

Adaptation to Climate Change in the Transboundary MAP Region

Adaptation au changement climatique dans la région transfrontalière de MAP

Elsa R. H. Mendoza¹; Fronika de Wit¹; Vera Lúcia Reis²; Irving Foster Brown¹; Sonaira Souza da Silva¹; Wilson Suri Palomino¹; Hugo Leonardo Fuentes¹; Jiang Oliver Liao Torres³; Juan Fernando Reyes¹; Eymar Lopes⁴; James Gomes²; André Bracciale¹; Norbert Fenzl¹ and Maria Apostolova¹.

1 Amazon Cooperation Treaty Organization (ACTO) – Brasilia/DF, Brazil. elsa_mendoza@uol.com.br; 2 Acre's Environmental State Secretary (SEMA) Rio Branco/Acre, Brazil. vlreis.ac@uol.com.br; 3 Regional Government of Madre de Dios (GOREMAD). Puerto Maldonado, Peru. jilaot@hotmail.com; 4 Brazilian Institute for Space Research (INPE). São José dos Campos/SP Brazil. eyymar@dpi.inpe.br

RÉSUMÉ

Le bassin amazonien est confronté à de nombreux défis concernant l'utilisation durable des ressources en terres et en eau. Le bassin de la rivière trinationale Acre se situe dans le sud-ouest du bassin amazonien et comprend les départements de Madre de Dios (Pérou) et Pando (Bolivie) ainsi que l'Etat d'Acre (Brésil). Cette recherche évalue la vulnérabilité hydrologique au changement climatique et à la variabilité de la région transfrontalière de MAP (Madre de Dios, Acre, Pando). Ce document décrit le processus d'intégration et de coopération effectives dans le bassin d'une rivière transfrontalière, en renforçant les actions gouvernementales pour faire face aux problèmes liés à la vulnérabilité au changement climatique. La méthodologie utilisée pour évaluer la vulnérabilité du bassin est l'Indice des Risques Écologiques (IRE) conçu par Mattson & Angermeier (2007). En utilisant la base de données scientifiques trinationale détaillée ainsi que les informations découlant des recherches sur le terrain, des cartes trinacionales d'Indice des Risques Écologiques ont été développées et donnent une vision synthétique des menaces qui pèsent sur le bassin. Une équipe trinationale et rodée d'experts a utilisé les cartes IRE pour choisir un emplacement pour la mise en œuvre d'un système trinational d'alerte d'urgence pour les inondations, les feux de forêt et autres types de catastrophes naturelles. Le développement de ce système de prévision offre une base d'amélioration des capacités de gouvernance des gouvernements intermédiaires pour formuler et mettre en œuvre des stratégies d'adaptation au climat.

ABSTRACT

The Amazon Basin is facing numerous challenges to the sustainable utilization of land and water resources. The trinational Rio Acre river basin is situated in the southwestern Amazon basin and includes the departments of Madre de Dios (Peru) and Pando (Bolivia) and the state of Acre (Brazil). This research assesses the trinational MAP (Madre de Dios-Acre-Pando) region's hydrological vulnerability to climate change and variability. The paper describes the process of effective integration and cooperation in a transboundary river basin by strengthening governmental actions to confront problems related to vulnerability to climate change. The methodology used to assess the basin's vulnerability is the Ecological Risk Index (ERI) devised by Mattson & Angermeier (2007). Using the elaborated trinational scientific database as well as field research information, trinational Ecological Risk Index maps were developed, providing an holistic view of the threats to which the basin is exposed. An established trinational team of experts used the ERI maps to choose the location to implement a trinational emergency alert system for floods, forest fires and other kinds of natural disasters. The development of this forecasting system provides the basis for improving governance capacities of the intermediate governments to formulate and implement climate adaptation strategies.

KEYWORDS

Climate adaptation strategies; Forecasting system; Transboundary river basin management; Vulnerability

