cartons, fabric scraps, cardboard, and other materials, addressing the three pillars of sustainability (economic, social, and environmental).
- Creation of a support and opportunity network, strengthening women's associations and assisting participants in entering the labor market.

- Sustainable crafts fair held in the town center, providing visibility and opportunities for product sales.

The project involved various partner institutions, including municipal departments, companies, and social organizations. Their collaboration resulted in material donations, as well as the delivery of workshops and lectures, creating a supportive ecosystem for women's productive inclusion.

The project aims to ensure that participants receive professional and civic training, promoting greater integration into the workforce.

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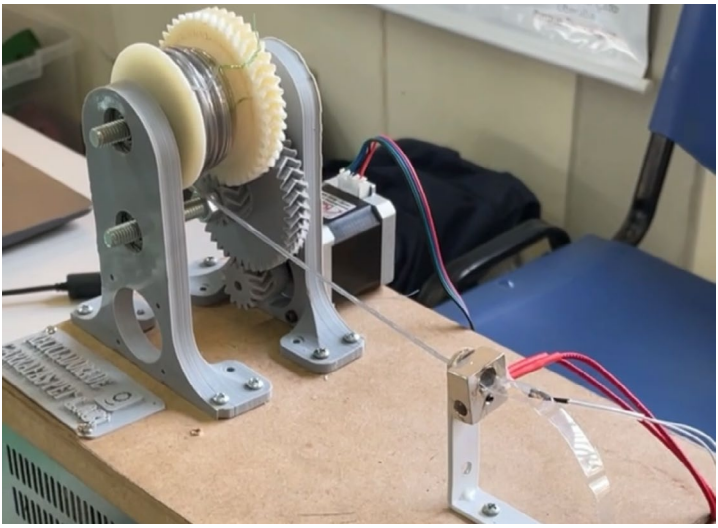
Responsible consumption and production

IFTM project develops a sustainable solution that reuses discarded plastic and fosters the circular economy



3D printer using filament made from PET bottles
Source: courtesy photo

Innovative machine produces filaments from PET bottles, reducing plastic waste and expanding access to materials for technology education.

Participants in the 'PET Bottle Recycler for 3D Printer Filament' project, at the Federal Institute of Triângulo Mineiro (IFTM), developed a machine capable of transforming PET bottles into 1.75 mm filaments, a standard used by most 3D printers. Launched in October 2023, the project combines technological innovation and sustainability by reusing plastic waste and discarded electronic components.

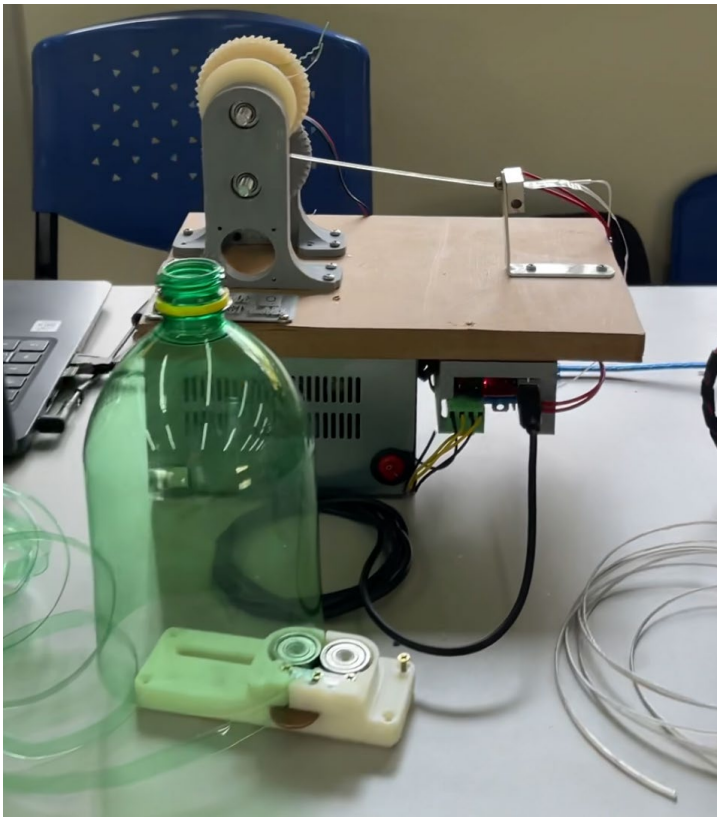
The recycler operates by cutting bottles into strips that are heated and pulled by an electronic board, producing continuous filaments. This provides a cost-effective alternative for the production of 3D printing supplies, lowering expenses and encouraging environmentally responsible practices.

The development of the machine involved different fields of knowledge, from the collection and preparation of bottles to the practical application of the filaments in 3D printers. The result is an accessible solution for schools, maker labs, and FabLabs (collaborative digital fabrication spaces focused on prototyping and innovation).

Among the advances already achieved are the production of filaments compatible with commercial equipment and recognition at innovation events. The project was highlighted at the Innovative Projects Exhibition during the 2023 Seminar on Research and Technological Innovation (SePIT), underscoring its academic and socio-environmental relevance.

More than providing a low-cost resource, the initiative fosters creativity, environmental awareness, and technological

education. By transforming waste into valuable inputs, the project demonstrates that sustainable solutions can generate a positive impact on both learning and the environment.



PET bottle in the filleting process using a manual cutter; in the background, the recycler receives the filament strip and transforms it into filament for 3D printing
Source: courtesy photo

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Seed bank of the Federal Institute of Triângulo Mineiro boosts restoration and protection of the Cerrado savanna

The project uses native plant stock for seedling planting and monitors changes in local vegetation and wildlife, enhancing the protection of the Minas Gerais ecosystem

Production of native seedlings by students
Source: courtesy photo

The initiative has a direct impact on carbon sequestration and on mitigating the effects of climate change.

The identification of native Cerrado savanna species within the territorial scope of the Federal Institute of Triângulo Mineiro and surrounding region is a crucial step for creating a seed database.The initiative aims to promote reforestation of the surrounding areas and reduce the impacts caused by changes to the natural landscape. Based on this, IFTM developed the project "Production and restoration of native Cerrado savanna species for carbon dioxide mitigation".

Based on this project, between 2023 and 2024, seedlings were produced for vegetation restoration, directly impacting carbon sequestration and reducing the effects of climate change. For registration and mapping, field visits were conducted to identify plant species compatible with the biodiversity of the Córrego Bebedouro watershed in Uberlândia (MG).

In the next stage, the matrices selected for seed production and supply were photographed and marked with precise coordinates using a GNSS device (Global Navigation Satellite System). This measure made it easier to return to the site for future monitoring visits. After collection, the seeds were processed and planted to produce specimens with high potential for carbon dioxide sequestration in the region.

As a result, the project documented 35 native Cerrado savanna specimens that flowered and fruited between July 2023 and September 2024. Over 2,000 seedlings were planted for the restoration of IFTM preservation areas, with hundreds more allocated for future plantings and activities.

The initiative also kept the nursery operational, supporting ongoing studies and research needs.

As part of the methodology, the team conducted observations of changes in local vegetation and wildlife to identify potential alterations. The study—which involved the rural community, regional producers, and students from the Uberlândia Campus—highlighted the importance of knowledge and the preservation of regional resources, while also enhancing soil and water management and conservation.

