ACTO
Amazon Cooperation Treaty Organization

PROJECT gefamazon
WATER RESOURCES AND CLIMATE CHANGE

AMAZON WATERS

ANO 2 • NÚMERO 6 • JUNHO 2014

gef UNEP

CLOSE-UP

Project studies vulnerability to climate change and adaptation strategies in the MAP Region

Over the past few decades, the basin of the Acre River – located in the MAP region, which is shared by Peru (Madre de Dios), Bolivia (Pando) and Brazil (Acre) – has been suffering intense pressure from both human activity and climate change. Various impacts have been affecting its water systems and bringing serious consequences to local biodiversity, subsistence economy and human health.

Facing this reality, the GEF Amazon Project recently carried out the pilot project *Adapting to Climate Change in the MAP Region,* in support of local communities. The project addresses the vulnerability and adaptive capacity of local water resources facing climate change, so as to contribute to policies for social and environmental adaptation in this extremely complex, cross-border region. The pilot project is one of the first to be carried out by three countries in the southwest Amazon – and can be replicated throughout the Amazon Basin, integrating and strengthening collaboration between countries.

According to Water Resources Governance expert Elsa Mendoza – the GEF Amazon Project consultant who carried out the project –, managing risks and protecting local populations and rainforests is crucial to adaptation. "Reducing the risk of disasters by means of early warning systems and involving communities in monitoring extreme hydro-climatic events are ways of strengthening affected populations," said professor Mendoza.

The project's main results were the creation and establishment of an early warning system – which will help improve the local governance capacity of Madre de Dios, Acre and Pando. The system anticipates actions for prevention and mitigation facing natural and unnatural disasters in the region, and monitors and analyzes environmental risk alerts.

Rio Branco, Acre, Brazil: Technicians from Bolivia and Peru met for the TerraMA2 Platform Course for the MAP region

The project also gathered and consolidated a great deal of information referring to climate change and its effects on ecosystem services in the MAP region. Other results were the identification and design of the Acre River basin as a planning unit; and risk analysis concerning local aquatic ecosystems. Moreover, the pilot project established specific methodology for the creation of a climate change vulnerability matrix for water resources in the MAP region, including explanatory maps. A documented list of areas where the pilot project's adaptation activities could be implemented in the Amazon Basin was also established.

For the project to be complete, a simple communication system has to be established between the MAP region's three countries as to alerts. "The early warning system does not work on its own: it needs communication to be established between the three countries," says professor Mendoza, explaining that all information will be transmitted by radio.

ACCESSIBLE PLATFORM

The alert system uses the free distribu-

tion TerraMA^2 platform, which belongs to the Brazilian National Institute for Space Research (Instituto Nacional de Pesquisa Espacial/INPE). Following the pilot project, the platform – previously available only to Brazil – is now accessible also to Bolivia and to Peru.

"The TerraMA^2 platform's system is installed in the three MAP region countries and has a website called 'web platform', which is accessible through the internet," says professor Mendoza, adding that the platform generates maps with real-time alert indexes for floods, forest fires and other natural disasters. "The alerts are sorted by colours: blue means 'observation'; yellow means 'attention'; orange means 'alert'; and red means 'high alert'," explains the consultant. According to professor Mendoza, from the time the alert level is identified, the TerraMA^2 platform sends an email to the people entrusted to take action. "At high alert, the indexes go through national technicians, by radio and other communication systems in the region, to relevant government institutions, so that they can take action *in loco*," says the professor, noting that one of the system's advantages is its 24-hour-a-day operation.

TRAINING

As part of the pilot project, GEF Amazon Project held its first TerraMA^2 Platform Course for the MAP region. The technical training course was held from March 31 to April 4 in the city of Rio Branco, Acre, in Brazil. Technicians from national technical institutions in the MAP region were thoroughly trained as to the implementation of the alert system and operation of TerraMA^2, to diagnose the present communications that serve this alert system, and to a new proposed communication system to this end.

