International Cooperation for Regional Development

Embrapa

Amapá

Brazilian Agricultural Research Corporation
Embrapa Amapá
Ministry of Agriculture, Livestock and Food Supply

International Cooperation for Regional Development

The conviction of the nobility of our commitments and firm determination to contribute to the longevity of the planet is the energy that drives our actions, motivating the quest for results that meet the aspirations of society, respecting the principles of sustainability and looking for increasingly harmonious ways of coexistence with other living beings on the planet.

Embrapa Amapá
Macapá, AP
2011

Copies of this publication can be acquired from:
Brazilian Agricultural Research Corporation – Embrapa
Embrapa Amapá
Rodovia Juscelino Kubitscheck, km 05, N° 2600, Universidade
68903-419 Macapá AP
Telephone Number: +55 (96) 4009-9500
Fax:+55 (96) 4009-9501
www.cpafap.embrapa.br

PREPARED BY
Ana Margarida Castro Euler e Maguida Fabiana da Silva

SUPPORTERS
Adelina do Socorro Serrão Belém, Adilson Lopes Lima, Ana Elisa Alvim Dias Montagner, Dulcivânia Gomes de Freitas, Eleneide Doff Sotta, Elisabete da Silva Ramos, Cesar Santos, Gilberto Ken-Iti Yokomizo,José Antonio Leite de Queiroz, Marcelino Carneiro Guedes, Nagib Jorge Melém Júnior,Valeria Saldanha Bezerra, Silas Mochiutti, Walter Paixão de Sousa

COVER PHOTOS
Alexandre Uhlmann, Ana Margarida C. Euler, Jô de Farias Lima, Marcelino Guedes, Marcos Dias Tavares, Valeria Saldanha Bezerra

PHOTOS PUBLISHED
Adilson Lopes Lima, Adinomar Rodrigues Nunes, Alexandre Uhlmann, Ana Elisa Alvim Dias Montagner, Ana Margarida Castro Euler, Carlos Alberto Monte Verde, Cesar Santos, Dulcivânia Gomes de Freitas, Eleneide Doff Sotta, Fábio Sian Martins, Gilberto Ken-Iti Yokomizo, Jackson Araújo dos Santos, Jorge Federico O. Segovia, Julia Stuchi, Jurema do Socorro Azevedo Dias, Maguida Fabiana da Silva, Marcelino Carneiro Guedes, Marcos Tavares Dias, Otto Castro, Ricardo Adaime da Silva, Silas Mochiutti, Thiago Soeiro, Valeria Saldanha Bezerra, Walter Paixão de Sousa

GRAPHIC DESIGN AND DESKTOP PUBLISHING
Fábio Sian Martins

International Cataloguing Data in the Publication (CIP)
Embrapa Amapá Library

International Cooperation for Regional Development/ elaboration Ana Margarida Castro Euler e Maguida Fabiana da Silva. Embrapa Amapá, 2011.
44 p. : il; 18,5cm x 26cm

ISBN 978-85-61366-03-2

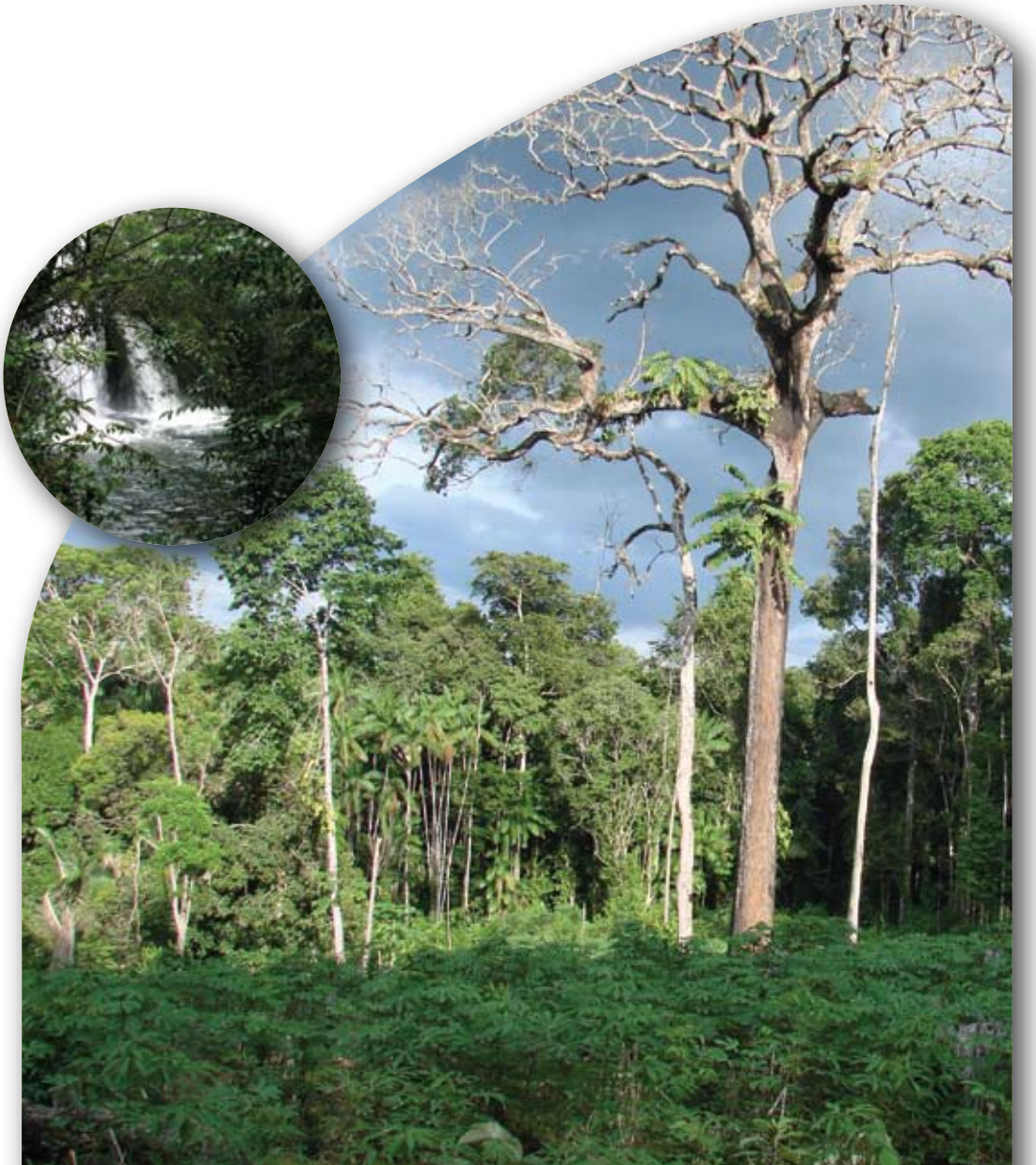
1. International Cooperation. 2. Technical - Scientific Cooperation. 3. Agriculture and Cattle Raising. 4. Agribusiness. 5. Public Policies. I. Euler, Ana Margarida Castro II. Silva, Maguida Fabiana da.