Results achieved

- Registration of 35 native Cerrado specimens.
- Production of over 10,000 seedlings.
- Distribution of species to producers and companies interested in carbon offsetting.
- Restoration of degraded areas in Permanent Preservation Areas (PPAs) of the Federal Institute.
- Replanting in areas affected by wildfires.

Seed collection of native Cerrado savanna species
Source: courtesy photo

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Federal Institute of Bahia expands technical training to reduce environmental impacts in refrigeration systems

Over the past decade, training programs led by faculty members have qualified professionals with a focus on reducing the use of refrigerant fluids

Training on the proper use of tools
Source: courtesy photo

In order to attract new students, a collaborative network was established with educational institutions, industry companies, and suppliers.

It is known that the amount of HCFC emissions—compounds made up of hydrogen, chlorine, fluorine, and carbon—could be drastically reduced through the application of proper practices in refrigeration and air-conditioning equipment. Over the past ten years, the project "Best Practices in Refrigeration: A Case Study at IFBA" has invested in training mechanics and technicians working in the installation, maintenance, and repair of "split" and "window" systems across Bahia.

Appropriate methods include preventive maintenance activities, leak detection, technical data recording, proper operation, as well as the recovery, recycling, and handling of fluids, among others. These processes require skilled and trained professionals, with a focus on significantly reducing gas consumption.

Between 2014 and 2024, faculty members at the Federal Institute of Bahia (IFBA) conducted theoretical and practical training sessions that enabled participants to learn and refine essential techniques and procedures. The methodology included workshops, multidisciplinary group projects, and behavioral assessments. In order to identify and attract new students, a collaborative network was established, bringing together educational institutions, industry companies, and component suppliers. IFBA also provides a virtual environment through the "Moodle" platform, supporting in-person courses across all teaching modalities.

After phasing out chlorofluorocarbons (CFCs) in 2010 and completing the first stage of the Brazilian HCFC Phase-out

Management Plan (PBH) in 2019, Brazil is now moving forward with the gradual reduction of hydrochlorofluorocarbons (HCFCs), substances that harm the ozone layer, with a target of complete elimination by 2040.

The second stage of the PBH outlines measures to reduce HCFC-22 consumption in the service sector and in the manufacturing of commercial refrigeration equipment, such as those used in supermarkets, and air-conditioning systems, as well as to eliminate the use of HCFC-141b. The program is coordinated by the Ministry of the Environment.

Results achieved

- Over 2,500 professionals requalified.
- 400 mechanics and technicians trained in the course "Best Practices for Improved Containment of HCFC-22 in Window and Mini-Split Air-Conditioning Systems".
- 200 mechanics and technicians trained in the course "Best Practices for Improved Containment of HCFC-22 in Commercial Refrigeration Systems".

Brazing training
Source: courtesy photo

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“JoinBike” links cyclists and boosts two-wheel safety

IFPR project aims to transform the cycling experience through technology and innovation

1st “Pedala JoinBike,” held in Colombo, Paraná (2023)
Source: courtesy photo

The initiative already brings together thousands of participants, organizes cycling events, and has been recognized by international institutions.

High traffic violence rates, along with alarming statistics on accidents and thefts, have led many Brazilians to stop using bicycles for transportation or leisure. Faced with this scenario, students and researchers at the Colombo Campus of the Federal Institute of Paraná (IFPR) developed 'JoinBike,' a project aimed at making group cycling safer and more accessible through technology.

The app targets all bicycle owners, regardless of age or experience level, while also aiming to connect cyclists in a collaborative network. The idea is to create a free platform where anyone can find riding groups that match their profile, promoting cycling as a healthy, sustainable, and safer activity.

Even before its official launch, the initiative is already showing significant results. Currently, over 300 cyclists participate in the WhatsApp channel, 3,500 follow the project on Instagram, and more than 100 rides have been organized in partnership with local groups and municipalities. Events such as 'Pedala JoinBike' in the city of Colombo and 'Cicloturismo Quitandinha,' both in the state of Paraná, have brought together hundreds of people and strengthened cycling culture.

Screenshots of the JoinBike app (2024)
Source: courtesy photo

The impact of the project "Joinbike: health, safety, and sustainability on two wheels" has crossed borders.". It was presented at international institutions such as Harvard and MIT, was also ranked the second-best mobility innovation in Brazil at the 'Urban Mobility Park,' and recognized among the 30 most sustainable projects worldwide by 'The Earth Prize' in Switzerland. These achievements highlight the social relevance of the initiative, which aims to expand its reach and establish Brazil as a reference in sustainable mobility.

More than simply creating an app, it is an initiative that encourages safer and more accessible cycling. By connecting cyclists and providing supportive tools, it helps make riding a collective, healthy, and sustainable activity.

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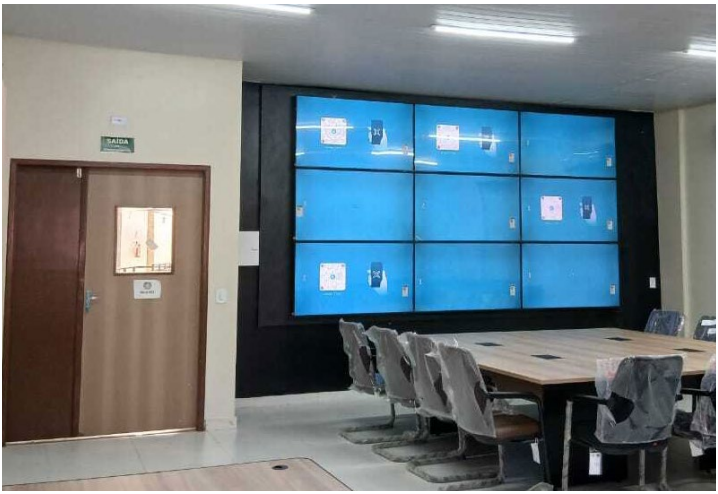
"Environmental restoration" integrates research, bioeconomy and REDD+ projects in the Amazon

Ongoing until 2028, the action contributes to reducing the effects of climate change and favors income generation in traditional communities



Ufopa meteorological situation room
Source: courtesy photo

Combining forest restoration and bioeconomy crops is emerging as an effective strategy for reducing climate impacts. Even so, there is a lack of studies that quantify the carbon sequestration potential of species restricted to a given region. To fill this gap, the Federal Institute of Pará (IFPA) is developing the project "Environmental Restoration: Integrating Bioeconomy and REDD+ Projects as a Strategy

for Mitigating Climate Change and Generating Income in Traditional Communities in the Amazon."

Scheduled for implementation by 2028, this proposal brings educational and research institutions closer to Amazonian communities, combining the restoration of degraded areas with socioeconomic benefits. At the same time, it helps reduce CO_2 emissions and increase soil carbon storage.

The study indicates that the transition to quality management systems increases plant productivity. As a result, pasture becomes a carbon sink, which strengthens community income. This return is made possible both by the commercialization of bioeconomy products and by the generation of carbon credits in REDD+ projects (financial reward to developing countries for the results of reducing greenhouse gas emissions from deforestation and forest degradation).