WORKSHOPS

GEF Project holds national TDA workshops in Brazil, Guyana and Suriname

Three national Transboundary Diagnostic Analysis (TDA) workshops were recently carried out in Brazil, Guyana and Suriname – all member countries of the Amazon Cooperation Treaty Organization (OTCA) – as part of the GEF Amazon Project. TDA methodology allows ACTO member countries to identify and assess concerns and priorities and cross-border issues concerning water resources and the natural environment, as well as the socio-economic activities that impact them. This methodology includes a cross-sectional analysis of scientific and technical documentation to identify and prioritize the sub-basins' problems, and includes governance analysis considering institutional, legal and political aspects. TDA will support the development of a Strategic Action Programme (SAP) for the Amazon Basin and will help create favourable conditions for its implementation.

Promoted by the Global Environment Facility (GEF) for projects involving international waters, TDA is always preceded by consultation with stakeholders, integrating them and leading to collectively establish strategies for problems identified.

Vulnerable ecosystems: a local TDA workshop mapped threats to the Amazon Basin in Suriname

BRAZIL

A national TDA workshop was held on May 14 and 15 in Brasilia, the Brazilian capital. The meeting was coordinated by the Brazilian National Water Agency (Agência Nacional de Águas/ANA). Participants included representatives from 23 institutions, including federal agencies such as the Brazilian ministries of the Environment (Ministério do Meio Ambiente/MMA) and Foreign Affairs (Ministério de Relações Exteriores/MRE) – as well as state

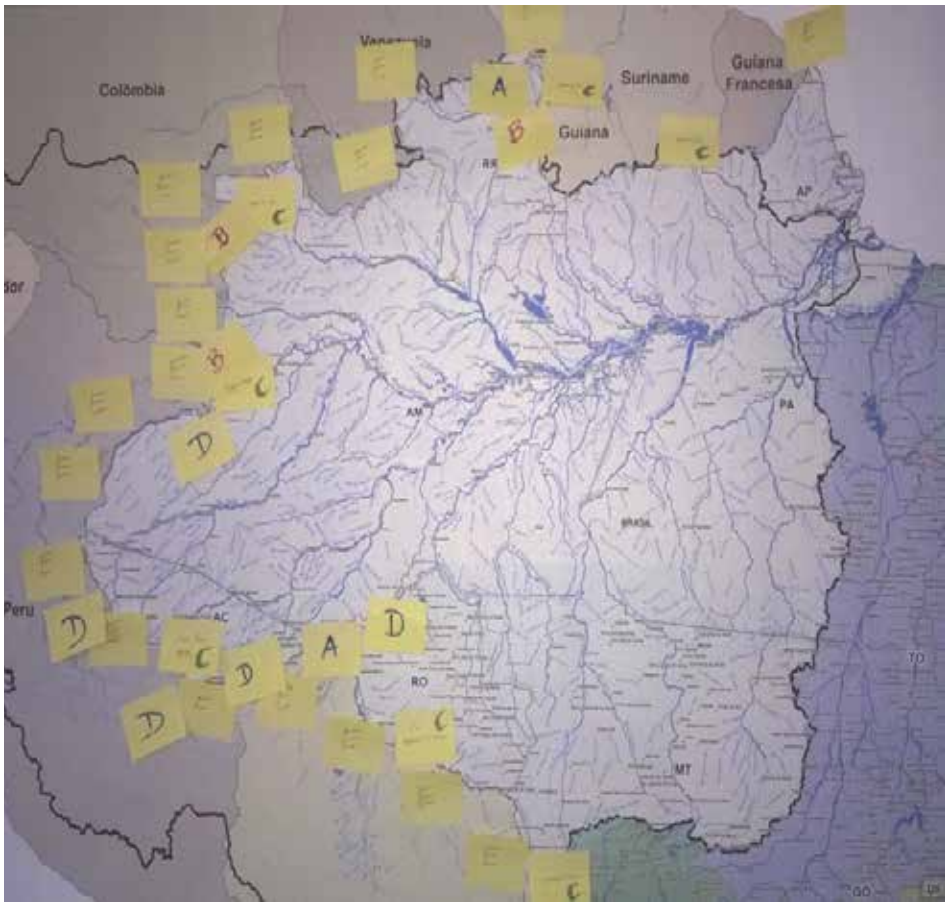
agencies, non-governmental organizations and universities.

Participants of the Brazilian TDA workshop presented their respective Amazon realities and revealed the main water-related problems that have been occurring in the Brazilian Amazon's border region. Five groups were made up to discuss specific topics that were identified during the workshop – such as pressures on local biodiversity; unsatisfactory integrated management; deforestation; lack of planning towards productive activities in the Amazon; and the lack of a system to monitor extreme hydro-climatic events.