1 INTRODUCTION

The Amazon Basin is facing numerous challenges to the sustainable utilization of land and water resources as the region experiences exponential socio-economic growth and internal migratory flows and immigration. In recognition of the hydrographical unity of the Amazon Basin and in order to address the need for coordinated action, the Basin countries signed the Amazon Cooperation Treaty (Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela) creating the Amazon Cooperation Treaty Organization (ACTO). In 2003, following an initiative introduced by the Brazilian National Water Agency, and based on the results of a meeting of national focal points of the Inter-American Water Resources Network, ACTO, in collaboration with the Organization of American States, sought the support of the Global Environmental Fund (GEF) to help develop a project proposal aimed at strengthening the institutional framework to effectively initiate integrated water resources management within the world's largest hydrographic basin. The project "Integrated and Sustainable Management of Transboundary Water Resources in the Amazon River Basin Considering Climate Variability and Change" (ACTO/GEF/UNEP) seeks to strengthen the institutional framework to effectively initiate integrated water resources management within the world's largest hydrographic basin, through planning and executing coordinated activities for the protection and sustainable management of the land and water resources of the Amazon River Basin, in the context of climate variability and change. The project employs an innovative participatory mechanism as the basis for understanding current and expected Integrated Water Resources Management (IWRM) challenges and issues. Part of this ACTO/UNEP/GEF Amazon Project is the Activity "Adaptation to Climate Change in the Trinational MAP Region", which goal is to evaluate the vulnerability of water resources to climate change in the Transboundary MAP region and develop an early warning system. This early warning alert system provides the basis for improving governance capacities of the intermediate governments to formulate and implement climate adaptation strategies. The trinational MAP region is situated in the south-western Amazon and includes the department of Madre de Dios (Peru), the state of Acre (Brazil) and the department of Pando (Bolivia). The Activity is carried out in the Higher Rio Acre river basin. The Rio Acre river basin comprises an area of approximately 35.967 km², with 88% on Brazilian, 7% on Peruvian and 5% on Bolivian territory (Latuf, 2011). The different uses and land uses of the Rio Acre basin, especially for livestock holdings and agriculture, show a high anthropogenic pressure on the Amazonian forest. Population growth and changes in land use have led to the intensification of deforestation and burning processes transforming the forest into pasture areas (Reis & Reyes, 2007).

2 METHODS

2.1 Team of Experts

To conduct research on the vulnerability of the river basin and adaptation to climate change, a trinational team of experts was established. As Integrated River Basin Management as a transdisciplinary subject, the trinational team of experts comprises members with different expertise from different areas, with equal participation from the three countries that are part of the Rio Acre river basin. The tasks of the team of experts involve monitoring and measuring the adaptation processes carried out in the region.

2.2 Trinational Scientific Data Base

With help from the team of experts, a trinational scientific database with georeferenced environmental data on the Rio Acre river basin in the MAP region was developed. Trinational data on the following topics was collected: geology, geomorphology, hydrography, land use and occupation, vegetation, relief, declivity, evolution of deforestation, distribution and access to water, digital elevation model, population density, settlements, urban networks and paved roads, fire scars in the forest, dams and reservoirs (area and location), sand mining and mineral water (location), roads and access, and theoretical models on climate change. All this information, together with information and data collected in the field, was standardized and put into the trinational database. The environmental data on the MAP region was used to produce trinational thematic maps.

2.3 Ecological Risk Index

The trinational database was used to evaluate the environmental risks and vulnerability of the water resources in the MAP region and identify possible risk areas. This vulnerability assessment was

carried out using the Ecological Risk Index (ERI) developed by Mattson and Angermeier (2007). The ERI risk-based protocol, is used to identify watersheds with least/most risk to conservation targets. The ERI protocol combined risk based components, like frequency and severity of human-induced stressors, with biotic drivers and mappable land- and water-use data to provide a summary of relative risk to watersheds (Mattson and Angermeier, 2007). The ERI methodology assesses the different stressors conforming their sensibility, severity and frequency, applying weight and grades to each of them, using the following formula:

$$ERI(i) = F(i) \times S(i)$$

In the formula above, ERI(i) stands for the stressor that is being assessed, F(i) for the stressor's (i) frequency and S(i) for the stressor's (i) severity in the river basin. The team of experts helped to calculate each stressor's individual ecological risk index, as well as a composite ecological risk index – ERI(c)- for the river basin as a whole.

3 RESULTS AND DISCUSSION

Using the elaborated trinational scientific database as well as field research, trinational Ecological Risk Index maps were developed, which provide an holistic view of the threats to which the Rio Acre basin is exposed. Understanding the environmental risks in a region, helps in the decision-making process to chose what kind of action is necessary to avoid or minimize negative impacts. After assessing the vulnerability and ecological risks of the Rio Acre river basin, using the ERI maps, the team of experts decided to implement a trinational Alert System for floods, forest fires and other kind of natural disasters as an adaptation strategy to climate change in the region. The team of experts chose to use the TerraMA2 operational system, which is an open-source software that provides all the technological infrastructure required to implement Operational Systems for monitoring and Early Warning for any spatially distributed phenomena. The TerraMA2 Platform, developed by Brazil's National Institute for Space Research (INPE), integrates geographical services and modeling, accessing weather, climatic, atmospheric, hydrological geotechnical and demographics data. Different teams in the MAP region were trained to work with the TerraMA2 platform. In addition, the hardware structure for each responsible institution was prepared and locally installed. The development of this trinational early warning system, provides the basis for improving governance capacities of the intermediate governments of the departments of Madre de Dios and Pando and the government of Acre to formulate and implement climate adaptation strategies.

4 CONCLUSION

The Project "Adaptation to Climate Change in the Trinational MAP region" shows that river basin challenges in a transboundary region, need an integrative and regional answer to be effective. The trinational ecological risks and vulnerability assessment that was carried out in the MAP region can inform the regional conservation planning in several ways. In addition, the Alert System that was installed in the region fortifies technical and scientific cooperation between the three countries in the MAP region.

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