"Environmental restoration" serves small and medium-sized producers, government agents from Pará and Amazonas, as well as undergraduate and graduate students from IFPA, the Federal University of Western Pará (Ufopa) and the Federal University of Pará (UFPA).

The methodology applied involves the installation of three experimental farms in municipalities in the Legal Amazon – Santarém (PA), Humaitá (AM), and Castanhal (PA). These sites belong to the educational institutions involved, which have qualified faculty to conduct the tests. The farms at these locations are equipped with micrometeorological towers,

as well as biosphere-atmosphere interaction systems and assessment of the impacts of land-use changes on CO_2 emissions or removals.

The actions include, among others, assessment of vegetation development stages, estimation of energy flows, water coverage even in periods of irregular rainfall, monitoring of vegetative and reproductive growth of plants, greenhouse gas balances (CO_2 and CH_4) and water use efficiency.

The project includes community visits for lectures on the carbon cycle and market, climate change, REDD+, safeguards, and governance. It also includes planting seedlings in degraded areas and joint efforts to support the Rural Environmental Registry (CAR), by training multipliers in the region.

As a communication strategy, "Climate Podcasts" will be launched, created by teachers under the supervision of journalists, covering topics such as climate conventions, regional impacts, and mitigation actions. Public school teachers can act as multipliers, encouraging students to create digital content to promote awareness of environmental education.

In September 2025, the Meteorological Situation Room was inaugurated at Ufopa, part of the Laboratory of Agrometeorology with Bioeconomy Modeling and Environmental Diagnosis (Lambda). The room integrates local and satellite data (Inpe,

Nasa) linked to the Amazon Atmospheric Observatory, boosting research, monitoring, and environmental management.

Results achieved

- Implementation of environmental monitoring systems: solar radiation sensors, rain gauges, and weather stations on farms.
- Producer training: promoting gender equality, diversity, sustainable use of natural resources, and developing environmental management tools.
- Support for civil defense and society: situation rooms and meteorological monitoring to monitor extreme events, such as droughts and fires.
- Occupation in agricultural activities.
- Increase in family per capita income.
- Adding value to low-carbon production.
- Creation of the Rural Environmental Registry (CAR).
- Bringing traditional communities closer together.
- Facing misinformation about the climate crisis.

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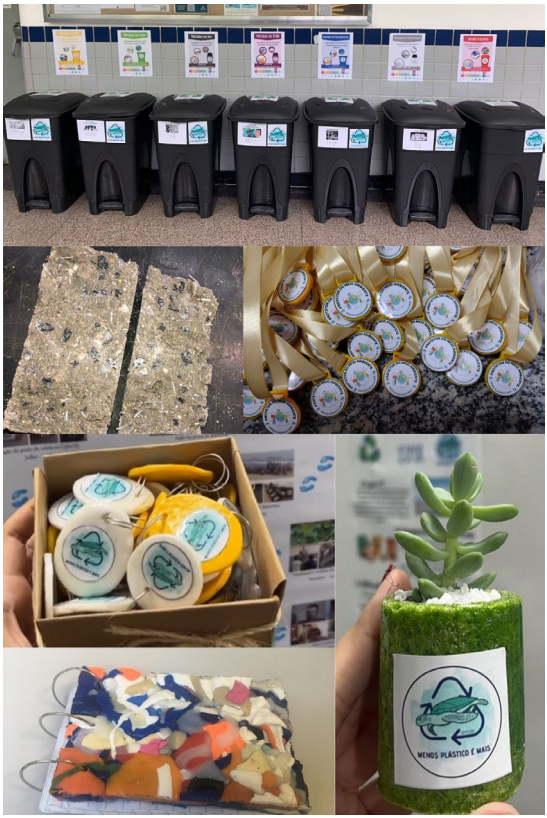
Environmental education: “Less Plastic is More” project promotes actions in Rio de Janeiro

Developed over seven years at Cefet/RJ, the initiative raises awareness about the risks of excessive plastic consumption and the consequences of improper disposal in the marine ecosystem



Collection and recycling station for sorted waste
Source: courtesy photo

The "Less Plastic is More" project began in 2018 at the Federal Center for Technological Education Celso Suckow da Fonseca (Cefet/RJ). For seven years, it has been working to raise awareness about excessive plastic consumption and the environmental damage caused by improper disposal.

The project reached Cefet/RJ students and staff, a waste pickers' NGO, beach cleanup volunteers, municipal school students, and beachgoers.

Within the academic community, the campaign set up a plastic collection station to sort waste according to recycling symbols, in line with NBR 13230. Every week, the material was washed, weighed, cataloged, and forwarded for selective collection.

The initiative also promoted beach cleanups across Rio de Janeiro, seeking to engage beachgoers and street vendors. The team was responsible for collecting waste in designated areas. Results of the waste audits were shared on the project's social media, both as a scientific outreach measure and as a way to encourage more informed decisions about plastic use and disposal.

The project reached Cefet/RJ students and staff, a waste pickers' NGO, beach cleanup volunteers, municipal school students, and beachgoers. Throughout the year, students

also held lectures, workshops, and storytelling sessions at the municipal school Conselheiro Mayrink.

After the project's conclusion, the group plans to continue research focusing on polystyrene. Studies are underway to refine the methodology developed by the project team.

Actions carried out over seven years

- Direct beneficiaries: about 200 people.
- Cleanups at six city beaches: Ipanema, Flamengo, São Conrado, Bica, Barra de Guaratiba, and Copacabana.
- Awarded during Cefet/RJ's Research and Extension Week.
- Studies on incorporating plastic into concrete, recycling cigarette butts, and reusing polystyrene.
- Lasting changes in habits within the academic community and increased interest in selective waste collection.

Waste collected during beach cleanups

- 17,503 cigarette butts.
- 27.08 kg of glass.
- 33.99 kg of plastic.
- 2.48 kg of metals.

- 70.73 kg of organic waste.
- 1,419 plastic caps.
- 1,872 plastic straws.
- 1,215 plastic packages.
- 718 plastic cups and utensils.
- 324 plastic tubes.
- 870 metal caps.
- 136 polystyrene packages.
- 185 aluminum items.

"Our project aims first to clean Rio de Janeiro's beaches and, in the future, to find ways to reuse the waste we collect".

Former student team member

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Preamar: IFPB develops program to restore marine biodiversity

Through environmental diagnostics, the initiative invests in artificial structures and reef ecosystem rehabilitation while boosting tourism along the Paraíba coast

Signing ceremony of the Conduct Adjustment Agreement (TAC)
Source: courtesy photo

Preamar combines science, cutting-edge technology, and public policy to promote coastal sustainability.

The "Strategic Program of Artificial Marine Structures of Paraíba" (Preamar) project is a set of social and environmental actions based on the use of artificial reefs, restoration techniques for natural coral reef environments, and the development of thematic areas for contemplative diving. The initiative of the Federal Institute of Paraíba (IFPB) seeks to support the recovery of marine biodiversity, carbon sequestration, and the fight against climate change. It also promotes nautical and underwater tourism and contributes to the management of artisanal and sport fishing.

Preamar conducts a comprehensive environmental assessment along 133 kilometers of the Paraíba coastline. The study provides the foundation for the state's Integrated Coastal Management (GCI) plan and supports managers and policymakers in making decisions geared toward sustainable socioeconomic growth. The program represents the realization of the aspirations of the Povos do Mar (communities living along the coast), and merges science, advanced technology, and public policy to foster coastal sustainability.