The first result of the Brazilian national TDA workshop was a map highlighting the five problems identified. For each of the issues, over 60 impacts were listed. The group found that deforestation is what causes the greater number of impacts – a including erosion, wildlife trafficking, uncontrolled use of land, illegal logging and the loss of fishing resources, amongst others.

Next, the groups analyzed causes – primary, secondary, tertiary and root causes – for the problems that were identified. The final list included 131 causes; the planning problem was at the top of the list as the most mentioned. The five groups then presented five activity plans for the five issues discussed during the workshop, as well as 17 activities considered strategic. In some cases, main stakeholders were also identified for each activity.

During the workshop, three regions were mentioned frequently and will be submitted to the regional TDA's consideration and recommendations: the Brazil/Guyana/Venezuela, Brazil/Colombia/Peru and Brazil/Peru/Bolivia borders.



Map highlighting cross-border issues identified during the Brazilian TDA workshop

TDA IN GUYANA

A national TDA workshop was held in Georgetown, Guyana, on May 8, with ACTO and GEF Amazon Project representatives as well as guests from the government and local universities and research institutes. The workshop's goal was to identify problems and their cross-border environmental and socioeconomic impacts, identifying causes and consequences.

Following initial introductions made to contextualize the workshop within the GEF Amazon Project, four groups were created to discuss the following issues: soil pollution; flooding; water pollution; and deforestation. Next, root causes and their relationship with technical, economic, institutional and socio-political issues were examined, in order to establish a strategic action plan.

The national Guyana TDA workshop participants also analyzed the impact of the strategic action plan in the context of the GEF Amazon, aiming at regional cooperation. Each group presented proposals for strategies – which ranged from the establishment of regional and inter-regional management for the Amazon Basin, to address soil pollution, to the proposed establishment of a regional committee for technology transfer, concerning deforestation.

SURINAME DISCUSSED CHALLENGES

Suriname hosted a national TDA workshop on May 6, in Paramaribo. Participants included 42 representatives from government institutions – such as the ministries of Natural Resources and Regional Development –, non-governmental organizations, research institutes and universities.

The workshop's specific objectives included listing challenges; establishing priorities among problems identified; identifying environmental and socioeconomic impacts and their causes, putting them into categories and relating them to each other; and defining measures to mitigate these impacts.

Following initial introductions to contextualize the workshop within the GEF Amazon Project, six groups were established so as to address the following topics: the use of mercury in small-scale mining and of chemicals in agriculture; management of waste and of wastewater; land use; data legislation and availability; climate change; and hydro-sedimentation.

NEWS FROM COMPONENT III

Project studies adaptation to climate change in the island of Marajó, Brazil

Island of Marajó: a natural sanctuary that is extremely vulnerable to climate change

Climate change is real. The Intergovernmental Panel on Climate Change (IPCC) has estimated a global 23-to-96 centimeter sea level rise from 1990 to 2100 – resulting in direct and indirect environmental and socio-economic impacts. In such a context, it is crucial to develop possible scenarios that may result from global climate change, so as to identify vulnerabilities and best adaptation strategies. This is the GEF Amazon Project's goal, applied to one of the world's most valuable and vulnerable regions.

Geologist and oceanographer Maamar el Robrini – a PhD in Marine Geology by Université de la Sorbonne Paris IV and associate professor at the Federal University of Pará – has carried out a GEF Amazon pilot project to assess the consequences of sea level rise and other phenomena caused by climate change on the world's largest estuarine island: the island of Marajó. This geological, hydro-climatic and environmental study of the coast of Marajó, in the Brazilian state of Pará, is part of the Project's Component 3 (Development of the Strategic Action Program). Its goal is to identify best local examples of climate change