CDD (21. ed.) 630.098116

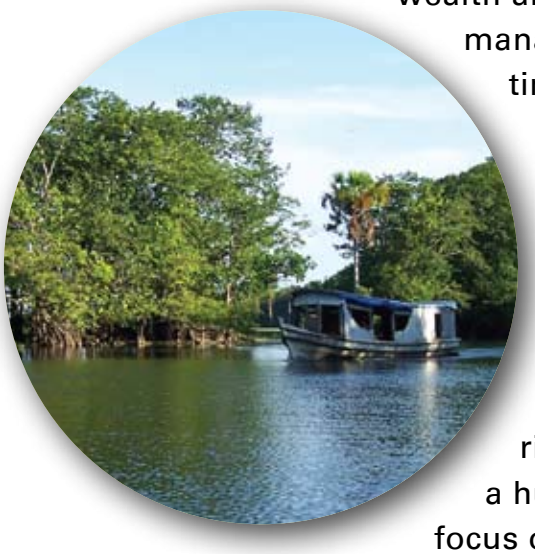
Sumary

Presentation

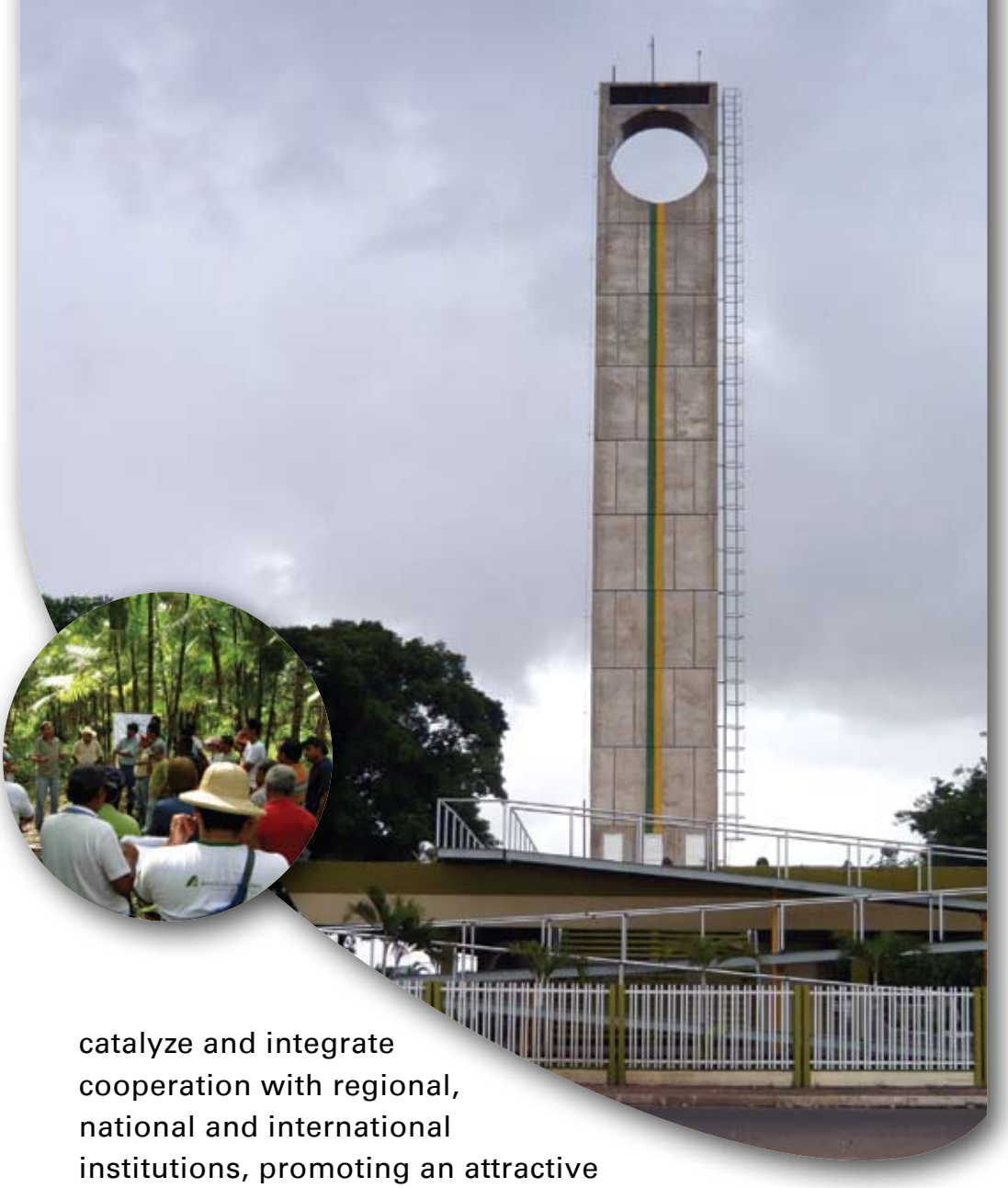
Discussions on environmental issues, in this first decade of the 21st century, were extended to the whole society, as a consequence of intensifying the occurrence of catastrophic events related to climate changes. For we who live in Amapá and Amazon estuary - one of the most preserved areas of the Amazon and of the planet – taking the lessons already learned in other parts of the world, we have the opportunity to chart a new path for the use of natural resources, and thus effectively



contribute to mitigating the effects of emissions of greenhouse gases and also to conserve the rich planet's biodiversity.
Our biggest challenge is the sustainable use of natural capital of the Amazon, generating social and economic development for the entire population of this region that still suffers from low human development rates. Population is concentrated mainly in urban centers as a result of the rural exodus of the 1980s and 1990s, and in rural communities consisting of gatherers, riverines, indigenous, traditional communities and family farmers that keep their traditional practices.
Forest and water resources related to biodiversity are our greatest assets and their use will generate permanent wealth and welfare to society. The sustainable management of timber and non-timber forest products depend on studies that enhance productivity, production chains and payment for environmental services for keeping the forest. Maintaining inventories for carbon sequestration, nutrient cycling and climate regulation.



Water, which has a key role in the riverine life of Amazon estuary and a huge potential for use, has been the focus of international discussions for being a vital source of life and energy. The use of biodiversity is subject to technological advancement, since the prospection, characterization and conservation through development of differentiated products with high added value to the market.
Embrapa has sought to provide its research center in Amapá with an infrastructure and qualified team to face these challenges. However, we are convinced of the need to



catalyze and integrate cooperation with regional, national and international institutions, promoting an attractive environment for the generation of knowledge and technologies to further enhance the research-oriented management of forest resources, environmental services, bioprospecting, adding value to products, sustainable agriculture and agroecology. We wish to integrate the efforts for utilization of natural resources and for generation of sustainable development in the Amazon.