Scheduled to run until 2026, the initiative is carried out through a partnership among the State Government of Paraíba, via the Paraíba Development Company (Cinep); the Federal Institute of Paraíba (IFPB), through its Innovation Hub; the Federal Prosecution Service in Paraíba (MPF-PB); and the IFPB Support Foundation (Funetec). Researchers and labs from several institutions are also involved, including the Federal University of Paraíba (UFPB), the State University of Paraíba (UEPB), the Federal University of Pernambuco (UFPE),

the Federal University of Campina Grande (UFCG), the Federal University of Ceará (UFC), the Federal Rural University of the Amazon (Ufra), and the National Center for Research and Conservation of Wild Birds (Cemave), part of the Chico Mendes Institute for Biodiversity Conservation (ICMBio). The program also counts on backing from civil society groups, along with fishers, divers, tourism professionals, and environmentalists.

Beneficiaries of Preamar

- 720 artisanal fishers (240 boats).
- 100 sport fishers (25 boats).
- More than 24,000 tourists (nautical and underwater tourism).
- 60 maritime workers.
- 500 high school and college students per year.
- Union's Assets Department (SPU), Brazilian Institute of Environment and Renewable Natural Resources (Ibama), ICMBio, Paraíba State Environmental Management System (Sudema-PB), Paraíba Secretariat of Environment and Sustainability (Semas-PB), and coastal city governments.
- Three social and environmental projects.
- Residents and tourists from nine municipalities served by Preamar.

Results achieved

- Licensing process for artificial reef deployment: preparation of institutional and technical documentation, obtaining approvals, authorizations, and validations, promotion of social and environmental actions.
- Integrated Coastal Management (GCI): broad institutional coordination, generation of technical and scientific data, and decision-making.
- Institutional: signing of a Conduct Adjustment Agreement (TAC), establishing structural interventions, a milestone for regulating actions in a complex and vulnerable coastal zone.
- Environmental diagnostics: generation of technical and scientific data consolidated in three Technical Notes (NTs).
- General actions: extensive physiographic characterization, proposals for new road layouts, replacement of asphalt with interlocking blocks, and installation of tourism support infrastructure.

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“Missing Pages”: IFBA project makes room for women at agroecological fair in Vitória da Conquista

Such work highlights the importance of the Ecoema Fair as a space for sustainable production and preservation of the community's cultural traditions

Stall showcases kombucha drink
Source: courtesy photo

By combining crafts and an agroecological fair, a space is created that values both conscious food production and local culture.

Documenting the experiences of women producers at the Ecoema Fair, located in Vitória da Conquista (BA): this is how the idea for the project "Missing pages - stories to tell about the agroecological fair" came about. Held between 2023 and 2024 by the Federal Institute of Bahia (IFBA), the action helped to publicize the agroecological and artisanal products displayed weekly, on Saturdays, at the location.

Agroecology combines different areas of knowledge to encourage sustainable farming methods aligned with ecological principles. This is the case with the absence of pesticides, for example, which reduces impacts on the environment and prevents contamination of both air, soil and water. By bringing together crafts and an agroecological fair, a space is created that values both conscious food production and local culture. The public has access to organic, healthy products, while at the same time the handcrafted pieces convey the identity and traditions of the participating communities.

During the project's implementation, the team conducted field visits, interviews, and conversations with the women vendors to understand the daily routines of the protagonists, who play a crucial role in integrating ecological practices as well as fostering cultural resistance. Aspects such as the interaction between producers and consumers, which characterize the goods offered for sale and help convey the atmosphere of the fair, were observed throughout the study. All stages were documented through photos and videos.

The narratives and life stories shared enriched the work carried out at the fair, where a wide variety of products are offered, including food, healthy drinks, homemade sweets, and handicrafts.

Although there are no quantitative data on sales volume, the research highlighted the positive impact on visitor attraction and, consequently, on boosting the local economy. Moreover, Ecoema emerges as a significant space for leisure, social gathering, and experience, thus underscoring its socioeconomic, cultural, and environmental contributions.

Documentary filming

Six women participated voluntarily in the filming, with authorization provided through image and voice consent forms. The audiovisual material produced—two short documentaries—captures the weekly collective experience and provides a rich insight into the fair's environment, as well as the agroecological and handicraft practices of the women vendors.

Link to documentary
"Missing pages - stories to tell about the agroecological fair"

"Agroecological fairs represent a form of protest against the neglection of Planet Earth".

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IF Goiano maps Environmental Protection Area and promotes carbon stock in Rio Verde

Research identifies 12.36 tons per hectare of retained material, underscoring the role of APPs in biodiversity conservation and environmental compensation

Permanent Preservation Area of Rio Verde (2023)
Source: courtesy photo

Between 2022 and 2024, the Federal Institute Goiano (IF Goiano) conducted a study to characterize the tree layer and promote carbon stock in a Permanent Preservation Area (APP) in the municipality of Rio Verde, Goiás. The APP hosts a perennial spring undergoing rehabilitation, which drives environmental compensation efforts.

Through the project titled "Ecosystem Services of Carbon in the Rehabilitation of Permanent Preservation Areas," tree species were identified, and both the diameter at breast height (DBH) and total height of each tree were measured.

The carbon stored in biomass was estimated using equations based on DBH, height, and wood density.

In the area selected for the study, 230 trees were recorded, belonging to 20 species across 12 families, totaling 12.36 tons of stored carbon per hectare. Of this total, three large tree species—A. colubrina, I. vera, and H. courbaril—accounted for 74.59%. The results indicate that including larger and denser specimens in rehabilitation projects can maximize carbon sequestration, supporting ecological restoration, biodiversity, and water sustainability. This evidence underscores the potential of APPs as strategic tools for environmental compensation.

The initiative reached not only the scientific community interested in carbon sequestration and storage studies, environmental managers, and public agencies responsible for water resource conservation, but also rural producers seeking sustainable practices and the local community, which benefits from improved environmental quality and water availability.

Results achieved

- 12.36 t/ha of carbon accumulated over two years (2022–2024).
- An increase of approximately 33% compared to the estimate in 2022.

- High contribution from a few species due to large tree size, significant DBH, high wood density, and developmental stage.
- Highlight on the species A. colubrina, H. courbaril, and Inga vera: together, they accounted for 74.59% of the carbon.
- APP rehabilitation – fencing, soil restoration, and seedling planting.
- Strengthening environmental awareness in Rio Verde and surrounding areas.
- Development of Degraded Area Recovery Plans (Prad) and environmental characterization reports of the APP.
- Publication of forest inventories in summaries and technical bulletins.
- Defense of a thesis related to the topic and encouragement to participate in postgraduate programs.
- Consolidation of an institutional committee.
- Strategic agreements with public agencies, companies, and educational institutions.
- Environmental education actions: lectures, courses, technical visits, field classes, and seedling planting (involving 350 participants).
- Strengthening study groups and institutional partnerships.

"I realized how small actions can have a significant impact on the community and the environment. This experience sparked my interest in research and the preservation of APPs, something I intend to carry forward into my professional career".

Rodrigo Chaves Ferreira, student

"Seeing the involvement of the academic community and society was inspiring. The exchange of experiences strengthens the field and shows that environmental preservation and sustainable agricultural production can go hand in hand".