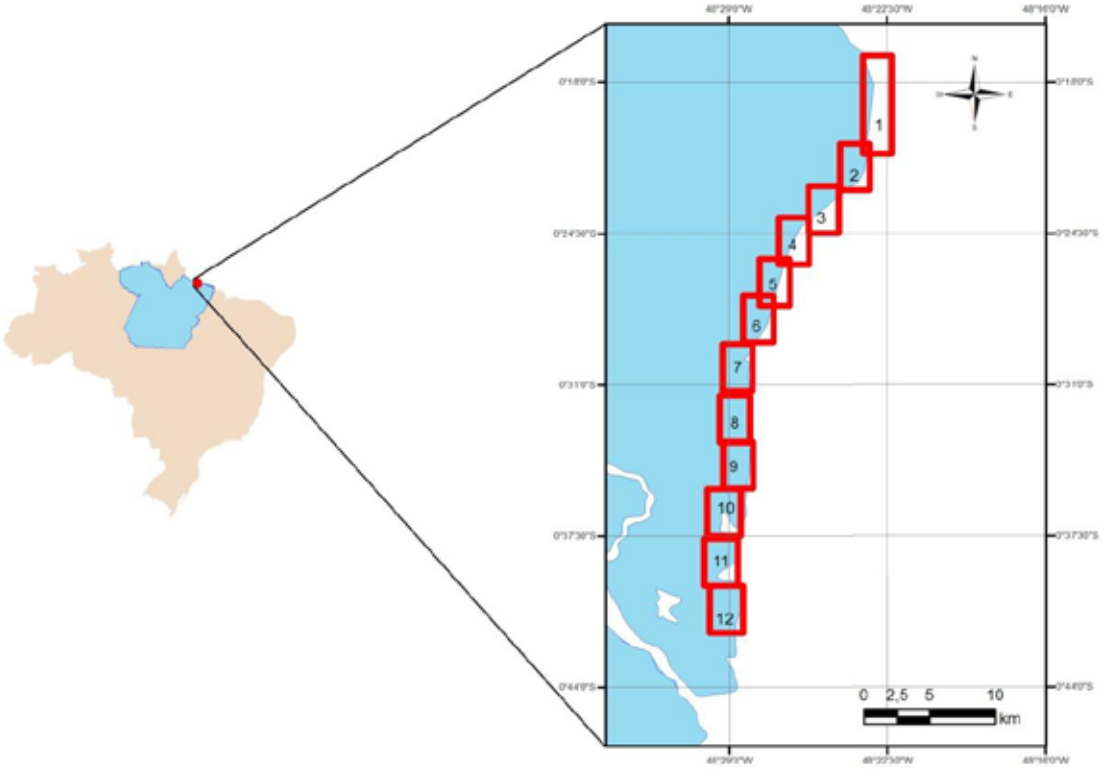
adaptation. The idea is to face as best as possible the impacts of global climate change on this environmentally vulnerable place, joining forces with local communities.

The island – bathed by the Amazonas, Pará and Tocantins rivers and by the Atlantic Ocean – is indeed extremely vulnerable: 60% of its coastline has already suffered erosion. To make matters worse, its population occupies the lower regions of the island, which are highly susceptible to rising sea levels. "These areas are also subject to other Amazonian processes – such as the rising level of the Amazon River –, as well as other meteorological processes, such as the extreme climate events that have recently been occurring in the Amazon," says professor el Robrini, who is assessing the impact of all these phenomena on the island's eastern (Pará River) and northern (Amazonas River) coastlines – the ones that most suffer erosion.

The environmental and socio-economic damage that threatens this precious natural sanctuary includes frequent flooding; erosion; salinization of groundwater; loss of agricultural lands, of fishing areas and of archaeological sites; population migration; and reduced availability of freshwater, among others. Another fact must be mentioned: deltaic regions are amongst the world's most fragile and cannot be rebuilt by man.

In an effort to diagnose Marajó's vulnerabilities and establish which are its best chances of adaptation, the pilot project coordinated by professor Maamar el Robrini has already produced a series of important results – such as a database containing information on the island's coastal areas as to morphology, geology, oceanographic conditions and erosion. The database brings together existing information – gathered from theses, articles, projects, plans, maps, photographs and satellite images – and information gathered during field work.

The pilot project also mapped the island's entire coastal area, with emphasis on the dynamics of its eastern and northern coastlines. The pilot project has also created vulnerability maps and a series of scenarios that could result from rising sea levels on the island of Marajó over the next hundred years, based on IPCC models. To be complete, the pilot project has yet to carry out a diagnosis of the island's coastal areas that are affected by rising sea levels and other associated events – as well as propose and test adaptation measures on the ground, also providing inputs for the preparation of appropriate policies.