Silas Mochiutti

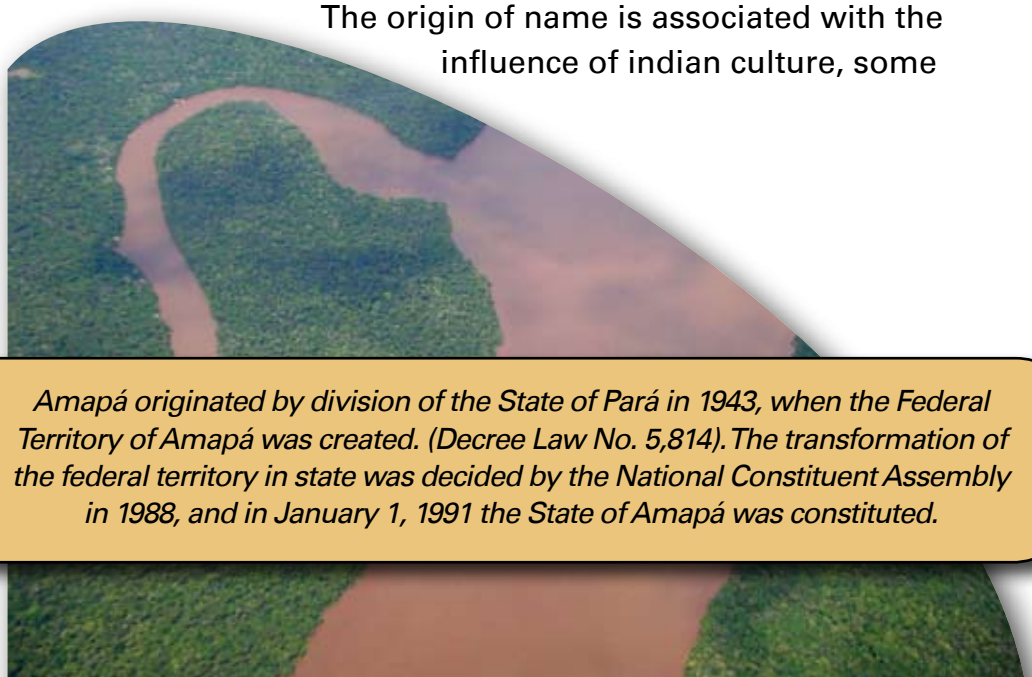
Embrapa Amapá's General Head

Where we are

The State of Amapá

Amapá is one of the 27 federal Aunits of Brazil, located in the extreme north of the country and part of the Brazilian Amazon. It is bordered with French Guiana to the north, the Atlantic Ocean to the east, State of Pará to the south and west and Suriname to the northwest. It occupies an area with 143 thousand km^2. Sixteen cities compose this state that has a population of 626,609 inhabitants, where approximately 90% of people live in urban areas. Its capital city is Macapá, crossed by the Equator and where it meets the Amazon River. Amapá is one of the newest Brazilian states and the most preserved one. Even having mining as main economic activity, the forests of the state of Amapá continue being preserved, because since the 1990's it adopted a conservationist policy that created several indigenous reserves and conservation units that currently form the Amapá Biodiversity Corridor, with 73% of the total area of the state, and the biggest park of rainforests on the planet, the "Montanhas do Tumucumaque" National Park.

The origin of name is associated with the influence of indian culture, some



Amapá originated by division of the State of Pará in 1943, when the Federal Territory of Amapá was created. (Decree Law No. 5,814). The transformation of the federal territory in state was decided by the National Constituent Assembly in 1988, and in January 1, 1991 the State of Amapá was constituted.

ethnic groups present until the present day (Galibi, Karipuna, Palicur, Tiriyó, Kaxuyana, Wayana, Apalaí and Waiãpi). In Tupi language, "amapá" means 'the rain place' and in Aruaque language it identifies a specie of tree of the Apocynaceae family (*Hancornia amapa*), from which is extracted the latex, called amapá milk, which is used in folk medicine.

With hot and humid climate, the vegetation is quite diverse and presents the floodplain and upland forests as well as flooded fields and savannas. In areas near the coast, mangrove is the vegetation found. The Amazon Forest here has an extraordinary biodiversity.

The main economic activities developed in Amapá are mining (manganese, gold and bauxite) and extraction of native fruits (açaí and Brazil-nut) and wood. Agriculture and industry sectors are still little significant.

The active population in agriculture is only 8.86% of the total, and this segment accounts for 4.6% of the state GNP (Gross National Product) and 0.1% of the Brazilian agricultural GNP. The public sector in turn contributes with 44.4% of the state GNP, placing the state in a situation of economic dependence on federal transfers.

Estuary of the Amazon River

The Amazon River is about 6,800 km long. In its mouth, a huge delta is formed , also called estuary, which distance between the edges is approximately 330 km. In this region most of the population lives in rural areas.

The estuary of the Amazon River is divided in two parts: the North canal, wider, and the South canal, also known as Pará River and Marajó Bay. Between these two canals there are many natural connections, called holes, where the water is distributed heading to the Atlantic Ocean.

These fluvial zones are characterized by the existence of particular vegetation, called estuarine floodplain, which receives daily flood depending on the tide, staying under water a few hours a day.

In the estuary's region the economy is based on the extraction of wood, palm heart, fruits (especially the açaí - *Euterpe oleraceae*), artisanal fisheries (especially shrimp), and extensive buffalo's raising. The diversity of activities carried out by the families is a strategy to face the seasonality of resources.

Our history

Embrapa Amapá

Agricultural and cattle raising research in the Amazon region began in 1939 with the creation of the Northern Agronomic Institute (IAN), transformed in 1962 into the Northern Agricultural and Cattle Raising Research Institute (IPEAN). With the creation the Brazilian Agricultural Research Corporation - Embrapa, in 1973, with national scope, IPEAN became the Agricultural and Cattle Raising Research Center of the Humid Tropics (CPATU), based in Belém, capital city of Pará State. In 1980 was created the Agricultural and Cattle Raising Research Center in Amapá, administratively linked to CPATU in order to generate low-cost agricultural technologies to the territory, aimed at self-sufficiency in food production. In 1988, with the transformation of the Amapa Territory in State, the Agricultural and Cattle Raising Research Center followed this transition becoming the Macapá Research Unit. In 1991, it finally became the Agroforestry Research Center of Amapá: Embrapa Amapá.

The Unit has its head office in Macapá, capital city of the state, about 2 km from Ground Zero Monument pointing the Equator. Its facilities include 6 buildings, divided in administrative and research area, five laboratories and library. It currently has 86 employees, 02 of which with post-doctor's degree, 12 with doctor's degree, 13 with master degree and employees for support to research.

Our commitments

Mission

> *Provide solutions for research, development and innovation for sustainable agriculture and use of biodiversity in the Amazon, with emphasis on Amapá and Amazon estuary.*

Sustainability, this is the slogan of the moment and the great hope of the current generation to sustainable and responsible coexistence with the natural resources available on the planet. The preservation of water sources and sustainable use of forests in the Amazon are the basic principles of any development process in the region.

The challenge is big, since over 80% of the Amapá

population lives near the banks of the Amazon River.

Moreover, a significant number of people living in the estuary have social and economic relationships with Amapá and live practically "on the waters of the Amazon River." There are thousands of families living on forest resources, especially in the management of palm heart and the capture of fishes and shrimps in the area periodically flooded by Atlantic tidal effect. The state of Amapá has shown to the world that chose to use the standing forest. Over 70% of its area is under some form of protection. The challenge, therefore, is to contribute to the sustainable use of natural resources and at the same time generate technologies that improve the productivity of existing production systems, providing appropriate living conditions for inhabitants of the state and improving quality of life on the planet.

Vision of future

> *To be a regional reference in the generation of knowledge, technology and innovation for sustainable production of food, fiber and products from the Amazonian biodiversity.*

The diversity of ecosystems existing in the state provides multiple opportunities for the generation of knowledge and technology: the açai floodplain forests; fish and shrimp in the

estuary; Brazil nuts, wood and vines on the upland forests; fruits and medicinal plants in savanna; buffalos in wetlands, represent some of the issues that beckon with endless possibilities of action for researchers and technicians in the region, to generate sustainable benefits expected by the population.

Traditional populations, indigenous groups and local producers engaged in agricultural land use activities are the focus of our actions. The production of healthy foods, the promotion of food security and the improvement of family income are linked to our vision of future and is the target of our search for reference in the region.

Our infrastructure

Experimental Fields

Experimental Field of Mazagão

Located in the city of Mazagão (Mazagão Novo), it has an area of 100 hectares, half of which in upland and half in the floodplain of the Amazon estuary. In upland, 60% of the area is occupied by experiments with fruit tree plantations (cupuaçu, coconut, mango), areas destined to experiments with grains (caupi bean, corn and rice) and germplasm bank of rubber tree and mango tree. The remaining of the area is covered by secondary vegetation. In the floodplain, 20% is occupied by the germplasm bank of the Euterpe oleraceae specie, locally called açaí, and the rest by natural forest.

The access by paved road is performed through ferryboat in one section of the road (Matapi River). The distance between the head office in Macapá and the office of the Experimental Field in Mazagão is 50 km.