Carolina Vieira, rural producer

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Southernmost Santa Catarina: IFC initiative combines environmental restoration, cultivation, and free seedling distribution

By integrating Teaching, Research, and Extension, this project reached over 20,000 beneficiaries and promoted sustainable practices in local and regional communities

Overview of seedling benches in Santa Rosa do Sul (SC)
Source: courtesy photo

The activities contribute to the preservation of rivers, streams, riparian forests, ecological corridors, wildlife, springs, and water sources.

The project "Rescue, Production, and Donation of Native Forest and Fruit Tree Seedlings for Environmental Preservation and Restoration in the Southernmost Region of Santa Catarina" continued the study of the same scope at the Technical Management Unit of the Santa Catarina Coast. Developed from 2019 to 2025, the project aimed to promote environmental education in the communities of the Southernmost Santa Catarina Municipalities Association (Amesc) through the integration of Teaching, Research/ Innovation, and Extension activities.

In addition to area restoration and the establishment of small orchards, the initiative by the Federal Institute of Santa Catarina (IFC) in Santa Rosa do Sul promoted knowledge dissemination by involving rural communities, municipal governments, cooperatives, and local schools, reaching an audience of over 20,000 beneficiaries.

The initiative highlighted the fundamental role of the selected species in diversifying fauna and flora—whether for their medicinal potential, as food sources and income through the production of seedlings, fruits, and pulps, in rural tourism, in bee pollination and production, or for handicrafts. These activities significantly contribute to the preservation of rivers, streams, riparian forests, ecological corridors, wildlife, springs, and water sources, while also promoting integrated agroforestry with beekeeping.

The study employed both suspended and non-suspended benches equipped with capillary rise and sprinkler irrigation systems. Seedlings were produced through seeds, cuttings,

and grafting, in a process that lasted an average of two years. Once ready for permanent planting, they were donated to local and regional communities and also used in various Teaching, Research, and Extension activities at the Institute.

Results achieved

- Study of the ripening periods and collection of fruits and seeds from 100 native forest and fruit tree species, belonging to 29 native botanical families of the Atlantic Forest.
- Production of 2,089 seedlings of native forest and fruit tree species, donated to rural communities in southern Santa Catarina, schools, and non-profit public agencies.
- Promotion of environmental education and preservation, as well as the restoration of both degraded areas, water springs, and riparian forests along rivers and streams.
- Production and donation of 12,038 seedlings, including grumixama, Pará guava, wild cherry, sugar apple, white inga, Maranhão nut, beach apricot, and pink trumpet tree (ipê rosa).
- Most species bear fruit in November, December, and January, with lower rates from May to July.
- Participation of institutions and agencies such as the Agricultural Research and Rural Extension Company of Santa Catarina (Epagri), Sicoob Credija,

Cooperja Demonstration Field (CDC), and the municipal governments of Sombrio (SC), Três Cachoeiras (RS), and Praia Grande (SC).

- Seedling distribution at IFC events: National Interdisciplinary Scientific and Technological Initiation Fair, Family Farming Technological Exhibition, and Southern Santa Catarina Scientific and Technological Integration Symposium.

- Donation of seedlings at events such as Environment Week, World Water Day, Cooperative Day, Arbor Day, and activities related to the environmental education program.

Pots with substrates for sowing and subsequent seedling repotting
Source: courtesy photo

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Serra da Mantiqueira: IF Sul de Minas proposes actions to restore deforested landscapes

This plan supports rural producers with a focus on forest restoration, sustainable farming, and rural sanitation, while also providing training for public officials, technical staff, and students

Aerial view of the Mogi Guaçu River and the area undergoing forest restoration
Source: courtesy photo

An estimated 13,362 tons of carbon dioxide are expected to be sequestered over the next 20 years.

The "Mantiqueira Conservator Plan: Actions of Core 2" is part of initiatives aimed at restoring deforested landscapes in the

Mantiqueira Range and aligns with the goal of recovering 1.5 million hectares within the Atlantic Forest biome.The technical team of the Federal Institute of Southern Minas Gerais (IF Sul de Minas), Inconfidentes Campus, is carrying out actions ranging from environmental assessments of rural properties—helping farmers comply with legislation with a focus on forest restoration, sustainable agriculture, and rural sanitation—to the drafting and implementation of municipal Payment for Environmental Services (PES) laws. The initiative also includes training for public officials, technical staff, and students; the establishment of a Demonstrative Forest Restoration Unit; and the consolidation of strategic partnerships with public institutions, private entities, and non-governmental organizations.

Through forest restoration measures, including seedling planting and natural regeneration, an estimated 13,362 tons of carbon dioxide are expected to be sequestered over the next 20 years. In addition to direct benefits for rural producers—such as increased property value and extra income through PES—the project also strengthens the comprehensive training of students, who participate as scholarship holders, interns, and multipliers of the initiatives, generating scientific, social, and environmental impact. "Core 2" is establishing itself as a reference in socio-environmental innovation, contributing to climate change mitigation and the promotion of regional sustainability.

The project benefits not only rural producers, students, entrepreneurs, and urban residents, but also the global population, which gains from climate improvements through

carbon sequestration. The initiative is set to continue until December 2030.

Methodology

- IF Sul de Minas joins the Mantiqueira Conservator Plan (PCM).
- Creation of the Payment for Environmental Services (PES) law.
- Training of the technical team on forest restoration.
- Training for municipal managers.
- Registration of rural producers.
- Diagnosis of properties for Payment for Environmental Services (PES).
- Demonstrative Forest Restoration Unit.
- Araucárias da Mantiqueira Socio-Environmental Project.
- Partnerships.

Results achieved to date

- 153 visits to rural producers.
- 108 property diagnoses.
- Environmental regularization of 64 properties.
- Conservation of 153 hectares of Atlantic Forest.

- Restoration of 61.74 hectares of forest areas.
- Planting of 51,666 native Atlantic Forest seedlings.
- Construction of 52.054 kilometers of fencing.
- Construction of 81 small water retention structures.
- Maintenance of 7,482 kilometers of rural roads.
- Installation of four drinking troughs and 60 biodigesters.
- Sequestration of 13.362 tons of carbon dioxide over 20 years.
- Socio-environmental impact, benefiting 10 landowners through PES.
- Comprehensive training of students.
- Extension, research, innovation and teaching initiatives.
- 16 students awarded scholarships.
- Scientific publications, radio and TV reports, social media, and organization of events and lectures.

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IFMG develops participatory research to promote sustainability in rural communities

The project works alongside Indigenous peoples, quilombola communities, and family farmers in São João Evangelista and the surrounding region, promoting socio-environmental assessments and collaborative actions

Research team with members of the Pataxó Kanã Mihay village
Source: courtesy photo

An initiative of the Federal Institute of Minas Gerais (IFMG), São João Evangelista Campus, the project 'Successful Approaches and Challenges in Promoting Sustainability in Rural Communities through Participatory Research' set out to investigate, over the course of one year, the potentials and challenges for promoting the advancement of socio-environmental sustainability. For this study, participatory research was adopted in rural communities- belonging to

indigenous, quilombola and family farmers - in the São João Evangelista region.