Areas analyzed on the western coast of Marajó Island

NEWS FROM COMPONENT III

Climate change threatens Purus River's cross-border sub-basin

As part of the GEF Amazon Project, a workshop within the ***Climate Change, Adaptation Capacity and Risk Governance in the Transboundary River Purus Sub-basin*** project was held on May 28 and 29 in Manaus, in the Brazilian state of Amazonas (AM), in preparation for a national civil defense conference to be held in Brasília, Brazil, in November. The workshop was coordinated by Federal University of Pará professor Nirvia Ravena – a PhD in Political Science and consultant for the GEF Amazon Project.

The workshop is part of a series of crucial studies concerning the impacts of climate change on the Purus-Madeira sub-basin, because the region – home to great biological and social diversity – is seriously threatened. "What the workshop's participants consider extreme, nowadays, will be considered 'normal' in coming years," said professor Ravena, adding that one of the event's main goals was "to develop a joint strategy and come up with response and adaptation measures to face whatever lies ahead."

Floods in 2014: the Madeira River overflowed in Humaitá, in the Brazilian state of Amazonas

According to the professor, the workshop was special in that it "managed to bring together the experiences of several local towns." The workshop was attended by representatives from municipal civil defense departments and by civil society representatives from all seven towns assessed by the project: Beruri, Tapauá, Canutama, Lábrea, Humaitá, Pauini and Boca do Acre. All these Amazonas municipalities were recently affected by extreme weather.

The state of Amazonas was chosen to host the workshop because it portrays all the problems that are inherent to the management of extreme weather events. Because of its size, its climatic and geographical conditions – as well as its economic activities based on natural resources –, the state is extremely sensitive to natural disasters. In 2005 and 2010, for example, Amazonas faced severe droughts; in 2009 and 2014, in turn, there was extreme flooding: only this year, 33 municipalities were hit by floods, more seriously in Purus and Madeira sub-basins. These extreme fluctuations affect coastal communities to the point of forcing them to leave the places where they historically built their ways of life, based on the use of natural resources. "During the workshop, participants listened to predictions about how much it is going rain, in 2016, in certain regions of the basin, and they said: 'there won't be any brazil nuts that year,'" said professor Ravena.

At the workshop, the professor presented the Risk Governance Model that is being created as a result of the *Climate Change, Adaptation Capacity and Risk Governance in the Transboundary River Purus Sub-basin* project. One of the workshop's goals was to train participants as to the model's variables and then validate it, even if only partially.

Participants also shared their experiences concerning local civil defense departments and civil society initiatives in the municipalities involved; assessed the impacts of climate change on local risk governance; and came up with participatory strategies to respond and adapt to these towns' extreme weather conditions, enabling the sustainable use of the basin's natural resources.

ADAPTATION SOLUTIONS

Workshop participants also shared some of the solutions they came up with to survive these extreme events – such as using canoes to harvest in wetlands and raising the floors of local houses – and suggested prevention and mitigation strategies for possible future scenarios. The alternatives presented will help adapt the Risk Governance Model to these municipalities, leading to more effective public policies. Representatives stressed regional characteristics and the importance of incorporating them into specific policies for each area.