It has qualified team for production of grains and dendrological data collection and it counts on infrastructure for the activities' development. It has suitable accommodations to lodge research teams.

Savanna's Experimental Field

Located in the city of Macapá, km 258 of BR156 Road, it has an area of 1,347 hectares. In this field are performed experiments with tree species (*Eucalyptus* spp. and *Acácia mangium*), production of grains (caupi bean and soy) and pasture for experiments with animals. It keeps germplasm banks of tree species (*Sclerolobium paniculatum* and *Hevea brasiliensis*) and fruit trees (mangaba). Over 90% of the area keeps the original vegetation of the savanna ecosystem with the preservation of riparian vegetation.

The access is through paved road. The distance between the head office in Macapá and the office in the Savanna's Experimental Field is about 60 km. It has qualified team for production of grains, dendrological data collection, cattle raising activities and it counts on infrastructure necessary to develop the activities. It has suitable accommodations to lodge the research teams.

Fazendinha's Experimental Field

Located in the city of Macapá, in the Fazendinha District, it has an area of 10 hectares, 90% of which is covered by secondary

vegetation and 10% is occupied by experiments with banana, ornamental species of the Amazon flora (orchids, helicons), clone bank of cupuaçu (*Theobroma Grandiflorum*) and scions production for implementation of experiments.
It has easy access, being 10 km from the head office. It has a qualified team for scions production and it counts on infrastructure to develop the activities.
Due to its proximity to the urban center of Macapá, this Experimental Field is often used for training purposes and environmental educational activities.

Laboratories

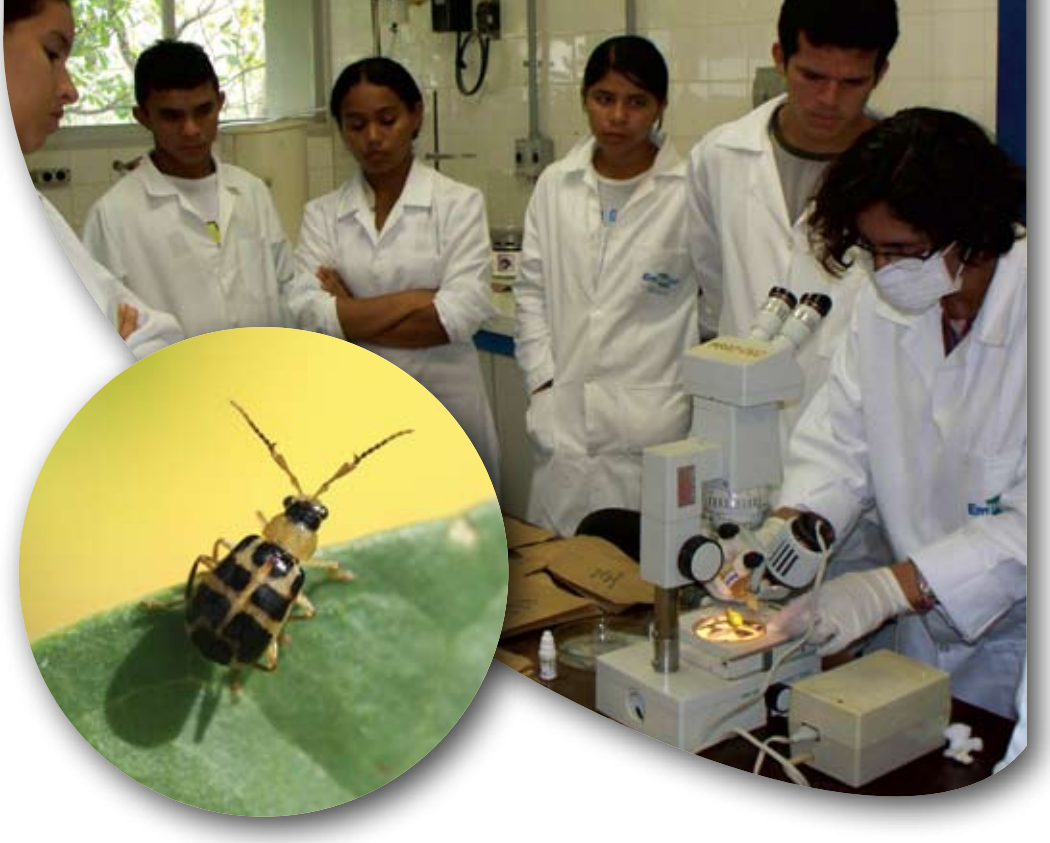
Embrapa Amapá counts on five laboratories and a support team with seven employees and one supervisor.

Laboratory of Soils and Vegetal Physiology

It is in process of expanding its infrastructure. It performs fertility analyses of land samples (pH, calcium (Ca), phosphorus (P), magnesium (Mg), potassium (K), carbon (C) sulfur (S), nitrogen (N), aluminun (Al) and acidity); physical analysis of undisturbed samples (apparent density, density of particle, porosity, humidity); microbial biomass; repirometry; and extraction and identification of organisms from the soil's macro fauna. It also performs analysis of the relative power of total neutralization (PRNT) of limestone samples.

Laboratory of Plants Protection

It is in process of expanding its infrastructure with the merger of two laboratories (entomology and phytopathology). It develops studies especially focused on bioecology of species of fruit-flies present in the Brazilian Amazon, besides activities focused on the development of strategies to handle pest species, especially the ones involving utilization of biological control.



Studies focused on isolation and identification of agents causing diseases of plants are also developed in this laboratory, as well as identification of fungal species that produce mycotoxins and activities related to isolation, characterization and multiplication of fungal agents of biological control.

Laboratory of Animal Nutrition

It has as purpose to provide support to the researches performed by Embrapa Amapá in the agricultural and cattle raising area through determination of the nutritional value of food used in animal nutrition, both voluminous (forage plants) as concentrates (animal food) through bromatological analyses. The analyses performed are: determination of moisture or dry matter, crude protein, fat or ethereal extract, crude fiber, ash / mineral matter, organic matter, calcium (Ca), phosphorus (P), magnesium (Mg), potassium (K), acid detergent fiber (ADF), neutral detergent fiber (NDF), lignin, silica and pH determination.

Laboratory of Food

It has as main focus to provide support for demands on researchs in the food area. Its work is essential in the conclusion of research actions aiming products improvement, so they can present superior quantitative characteristics (productivity) , as well as the qualitative and more specific ones, such as nutritional value, flavor, and conservation potential (shelf life), among others. The analyses include physical evaluation of fruits, like weight, size and proportions of pulp / fruit; chemical evaluation of fruits and processed food for nutritional information, like dry matter, pH, Brix, crude protein, fiber, ashes, ethereal extract, vitamins, anthocyanin content, etc.

Laboratory of Aquiculture and Fishing

Currently Embrapa Amapa has a research area called Aquaculture & Fisheries, which counts with a team of five researchers and one laboratory technician. To meet the work of this team and cope with the demands of the society Embrapa Amapá counts with approximately 1000 m^2 of built

area, divided into three working spaces: Rooms for Researchers and Technicians, Laboratory of Aquaculture & Fisheries, Cultivation Shed and Feed Factory.

The "Dr. Dorival Pimentel" Library

Embrapa Amapá's library occupies an area of approximately 220m^2, and it has a collection specialized in Agriculture, Zootechny, Agroforestry, Phytotechny, Socioeconomics, Agricultural Policy, Aquaculture, Phytopathology and Entomology.
There are 14.537 publication titles among books, pamphlets, folders, reprints, proceedings, theses, reference works, bibliographies, VHS tapes and CDs. The journal collection has 735 national and foreign titles.
Its target audiences are especially researchers, teachers, high school students and college students. It serves about 80 users per month.