This idea arose after identifying a gap regarding the low connection between conventional research, social contexts, and Indigenous Local Knowledge (ILK), which reduces the effectiveness of scientific action for sustainable development. Therefore, it was necessary to combine interdisciplinarity and transdisciplinarity through the exchange, as well as the collaborative production (coproduction) of knowledge. This research integrates scientific knowledge and CLI, aiming to mitigate issues such as climate change, biodiversity loss, and poverty, which are all linked to the SDGs established by the UN 2030 Agenda.

The scope of the study lies within the Atlantic Forest, which is Brazil's most biodiverse biome. At the same time, however, the region faces severe economic vulnerability and a lack of technical and political support for local communities. The initiative reaches Pataxó Indigenous peoples from the Kanã Mihay village (Carmésia, MG), quilombola residents of the São Félix community (Cantagalo, MG), and family farmers from São João Evangelista (MG).

The collection of qualitative data included a socio-environmental assessment of the local, territorial, and landscape context, as well as the communities' priority needs, carried out through interviews, participant observation, social mapping, and guided tours. This material provided the basis for mapping priorities across the social, economic, and environmental dimensions of the territories. Subsequently,

the team developed a participatory agroecological environmental plan and established demonstration units both in the study areas and on the IFMG campus.

Diagnosis

- Family farmers, Indigenous peoples, and Quilombola communities: traditional, subsistence-based, and sustainable agriculture.
- Tradicional agriculture gradually being abandoned: capitalist activities in advance; lack of government support, and inadequate infrastructure.
- Environmental sustainability: water scarcity as a limiting factor for agriculture.
- River springs: contaminated by sewage discharge.
- Scarcity in the humid Atlantic Forest biome: necessity to provide access to rainwater harvesting techniques from the semi-arid region.
- Streams: polluted due to sewage discharge.
- Climate change: water reduction.
- Pataxó from Kanã Mihay: they face difficulties accessing rural credit as well as agriculture abandonment.
- Creation of "Afroecological Network" by Quilombola communities, bringing together universities, NGOs, and public officials.

- High school dropout rates among youth in SJE: agriculture limited to a few crops.
- Migration: residents of SJE and the São Félix quilombo move to nearby areas and São Paulo. The Pataxó migrate from Terra Indígena Barra Velha do Monte Pascoal (BA) to the village.
- Across the three communities: urban habits; obesity; no waste collection; cellphone use increased.
- The richness of Traditional Local Knowledge (TLK): many social technologies are used in agriculture and crafts, for example; and no external inputs are used.
- Prioritizing actions: land/soil for vegetable farming; techniques improvement; seedlings and fertilizers preparation; among others.
- Achievements: recovery of agricultural practices as well as its strengthening; changes in eating practices and in the management of vegetables and agroforestry systems.
- Challenges: agricultural practices abandonment; labor issues; technical and political support; water scarcity; urban habits.

"Participatory research is an important path to follow in order to mitigate and reverse erosion, but it requires time and availability of resources so that it can generate effective change. This

effectiveness also depends on changes at the government and societal levels. The urgent need for public policy support to restrain the abandonment of family farming is highlighted".

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Project boosts sociobiodiversity and juçara açaí production in southern Brazil

Initiative by the Federal Institute of Santa Catarina (IFC) engages family farmers and Mbya Guarani indigenous communities in Rio Grande do Sul

Juçara açaí production workshop with IFC students
Source: courtesy photo

The initiative boosts the strengthening of a production system based on sociobiodiversity, a cornerstone of sustainable development in the region.

The project "Consolidation and expansion of the sociobiodiversity chain in southern Brazil" prioritized a production system based on biological and sociocultural

diversity, with a specific focus on the juçara açaí supply chain. The audience reached throughout 2024 included family farmers from the southern region and Mbya Guarani Indigenous communities located on the northern coast of Rio Grande do Sul. In recent years, the NGO Centro Ecológico (RS) has been at the forefront of transformative initiatives to support local farming families. These efforts encourage the diversification of practices and the adoption of strategies better suited to cope with the growing climate uncertainties affecting the region.

The first phase of the project enabled a substantial increase in the number of farmers involved in the cultivation and harvesting of fruits in forested areas. Additionally, it facilitated the entry of Centro Ecológico into Indigenous territories through productive collaborations with partner organizations. Subsequently, in the second phase, facilitators from the communities were hired to identify potential suppliers of native fruits, along with the establishment of a working capital fund designed to enable direct purchases from local producers.

The project aimed to promote collaborations with emerging juçara açaí initiatives in neighboring states within the Atlantic Forest region. It also leveraged government actions: at the state level, through the Rio Grande do Sul State Secretariat for the Environment, with funding for environmental compensation; and at the federal level, with support from the Ministry of Environment and Climate Change. Notably, production cooperatives played a key role in encouraging new families to engage in the initiative. Overall, the initiative

boosts the strengthening of a production system based on sociobiodiversity, a cornerstone of sustainable development in the region.

Results achieved

- Expansion of cultivation and harvesting of juçara palm fruits by participating families.
- Increase in the number of Mbya Guarani Indigenous people supported by the project.
- Growth of agroforestry areas certified by the Rio Grande do Sul State Secretariat for Environment and Infrastructure (Sema-RS).
- Carbon sequestration in agroforestry systems.
- Participation of students from the Santa Rosa do Sul Campus (IFC) in hands-on biodiversity conservation and adaptation activities in the context of climate change.

Methodology used

- Participatory mapping and assessment: mapping of areas used for the cultivation and extraction of sociobiodiversity products.
- Training and support: implementation of training programs and technical assistance specifically designed for family farmers and Indigenous communities.

- School integration: involvement of IFC students in hands-on fruit harvesting and processing activities.
- Strengthening the production chain: partnerships with local cooperatives, promotion of fairs and events, and obtaining quality and sustainability certifications.
- Monitoring and evaluation: monitoring the activities carried out, assessing impacts, and making adjustments.

IFC agronomy student with a Guarani leader
Source: courtesy photo

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Solutions bring together science and community to protect the waters and forests of the Atlantic Forest

The initiative integrates scientific research, sustainable tourism, and agroecological practices in line with the UN 2030 Agenda

Agroforestry systems established in an area affected by fire, two years after their implementation
Source: courtesy photo

This experience demonstrates how sustainable practices can generate environmental, social, and economic benefits in conservation areas.

The focus of the project "Nature-Based Solutions Applied to Integrated Water Management" is to implement innovative agroforestry and water conservation practices in protected areas. Ongoing since 2021 at the Águas Claras Site, the project spans the municipalities of Conceição de Macabu, Trajano de Moraes, and Santa Maria Madalena in the state of Rio de Janeiro.

The initiative aims to integrate science, permaculture (or "permanent culture," which combines traditional knowledge and modern practices to promote more sustainable human settlements), and sustainable tourism to preserve the Águas Claras I and II Private Natural Heritage Reserves (RPPNs), located in the Carukango River micro-basin, an important public water supply source in the region. Practices implemented include agroforestry systems, native seedling nurseries, greywater treatment techniques, and ecopedagogical signage for visitors.

The project is also linked to community-based tourism activities, such as guided trails, forest bathing, environmental workshops, and even stargazing. This strategy strengthens the connection between environmental education and local income generation.