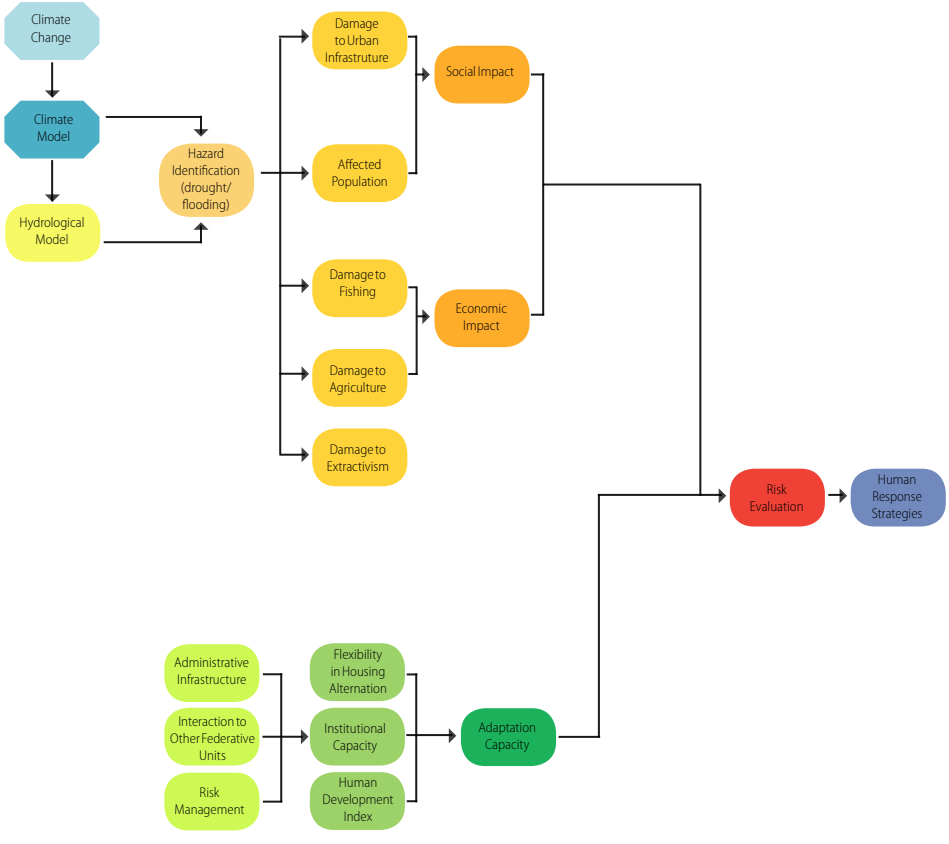
Among the problems listed by the workshop were also issues referring to water quality: artesian wells are insufficient; during floods, wells are contaminated and diseases

such as leptospirosis, diarrhea and cholera occur; facing droughts, there is an increase in the occurrence of diseases such as leishmaniasis and itching.

Damage to urban infrastructure was also mentioned: floods destroy paving; water infiltrates, and floors and walls of wooden houses are destroyed. Moreover, open cesspools overflow. Damage to river transportation also occurs: in droughts, large boats cannot sail and transportation of fuel and food is thus reduced, increasing time spent in transportation and cost of goods. Small, family agriculture also suffers: when there is flooding, plantations in lowland areas are submerged and diseases in crops increase, often leading to a total loss of produce. Droughts make the soil crack, leading to decreased productivity.

Workshop: participants from seven Amazonas municipalities shared their experiences

Operational Model of Climate Change, Adaptation Capacity and Human Response Strategies for Risk Governance



As for fishing, flooding makes it easier for large outside boats to come in, reducing stocks of fish for local fishermen; when there are droughts, on the other hand, stocks naturally diminish, with direct impacts on local families' diets. Damage to plant extractivism also occurs: droughts make it hard to reach production areas. In the rainy season, activities become more intense because of access by the river, but in cases of extreme flooding there may be reduced production of rubber, nuts, and açaí berries (because flowering is hindered, in the case of brazil nuts, and because coagulation is made more difficult, in the case of rubber).

MODEL PREDICTS RISKS

The goal of the Risk Governance Model presented at the workshop is to predict risks to local populations, during a 30-year period, helping to develop strategies to respond to climate change in the Purus River sub-basin.

The climate model provides rainfall data and the water balance reveals the elevation of rivers; based on this data, the model identifies threats of droughts or flooding in the Purus River sub-basin municipalities. The model's output is an assessment of the risks faced by local populations – and this risk is based on their social and productive vulnerability. This risk can be either acceptable, tolerable or intolerable, given the respective adaptability capacities of each municipality.

NEWS FROM COMPONENT III

GEF Amazon Project monitors the quality of Amazon Basin waters

As part of a joint effort by the eight Amazon Basin countries – Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela – to protect and sustainably use the basin's water and land resources, the GEF Amazon Project produces information about the types and sources of water pollution in the region; the means to monitor the problem; and the mechanisms to address the root causes of this pollution. This monitoring work is crucial to Amazon countries and to the integrated management of their water resources.

This is no easy task: the Amazon basin spans around 7 million square kilometers. Its average water represents about 20% of the world's supply of freshwater. However, urban pollution, lack of sanitation and waste from other sources of pollution affect the quality of groundwater, which is often unfit for human consumption.