Our main focus

Research Areas

Embrapa Amapá prepared in the first half of 2008 its IV Master Plan of the Unit (PDU), result of a work that included the participation of all employees and consultation with several segments of Amapá's society. Based on the result of this work, the focal research areas were defined, as presented below.

1. Aquiculture and Fishery Management in the Amazon

This is a field which was defined as a priority from the IV PDU and Embrapa Amapá began a new line of research called Aquiculture Production Systems. Its creation occurred due to strong demand of local society for information related to the species found in the coast and the continental waters of the State of Amapá, as well as, of Embrapa's technical support regarding the implementation and operation of projects destined to aquiculture and fishery.

The research activities involve five researchers and it has as purpose to ensure competitiveness and sustainability of aquiculture in the Amazon and foment the development of technologies for sustainable use of biomes and productive integration of the Amazon region. We highlight as priority goals of this area:

- Develop shrimp culture with native species of fresh water, through production systems suitable to the Amazon estuary.
- Increase availability of fishery through validation and adaptation of aquicultural technologies.
- Increase the sustainability of the fishing activity through biological and ecological studies of aquatic species with higher capture pressure and economic value.

The research projects in progress work from the holistic view of different aquicultural production systems in the state of Amapá, such as: productive chain of uçá crab (*Ucides cordatus*); management methods for regional

shrimp (*Macrobrachium amazonicum* and *Macrobrachium carcinus*); dispersion degree of Nile tilapia (*Oreochromis niloticus*); and the parasitic fauna of cultivated fish species.

2. Prospecting of Products from Biodiversity

The state of Amapá is rich in diversity of ecosystems, with occurrence of upland forests, floodplain forests of the Amazon estuary, lowland fields, savannah and mangroves. Consequently, it is rich in diversity of species with potential for several uses.

This subject area involves seven researchers working on several research fields related to the prospection, characterization and conservation of species biodiversity, to generate pretechnological products with high added value and focus on market demands.

Works are being performed, ranging from the prospection of species with potential for sustainable use and exploitation, as in the case of ornamental plants (*Heliconiaceae, Orchidaceae*) and medicinal plants of the Amazon, through germplasm characterization as in the case of regional fruits, like açaí fruit (*Euterpe oleracea*), mangaba (*Hancornia speciosa*), peach palm (*Bactris gasipaes*) and cupuaçu (*Theobroma grandiflorum*). Finally the characterization and evaluation of native plants to the Amazon region with potential for production of agrofuels, as buriti (*Mauritia flexuosa*), inajá (*Maximiliana maripa*), murumuru (*Astrocaryum murumuru*) and andiroba (*Carapa guianensis*).

3. Forest Management and Environmental Services

The forest management in Amapá State is promising, taking into account the large extent of areas of upland forest and floodplain. In the Amazon as a rule, this activity competes unevenly, in economic terms, with other productive activities that are normally associated to deforestation, such as cattle raising.

To change this situation requires the continuous generation of knowledge and new technologies. It is also necessary to consider the character naturally diverse of forest activities, being essential the development of research both for wood management and for the use of nonwood resources and valuation of environmental services.

Currently, this subject area has five researchers and between different lines of research we can highlight the following ones:

• Wood management of upland forests in areas of private companies. The research is focused on botanical identification and characterization of the environment; use of geotechnology in monitoring and planning of forest exploitation; use of permanent plots for studies of forest dynamics, silvicultural systems and procedures, definition of sustainability rates of forest management.

• Management of non-wood forest products in areas of traditional communities. The main species are açaí (*Euterpe oleraceae*) Brazil nuts (*Bertholletia excelsa*), copaiba (*Copaifera* spp.), andiroba (*Carapa guianensis*) and titica vine (*Heteropsis flexuosa*). The main purpose is to generate knowledge about the ecology, ethnobotany and management practices of these species, and to study processing aspects of its main products.

• Forest management for multiple uses of the floodplains of the Amazon estuary. It seeks to assess aspects of the ecology, operation, form of use by riverines, inventories of wood and non-wood products from the floodplains of the Amazon estuary, as a way to subsidize the development of silvicultural techniques, management and monitoring of sustainability of forest production in this ecosystem.

• Environmental services is a new subject, of great interest, which offers huge opportunities for the state of Amapá due to the extent of its protected areas covering approximately 70% of the territory. Currently Embrapa develops in partnership with the State Government a study to quantify the carbon stock in protected areas.

• Ethnoscience is related to valuation of the traditional Amazonian population's culture and knowledge associated to the use

of natural resources. Building a research network for the development and innovation of ethnoscience is among Embrapa's priorities on its Amazon agenda.

4. Family Agriculture

In Amapá, family production can be found in the surrounding towns, which produce mainly vegetables and fruits, and in areas of agrarian reform settlements, and cassava culture is the main production activity, although there is foment of fruits cultivation, especially banana.

The prevalence of the use of fire by family farming has as main purpose the conversion of vegetated areas (mainly secondary) in areas suitable for production of annual crops, especially cassava. Besides cleaning the area, the fire provides the nutrients accumulated in vegetation, providing its readily availability but in ephemeral character, as a result of high rainfall, nutrients are quickly lost, making the area barren rapidly.

Several alternatives to reduce the use of fire have been proposed, among which it is possible to indicate agroforestry,

use of green or dead roof, the use of organic compounds, systems that advocated cutting and grinding of the secondary vegetation or systems that work based on intercropping of annual crops after soil correction with fertilizers and correctors.

Currently this subject area has a team of five technicians, among researchers and analysts, which is developing projects aimed at reducing the use of fire, standing out as the main action lines the foment to diversification of agricultural crops (cassava, beans, rice, banana, etc.) the production of seedlings of fruit trees, apiculture and forest management.

The study of social reproduction strategies used by family farmers in Amapá and its relation to production systems established is among the research priorities in this field which is oriented to the development of proposals using a participative, systemic and multidisciplinary approach, since the generation up to the transference of technology.

5. Production of Grains in Amapá's Savannahs

Amapá has an estimated area of 986 hectares of savannah, and in about 50% of this area there is potential to cultivate some kind of grain. Currently Amapá depends on the production from other states for its domestic supply of food. This demonstrates the importance to develop and adapt technologies that may allow the expansion of local agricultural production, respecting environmental constraints in order to ensure the conservation of biodiversity in this ecosystem.

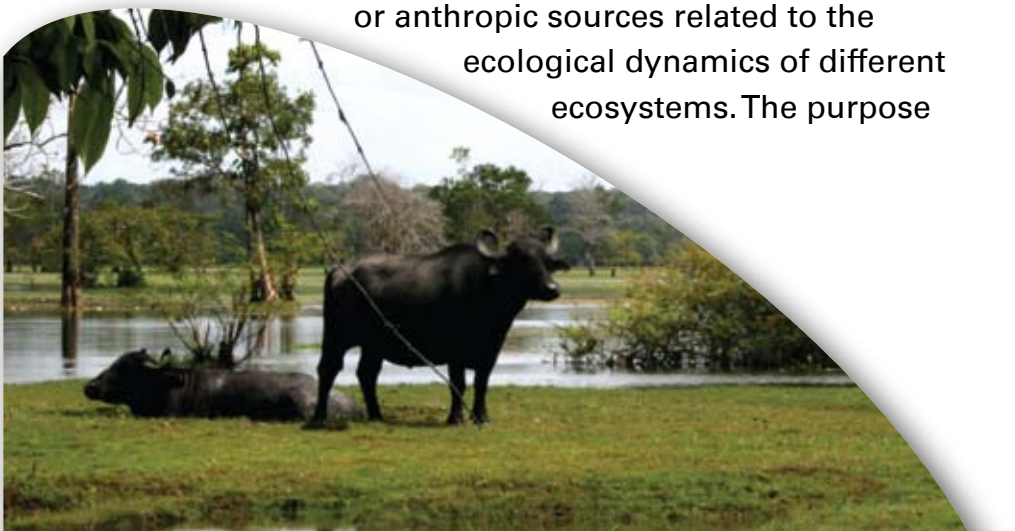
Currently this area has five researchers working in projects aimed at the grain production in the Amapá's savannah in order to make it economically sustainable and

environmentally friendly. Other areas includes the direct plantation of pasture and grains (soy, rice, corn, millet and sorghum) and studies of plant genetic improvement for soy selected materials. Also to increase the productivity of Phaseolus bean focused on disease resistance.