The activities involve everyone from local elementary school students, who have become aware of the importance of conservation, to high school students in integrated technical programs, as well as undergraduate and graduate students from the Fluminense Federal Institute, who participate in field research. In addition, the project engages local residents,

tourists, environmental professionals, and partner institutions, broadening its impact well beyond the boundaries of the RPPNs.

In addition to already producing concrete results, such as the implementation of agroforestry systems and support for the management plans of the RPPNs, the project is expanding its activities through research on unconventional edible plants, hydrological modeling of the micro-basin, and the development of new ecotourism trails. The expectation is that the solutions being tested can serve as a reference for environmental policies, as well as support the achievement of Sustainable Development Goals (SDGs) 6, 13, and 15.

Main project deliverables

- Medicinal and aromatic agroforestry system (70 m^2) and a fruit tree system (0.3 hectares).
- Native seedling nursery with gravity-fed irrigation.
- "Banana circle" for greywater treatment.
- Observation deck for stargazing and yoga practices (Mirante das Estrelas).
- Butterfly garden with cultivated and native Atlantic Forest species.
- Demonstrative permaculture circuit and ecopedagogical trails.

- Meteorological station installed for climate monitoring.
- First astrotourism event in Conceição de Macabu.
- Support for the development of the Management Plans for the Águas Claras I and II RPPNs.

Butterfly Garden of the project's Permaculture Demonstration Unit – integrating landscaping with riparian vegetation restoration
Source: courtesy photo

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IFFar strengthens strategic partnerships for the 2030 Agenda

Institutional program integrates Teaching, Research, and Extension to promote sustainable development and regional cooperation

Cover of the e-book with extension projects and their relation to the SDGs
Source: courtesy photo

The initiative has already trained more than 600 people, consolidated projects with the Selo ODS Educação, and produced reference materials on partnerships and sustainability.

The world faces complex social and environmental challenges, and the UN 2030 Agenda emerges as a global plan that requires strong collaboration. Within this context, SDG 17 (Partnerships for the Goals) highlights the importance of strengthening cooperation among different sectors of society. The Federal Institute Farroupilha (IFFar), a network with 11 campuses, has sought to respond to this call through strategic initiatives that connect Teaching, Research, and Extension.

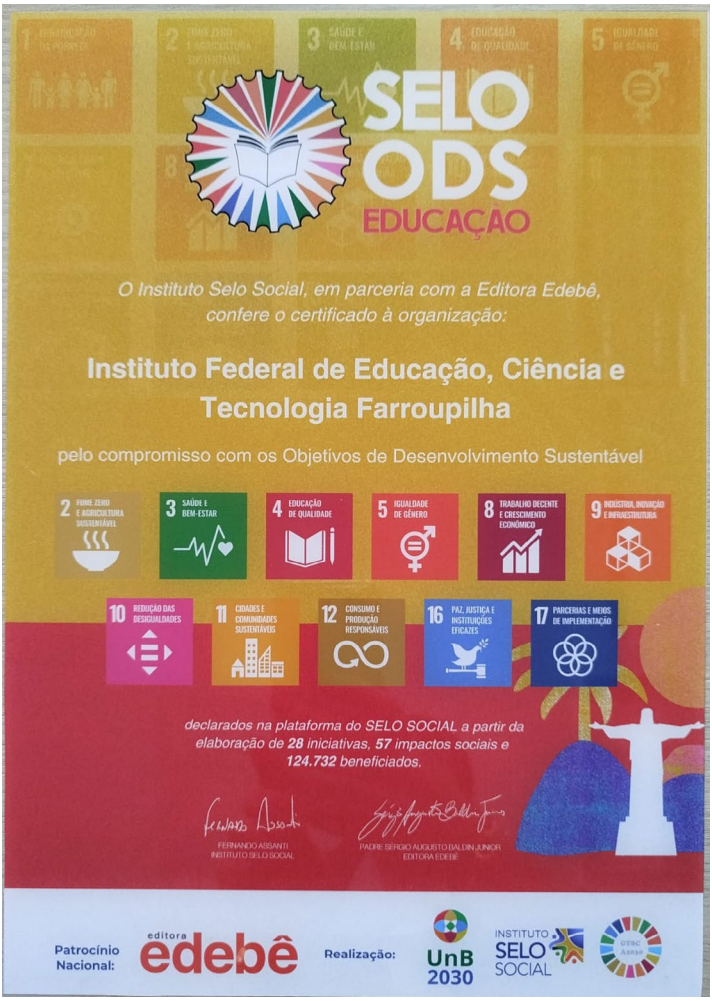
The "Institutional Program Agenda 2030: SDG in Educational Practice" was created to integrate sustainability into academic activities and strengthen strategic alliances. As part of its work, the program maps existing projects across all IFFar campuses, recording their actions and identifying potential external partners for collaboration. It also seeks to enhance these initiatives through the "Selo ODS Educação" (lit. "SDG Education Seal"), which recognizes projects that already foster partnerships, and ensures continuity by formalizing governance. In this way, the 2030 Agenda is consolidated as a strategic pillar that depends on strong partnerships for effective implementation.

The program benefits a wide audience, including faculty, staff, and students across campuses, as well as public managers and society at large. Internally, it trains and engages the academic community to act as agents of transformation; externally, it fosters cooperation with public sectors and local organizations, strengthening regional development in a sustainable way.

Among the results achieved, key actions included training activities aimed at different audiences, the publication of two e-books compiling 68 works, and a significant increase in projects submitted for the Selo ODS Educação. The initiative also supported the development of staff, faculty, and managers from the external community, broadening knowledge dissemination and reinforcing governance processes.

The program demonstrates how collaboration among different sectors can generate tangible impacts in society and strengthen public policies aligned with the 2030 Agenda. By integrating Teaching, Research, and Extension, IFFar promotes sustainable results and expands the social impact of its initiatives.

> "Participating in the lectures on the 2030 Agenda showed me that my program goes far beyond the classroom. It is about real impact in the community and about how we can use what we learn to build a better future".
>
> *Maria Eduarda Silva (undergraduate student)*



SDG Education Seal 2024 plaque
Source: courtesy photo

SDG Brazil Network Meeting
Source: courtesy photo

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Amazon Green Technologies Observatory strengthens sustainable innovation and bioeconomy in Brazil

Initiative by Inpi, Suframa, and IFAM provides strategic information on environmentally sustainable patents

Launch of the Observatory at ExpoAmazônia Bio & TIC 2024, in Manaus (AM)
Source: courtesy photo

The project offers an interactive data dashboard and a Technology Radar, benefiting researchers, companies, and managers in the innovation ecosystem.

The "Amazon Green Technologies Observatory" is the result of a Technical Cooperation Agreement (ACT) signed between the National Institute of Industrial Property (Inpi), the Manaus Free Trade Zone Authority (Suframa), and the Federal Institute of Amazonas (IFAM). The observatory's goal is to consolidate and provide technological prospecting data on sustainable innovations, supporting the development of the national bioeconomy.