In the Amazon, monitoring of water quality through standardized parameters is relatively recent. The process is complicated by issues such as the enormous scale of the Basin and the lack of infrastructure and logistics for collecting, transporting and analyzing water samples. Moreover, data on water quality is collected according to different parameters and methodologies, and sampling points are not geo-referenced.

These were some of the challenges faced by the *Water Pollution in the Amazon Basin* project, which belongs to the GEF Amazon Project's Component III (Development of the Strategic Action Program). At this first stage, the activity's goal was to compile information on the monitoring of the quality of waters of Amazon rivers in Brazil, Peru, Ecuador and Colombia. The data – produced by government bodies in the four countries – was gathered by GEF Amazon Project consultant Fernanda Souza do Nascimento, a PhD in Geology and Geochemistry.

COLLECTION

In Brazil, information about the quality of Amazon waters is gathered by the Brazilian Ministry of Environment's National Water Agency and covers ten sub-basins. There is periodical collection up to 50 parameters, depending on the technological infrastructure at the sampling point – and 187 sampling stations in the national hydro-meteorological monitoring network. The parameters of water quality are dissolved oxygen, thermo-tolerant coliforms, potential of hydrogen (pH), biochemical oxygen demand (BOD), temperature, total nitrogen, total phosphorus, turbidity, and total residue. Sampling stations in the Brazilian Amazon Basin include points in the Amazonas, Xingu, Madeira, Guapore, Negro, Branco, Solimões, Purus and Coari rivers, amongst others.

In Colombia, data on the quality of Amazonian waters comes from the Institute of Hydrology, Meteorology and Environmental Studies. There is periodical collection up to five parameters, in 162 sampling stations in the Colombian Amazon Basin. Parameters are dissolved oxygen, suspended matter, pH, BOD and electrical conductivity.

In Ecuador, this information comes from the National Water Secretariat. Collection occurs according to different parameters, irregularly, in 150 sampling stations in the Ecuadorian Amazon Basin. Samples are carried out in Napo, Pastaza and Santiago basins. Parameters include dissolved oxygen, oil, grease, pH, total hydrocarbons (PAH and benzene, toluene, ethyl-benzene and xylenes), thermo-tolerant coliforms, dissolved solids, BOD, chemical oxygen demand (COD), nitrogen and phosphorus species, cyanide, conductivity, turbidity, sulfates, heavy metals, carbonates, bicarbonates, fluoride and temperature.

In Peru, monitoring the quality of Peruvian Amazonian waters is carried out by the National Water Authority. There are about 150 sampling stations in the Peruvian Amazon Basin. Measurements are carried out in the basins of the Purus, Yurua, Marañón, Ucayali and Madre de Dios rivers. Water quality parameters include dissolved oxygen, oil, grease, pH, temperature, total hydrocarbons (PAH and benzene, toluene, ethyl-benzene and xylenes), thermo-tolerant coliforms, dissolved solids, BOD, COD, nitrogen and phosphorus species, cyanide, conductivity, turbidity, sulfates, heavy metals, carbonates and bicarbonates.

Data systematized by consultant Fernanda Nascimento will subsidize proposed coordination among Amazon Cooperation Treaty Organization (ACTO) member countries as to Amazon water quality monitoring systems, as part of the GEF Amazon Project's Strategic Action Program (SAP), aiming at the integrated and sustainable management of water resources in the region.

©ACTO 2014 Amazon Cooperation Treaty Organization- Permanent Secretary (ACTO/PS). Secretary General **Amb. Robby Ramlakhan,** Executive Director **Amb. Mauricio Dorfler**, Administrative Director **Carlos Aragón,** Transport, Tourism and Communication Coordination **Carlos Arana Courrejolles**, Indigenous Affairs Coordination **Sharon Austin,** Science, Technology and Education Coordination **Germán** Gómez, Environment Coordination **Antonio Matamoros**, Health Coordination **Antonio Restrepo**, Photos: ACTO Archives. ACTO Address: SHIS QI 05, Conjunto 16, Casa 21, Lago Sul.CEP 71615-160 Brasilia, DF, Brasil Tel.+5561-3248-4119. www.otca.info
GEF Amazon Project: Regional Technical Coordinator **Norbert Fenzl**
Contact: http://gefamazonas.otca.info
Project Address: SHIS QI 09, Conjunto 03, Casa12, Lago Sul, Brasilia DF, Brasil CEP71625-030 Tel. +5561-3248 -7730