6. Buffalo Raising in Floodplains

The areas used for agricultural and cattle raising production are represented by floodplains and savannah ecosystems, which have in addition to great socio-economic relevance, good representation in the state area, corresponding to 11.20% (1,606,835 ha) and 6.87% (986.189 ha) respectively. Yet the current production is insufficient to meet domestic demand for food, and there are limitations to the intensive animal production because it is dependent on grain production. Agriculture in the Amazon plays an important role to maintain the increase of national development rates through the region's socio-economic insertion and preservation of its biome. The Amazon herd are increasing at high rates when compared with other Brazilian regions, the actions of this line of research proposals aim to develop strategies to maintain and/or sustain the increase in productivity without compromising the biological diversity of different ecosystems in the long term.

Currently this subject area has one researcher studying disturbance / stress processes originating from natural or anthropic sources related to the ecological dynamics of different ecosystems. The purpose



is to generate information that enables the rational use and simultaneously makes the activities performed economically and environmentally sustainable.
In this sense actions have been developed with the purpose to optimize the exploitation of local resources for agriculture and cattle raising. Through the adaptation and validation of technologies successfully employed in other parts of the country to increase productivity and efficiency of the agricultural and cattle raising sector.

7. Post-Harvest and Processing of Production

The area of post-harvest and processing of Embrapa Amapá has as main purpose to provide support to research projects in the plant improvement area, whether in the study of prospection of potential oilferous/oleaginous regional species for biofuels, whether in the physic-chemical characterization of species of interest from the Amazon biodiversity. The profile revealed by quantitative and qualitative evaluations supplies more intrinsic parameters that can be complementary to the decisions during the selection of more productive or resistant specimens.

It is also responsible for the study of a better use of raw food material, through the use of residues that can be processed into a protein source for humans or animals.
Currently this area has one researcher who conducts studies on palm trees species such as inajá (*Maximiliana maripa*), murumuru (*Astrocaryum ulei*), buriti (*Mauritia flexuosa*); and perenial tree species such as andiroba (*Carapa guianensis*) as source of oil for biofuel. Futhermore, the utilization of the residues for animal food. The anthocyanin pigment, present in the fruit of açaí (*Euterpe oleraceae*), is being quantified and it will serve as base in açai improvement projects. Mangaba, a Savannah threatened specie, is featured for the existing germplasm bank to be a source of future plant improvement projects.
The sanitary-hygienic safety of some food production processes is also an object of study, contributing to improving the quality of some processed products such as açaí and cassava flour.

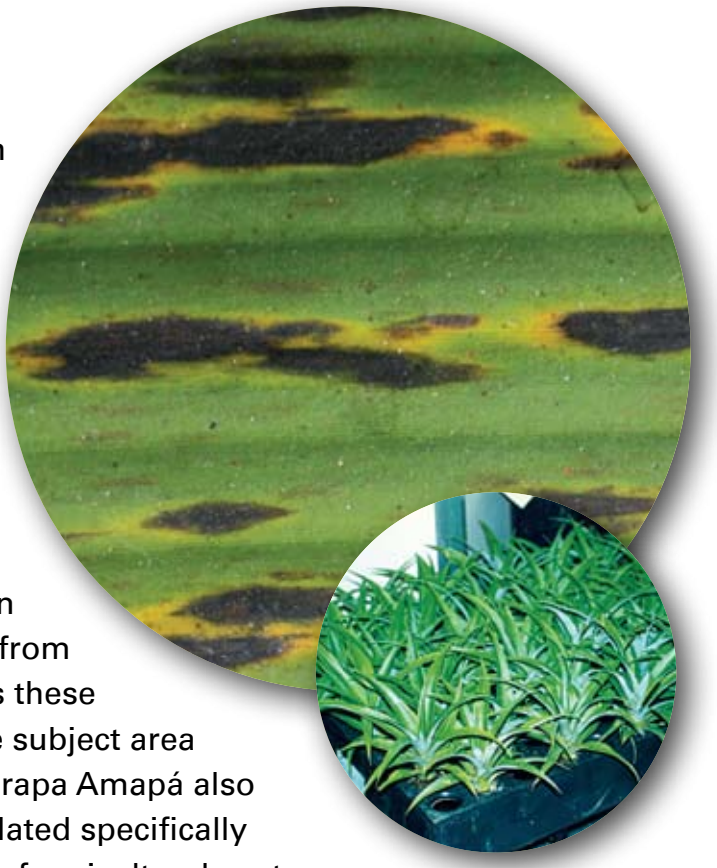
The main achievements to date have been the characterization of cultivars of sigatoka-negra resistant banana and promising materials from the germplasm bank of cupuaçu (*Theobroma grandiflorum*), and agro-industrial processes for the manufacture of cassava flour and frozen açaí.

8. Plant Protection

Embrapa Amapá's Plant Protection area works with the purpose of generating information that can produce technological innovation aimed at the sustainable economic development of Amazonian ecosystems, trying to prioritize food production achieved through environmentally correct technologies.

Aiming preventing the establishment and/or entry of pests that can affect negatively the expansion of agricultural production and productivity of the state, Embrapa Amapá develops researches focused on the study and control of major regional phytosanitary problems. Futhermore, it also seeks to generate technological information that can be used in tropical countries, once Brazil is increasingly consolidating its leadership in this segment and prospecting opportunities for

technology transfer, training and other forms of provision of products and services focused on tropical agriculture. Currently this subject area has three researchers and several graduation and post-graduation students, and infrastructure for support to research represented by the Plants Protection Laboratory. The research projects have as main focus to generate information related to bioecology of fruit flies in



the Brazilian Amazon, with emphasis on star fruit-fly (*Bactrocera carambolae*); provide alternatives to control fruit flies through the use of entomopathogenic fungi and parasites; and understand the factors that influence production of mycotoxin in Brazil-nuts by the species from *Aspergillus* genus. Besides these main lines of research, the subject area of Plant Protection of Embrapa Amapá also contributes to activities related specifically to prevention and control of agricultural pests occurring in the state as the sigatoka-negra.

Transfer of Technology and Communication

This area is responsible for liaison between Embrapa Amapá and its stakeholders, through technology transfer and institutional arrangements formed with the participation of organizations from public, private and third sectors.

Technology transfer is arranged in several lines of action, from the implementation of joint projects to support to governmental programs at the federal, state and local levels. Among the mechanisms used for this work are the observation units, demonstration units, field days, training courses for multipliers, agents, production of content for radio and television shows,

web and print media, participation in fairs and exhibitions,and personal and virtual customer service. It has a team of seven technicians and it currently develops technology transfer projects training extension agents who work directly with family farmers and traditional communities, courses in agroforestry, agricultural and cattle raising techniques to students enrolled in the Family Schools of Amapá.

In the scope of communication activities, it enhances the use of information channels and institutional interaction and relationship with local and national media, producing content in print and electronic formats to suit the profile and needs of its target audience.