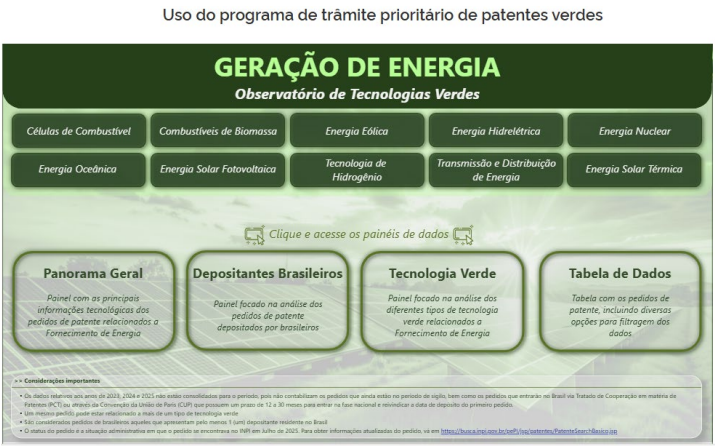
The target audience includes the innovation and patent ecosystem, covering researchers, companies, public managers, and others interested in green technologies. Among the results achieved are the interactive data dashboard (available at https://www.gov.br/inpi/pt-br/servicos/patentes/observatorio-de-tecnologias-verdes/observatorio-de-tecnologias-verdes), which allows monitoring of the patent protection landscape over time, and the Technology Radar launched by Inpi, which consolidates information on the use of Brazil's fast-track program for green patents.

Check out the results achieved through the QR Code

The observatory's methodology involved creating a knowledge pathway to train IFAM researchers in structuring the platform. Patents using the "Green Patents" priority examination program were identified in the Inpi Technological Information Database (Bintec). The data were

processed using automatic, suggestive, and manual features in the VantagePoint® software for cleaning, standardization, and categorization. In addition, documents related to the Amazon and regional bio-inputs were highlighted.

The project contributes to the strategic use of technological information by supporting public policies, evaluating industrial policy results, and improving the use of resources for research, development, and innovation. Periodic updates and the option to download data in spreadsheet format make the observatory an essential tool for monitoring and strengthening sustainable technologies.



Data dashboard
Source: courtesy photo

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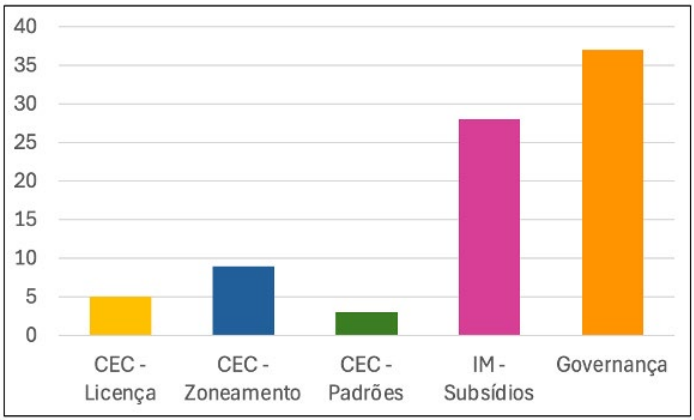
IFTM Analyzes the effectiveness of environmental regulations and governance in Uberaba

Research by the Federal Institute provides resources to advance SDG indicators in the municipality, while also promoting improvements in the population's quality of life



Regulatory instruments in Uberaba, according to Municipal Ordinances
Source: courtesy photo

Through applied research, the Federal Institute of Triângulo Mineiro (IFTM), in partnership with the Federal University of Uberlândia (UFU), carried out between 2024 and 2025 the project "Sustainable local development from the perspective of environmental regulations and governance in the city of Uberaba. "The project analyzes the effectiveness of environmental regulations and governance in the municipality.

Regulations are aimed at curbing pollution and the degradation of natural resources. Governance, on the other hand, involves a coordinated action through which governments, businesses, civil society, and educational and research institutions work together to ensure measures such as compliance with environmental standards, the promotion of sustainability, the mitigation of negative impacts, and the responsible use of natural resources as public goods.

To achieve this purpose, the research was divided into two specific objectives: to classify the regulatory instruments, considering the municipal ordinances in Uberaba for the year 2024, and to correlate these ordinances with the 17 Sustainable Development Goals (SDGs).

The data analysis showed that the legislation mainly covers market-based instruments (MBIs), particularly subsidies, followed by command-and-control (CAC) regulations, especially zoning. These results are consistent with previous international research, which identifies the prevalence of these instruments in countries or regions with recent industrialization. Regarding the SDGs, legislation related to SDG 9 (Industry, Innovation, and Infrastructure), SDG 3 (Good Health and Well-Being), and SDG 11 (Sustainable Cities and Communities) predominates.

Regarding the target audience, the work involves all actors linked to governance, including government agencies, businesses, NGOs, and the community of Uberaba. The project "Sustainable Local Development" provides means to

improve the city's SDG indicators as well as the population's quality of life.

Classification of local laws

Regulation

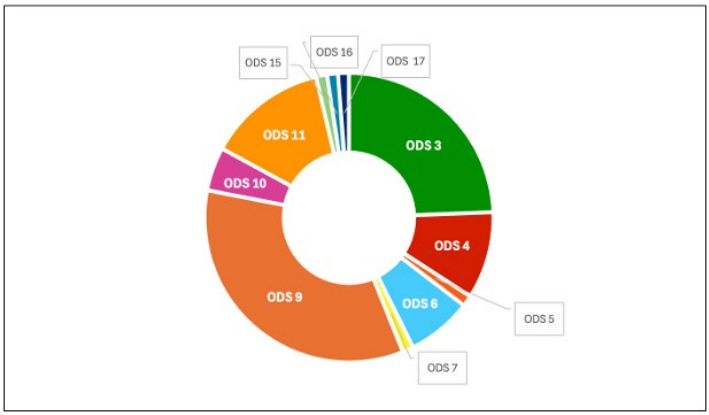
- CAC – Command-and-Control: permits, zoning, standards.
- MBI – Market-Based Instruments: environmental fees, deposit-refund systems, subsidies.

Governance

- Relation to SDGs – Sustainable Development Goals.

"The project reinforces our contribution to building effective municipal governance. In addition to highlighting the role of research at two important educational institutions in the region (IFTM and UFU), it helps make teaching and learning activities more dynamic".

Luzélia Moizinho, project coordinator
Jaluza Borsatto, team member



Municipal Ordinances by SDG in Uberaba
Source: courtesy photo

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This publication brings together 57 projects developed by institutions of the Federal Network of Professional, Scientific, and Technological Education (RFEPCT), selected from more than 300 submissions to Public Call REI/IFPE No. 11/2024. Organized according to the 17 Sustainable Development Goals (SDGs) of the UN 2030 Agenda, the projects were presented at the 3rd National Meeting on Innovation in Professional and Technological Education (InovaEPT) in 2025 and highlight how science, technology, and social commitment can be integrated to generate innovative and sustainable solutions.

The publication comes at a special moment, marked by the COP30 being held in Belém, Pará, Brazil, and represents the Federal Network's contribution to the international debate on climate change, sustainability, and innovation. More than a record of good practices, the book is an invitation to reflection and dialogue, aimed at students, educators, administrators, researchers, and policymakers seeking pathways to build more just, inclusive, and resilient societies.

This volume continues the series begun in 2023, with the first volume published by the Federal Institute of Maranhão Press (IFMA), consolidating the record and visibility of sustainability actions developed within the Federal Network of Professional, Scientific, and Technological Education.