Post-Graduation Programs

Post-Graduation Program in Tropical Biodiversity (PPGBio)

The Post-Graduation Program in Tropical Biodiversity (PPGBio) is a joint effort of the Federal University of Amapá (UNIFAP), the State Institute of Scientific and Technological Researches (IEPA), Embrapa-Amapá and the Conservation International NGO.

It has as main purpose to form masters and doctors with a strong scientific base focused on conservation and sustainable use of the biodiversity existing in Amapá and in the Amazon. The northern region, which includes most of the Brazilian Amazon, has the lowest number of post-graduation programs in Brazil,considering all knowledge areas.

Regarding the area of biological sciences, the PPGBio is the only one, among the post-graduation programs of the country focused on specific qualification in tropical biodiversity, especially of the Amazon. The program is structured into three lines of research aimed at answering the following questions:

- What is the composition of the Amazonian biodiversity and how it changes over time and space?
- How to maintain it efficiently?
- How to use it in a sustainable way?

Integrated Master Degree Course in Regional Development (MIDR)

The Integrated Master Degree Course in Regional Development (MIDR) has UNIFAP, the National Board of Scientific and Technological Development (CNPq), the Coordination of Improvement of Higher Education Personnel (CAPES), the Federal University of Pará, Embrapa Amapá, and IEPA as participant institutions. Its main purpose is the qualification of professors of the Federal University of Amapá and of technicians from research institutions, state and local authorities of the state of Amapá, aiming to provide them with new techniques and knowledge in the teaching, extension and research areas, within a multidisciplinary view that san be applied to the specificities of the Amazon region and to its development.

Publications

Aquiculture and Fishery Management in the Amazon Estuary

LIMA, J. de F. Larval development of *Austinixa bragantina* (Crustacea: Brachyura: Pinnotheridae) reared in the laboratory. **Zoologia**, v. 26, n. 1, p. 143-154, Mar. 2009.

MARIANO, W. dos S.; OBA, E. T.; SANTOS, L. R. B.; FERNADES, M. N. Respostas fisiológicas de jeju (*Hoplerythrinus unitaeniatus*) expostos ao ar atmosférico. **Revista Brasileira de Saúde e Produção Animal**, v. 10, n. 1, p. 210-223, jan./mar. 2009.

TAVARES-DIAS, M.; OLIVEIRA, S. R. A review of the blood coagulation system of fish. **Revista Brasileira de Biociências**, v. 7, n. 2, p. 205-224, abr./jun. 2009.

TAVARES-DIAS, M.; OLIVEIRA-JÚNIOR, A.; SILVA, M. G.; MARCON, J. L.; BARCELLOS, J. F. M. Comparative hematological and biochemical analysis of giant turtles from the Amazon farmed in poor and normal nutritional conditions. **Veterinarski Arhiv**, v. 79, n. 6, p. 601-610, 2009.

TAVARES-DIAS, M.; AFFONSO, E. G.; OLIVEIRA, S. R.; MARCON, J. L.; EGAMI, M. I. Comparative study on hematological parameters of farmed matrinxã, *Brycon amazonicus* Spix and Agassiz, 1829 (Characidae: Bryconinae) with others Bryconinae species. **Acta Amazonica**, v. 38, n. 4, p. 799-806, dez. 2008.

Prospecting of Products from Biodiversity

ALMEIDA, V. C. de; HOFFMANN, L. V.; YOKOMIZO, G. K. I.; COSTA, J. N. da; GIBAND, M.; BARROSO, P. A. V. In situ and genetic characterization of *Gossypium barbadense* populations from the states of Pará and Amapá, Brazil. **Pesquisa Agropecuária Brasileira**, v. 44, n. 7, p. 719-725, jul. 2009.

CORREIA, A. F.; SEGOVIA, J. F. O.; GONÇALVES, M. C. A.; OLIVEIRA, V. L. de; SILVEIRA, D.; CARVALHO, J. C. T.; KANZAKI, L. I. B. Amazonian plant crude extract screening for activity against multidrugresistant bacteria. **European Review for Medical and Pharmacological Sciences**, Itália, v. 12, n. 6, p. 369-380, 2008. p. 369-380.

Forest Management and Environmental Services

CARNEIRO, C. R. A.; MELÉM JÚNIOR, N. J.; AZEVEDO, M. C. B. de; ANDRADE, E. A.; KOGUISHI, M. S.; DIEHL, R. C.; RICCE, W. da S.; PASSARIN, A. L.; VAZ, R. H. de M.; STELMACHUK, T. L. da L.; GUIMARÃES, M. de F.; RALISCH, R. Efeitos dos sistemas de manejo sobre o carbono orgânico total e carbono residual de um latossolo vermelho eutroférrico. **Semina**, Londrina, v. 30, n. 1, p. 5-10, jan./mar. 2009.

QUEIROZ, J. A. L. de; MACHADO, S. do A. Fitossociologia em floresta de várzea do estuário amazônico no estado do Amapá. **Pesquisa Florestal Brasileira**, n. 57, p. 5-20, jul./dez. 2008.

QUEIROZ, J. A. L. de; MACHADO, S. do A.; HOSOKAWA, R. T.; SILVA, I. C. da. Estrutura e dinâmica de floresta de várzea no estuário amazônico no Estado do Amapá. **Floresta**, Curitiba, v. 37, n. 3, p. 339-352, set./dez. 2007.

MOCHIUTTI, S.; QUEIROZ, J. A. L. de; MELÉM JUNIOR, N. J. Produção de serapilheira e retorno de nutrientes de um povoamento de taxi-branco e de uma floresta secundária no Amapá. **Boletim de Pesquisa Florestal**, Colombo, v. 52, p. 3-20 jan./jun. 2006. META 2007.

Family Agriculture

BRITO, O. R.; MELÉM JUNIOR, N. J.; FONSECA, N. S.; BRITO, R. M. Answer of two carioca beans cultivar to the chemical and organic fertilization. **Annual Report of the Bean Improvement Cooperative**, East Lansing, v. 51, p. 256-257, Mar. 2008.

MELÉM JÚNIOR, N. J.; FONSECA, I. C. de B.; BRITO, O. R.; DECËNS, T.; CARNEIRO, M. M.; MATOS, M. de F. A. de; GUEDES, M. C.; QUEIROZ, J. A. L. de; BARROSO, K. de O. Análise de componentes principais para avaliação de resultados analíticos da fertilidade de solos do Amapá. **Semina: Ciências Agrárias**, Londrina, v. 29, n. 3, p. 499-506, jul./set. 2008.

DIAS, J. do S. A.; YOKOMIZO, G. K.-I.; GAZEL FILHO, A. B. Recomendações de cultivares de bananeira resistentes à sigatoka-negra para o estado do Amapá. Macapá: Embrapa Amapá, 2005. 12 p. (Embrapa Amapá. **Circular Técnica**, 34).

SOUSA, W. P. de; FERREIRA, L. A. Os sistemas agrários com castanha-do-brasil (*Bertholletia excelsa* H.B.K.) na região sul do estado do Amapá. **Amazônia: Ciência & Desenvolvimento**, v. 2, n. 3, p. 217-246, jul./dez. 2006.

Production of Grains in Amapá's Savannahs

YOKOMIZO, G. K.-I.; VELLO, N. A. Evaluation of the vegetable soybean seedlings production by speedling styrofoam in comparison at the traditional system. **Soybean Genetics Newsletter**, v. 32, 2005.

YOKOMIZO, G. K.-I.; VELLO, N. A. Scott-Knott classification in two cultivation epochs from topcrosses among food type and grain type soybean. **Soybean Genetics Newsletter**, v. 32, 2005.

DIAS, J. do S. A.; YOKOMIZO, G. K.-I.; RODRIGUES, M. da C.; SILVA, R. A. da; GAZEL FILHO, A. B. Reação à sigatoka-negra e características de produção de três ciclos de híbridos triplóides e tetraplóides melhorados de bananeira. Macapá: Embrapa Amapá, 2005. 21 p. (Embrapa Amapá. **Boletim de pesquisa e desenvolvimento**, 79).

MEIRELLES, P. R. de L.; MOCHIUTTI, S.; YOKOMIZO, G. K.-I. Comportamento produtivo de forrageiras cultivadas sob sombreamento no cerrado do Amapá. Macapá: Embrapa Amapá, 2005. 14 p. (Embrapa Amapá. **Boletim de pesquisa e desenvolvimento**, 78).

Buffalo Raising in Floodplains

COSTA, N. de L.; MAGALHÃES, J. A.; PEREIRA, R. G. A.; TOWNSEND, C. R.; OLIVEIRA, J. R. da C. Considerações sobre o manejo de pastagens na Amazônia Ocidental. **Revista CFMV**, Brasília, DF, v. 13, n. 40, 2007.

COSTA, N. de L.; PAULINO, V. T.; TOWNSEND, C. R.; MAGALHÃES, J. A.; OLIVEIRA, J. R. da C. Desempenho agronômico de genótipos de Brachiaria brizantha em diferentes idades de corte em Porto Velho, Rondônia, Brasil. **REDVET**, v. 8, n. 8, ago. 2007.

COSTA, C.; MEIRELLES, P. R. de L.; SAVASTANO, S.; ARRIGONI, M. de B.; ROÇA, R. de O.; MOURÃO, G. B. Desempenho produtivo e características de carcaça de bovinos inteiros e castrados criados no sistema superprecoce. **Veterinária e zootecnia**, v. 14, n. 2, p. 252-259, dez. 2007.

COSTA, C.; MEIRELLES, P. R. de L.; SAVASTANO, S.; ARRIGONI, M. de B.; SILVEIRA, A. C.; ROÇA, R. de O.; MOURÃO, G. B. Efeito da castração sobre a qualidade da carne de bovinos superprecoces. **Veterinária e zootecnia**, v. 14, n. 1, p. 115-123, jun. 2007.

COSTA, N. de L.; MOURA, G. de M.; MAGALHÃES, J. A.; TOWNSEND, C. R.; PEREIRA, R. G. de A.; OLIVEIRA, J. R. da C. Regimes de cortes em cultivares de mandioca para alimentação animal em Porto Velho, Rondônia, Brasil. **REDVET**, v. 8, n. 9, set. 2007.

Post-harvest and Processing of Production

BEZERRA, V. S.; DIAS, J. do S. A. Avaliação físico-química de frutos de bananeiras. **Acta Amazonica**, v. 39, n. 2, p. 423-427, jun. 2009.

BEZERRA, V. S. **Açaí congelado**. Brasília, DF: Embrapa Informação Tecnológica; Macapá: Embrapa Amapá, 2007. 40 p. (Coleção Agroindústria familiar).

ALVES, N. M. S.; BEZERRA, V. S. Castanha-do-brasil: da floresta à mesa. Macapá: Embrapa Amapá: OCB/AP, 2007. 31 p. (Embrapa Amapá. **Documentos**, 31).

BEZERRA, V. S. **Valor nutricional de misturas comerciais à base de fécula de mandioca**. **Revista Brasileira de Mandioca**, Cruz das Almas, v. 18, n. 2, p. 65-70, 2005.

BEZERRA, V. S.; DIAS, J. do S. A. Aspectos qualitativos dos frutos de bananeira resistentes à sigatoka-negra no Estado do Amapá. Macapá: Embrapa Amapá, 2005. 7 p. (Embrapa Amapá. **Circular técnica**, 35).

Plants Protection

MINEIRO, J. L. de C.; SILVA, W. R. da; SILVA, R. A. da. Ácaros em fruteiras e outras plantas no estado de Amapá. **Biota Neotropica**, v. 9, n. 2, 2009.

DEUS, E. G.; SILVA, R. A.; JESUS, C. R.; SOUZA-FILHO, M. F. Primeiro registro de *Anastrepha shannoni* Stone (Diptera: Tephritidae) no estado do Amapá, Brasil. **Arquivos do Instituto Biológico**, São Paulo, v. 76, n. 4, p. 725-728, out. / dez. 2009.

JESUS, C. R. de; OLIVEIRA, M. N. de; SOUZA FILHO, M. F. de; SILVA, R. A. da; ZUCCHI, R. A. First record of *Anastrepha parishi* Stone (Diptera, Tephritidae) and its host in Brazil. **Revista Brasileira de Entomologia**, v. 52, n. 1, p. 135-136, mar. 2008.

JESUS, C. R. de; PEREIRA, J. D. B.; OLIVEIRA, M. N. de; SILVA, R. A. da; SOUZA FILHO, M. F.; COSTA NETO, S. V. da; MARINHO, C. F.; ZUCCHI, R. A. New records of fruit flies (Diptera: Tephritidae), Wild Hosts and parasitoids (Hymenoptera: Braconidae) in the Brazilian Amazon. **Neotropical Entomology**, v. 37, n. 6, p. 733-734, Dec. 2008.

ALMEIDA, F. B. dos R.; CERQUEIRA, F. M.; SILVA, R. do N.; ULHOA, C. J.; LIMA, A. L. Mycoparasitism studies of Trichoderma harzianum strains against *Rhizoctonia solani*: evaluation of coiling and hydrolytic enzyme production. **Biotechnology letters**, v. 29, n. 8, p. Aug. 2007.

Technical Chart

Researchers	Research Areas
Adilson Lopes Lima	Phytosanity
Ana Elisa Alvim Dias Montagner	Cattle Raising
Ana Margarida Castro Euler	Forest Management and Ethnoecology
Antônio Cláudio A. de Carvalho	Statistics and Economics
César Santos	Bioecology of Fishes
Cristiane Ramos De Jesus	Entomology
Emanuel da Silva Cavalcante	Phytotechny
Eliane Tie Oba Yoshioka	Fish Nutrition and Food
Eleneide Doff Sotta	Environmental Services and Global Changes
Francisco Nazaré R. de Almeida	Seeds
Gilberto Ken-Iti Yokomizo	Plant Improvement
Jô de Farias Lima	Shrimp Culture
Jorge Frederico O. Segóvia	Plant Production
José Adriano Marini	Family Agriculture
Jurema do Socorro Azevedo Dias	Phytopathology
Karlia Dalla Santa Amaral	Water Quality
Maguida Fabiana da Silva	Genetic Resources
Marcelino Carneiro Guedes	Soils, Residues and Forest Resources
Marcos Tavares Dias	Health of Aquatic Organisms
Milza Costa Barreto	Economics
Nagib Jorge Melém Junior	Soils Fertility and Management
Paulo Marcelo Veras de Paiva	Soils and Forest Resources
Raimundo Pinheiro Lopes Filho	Irrigation and Climatology
Ricardo Adaime da Silva	Entomology
Rogério Mauro Machado Alves	Plant Physiology
Silas Mochiutti	Forest Management and Silviculture
Valéria Saldanha Bezerra	Food Science and Technology
Wardsson Lustrino Borges	Agroecologia

Embrapa Amapá has as mission to provide solutions for research, development and innovation for sustainable agriculture and use of biodiversity in the Amazon, with emphasis on Amapá and Amazon estuary.

ISBN 85613660-4-4

Embrapa

Ministério da Agricultura, Pecuária e Abastecimento

GOVERNO FEDERAL
BRASIL
PAÍS RICO É PAÍS SEM POBREZA