Ecosystem Response to Climate Change in Mountain Wetlands

Juan Mauricio Castaño[1] (PI) (Associate Professor), Jay Martin[2] (US PI Partner)(Professor), Dr. Gabriel Colorado[3] (Auxiliary Professor - Fauna), Jorge Hernan Marulanda[4] (Biologist), Marcela Uribe[1] (PhD Student – Wetland Vegetation), Jeymmy Walteros[1] (Master Student – Aquatic Macro invertebrates – Aquatic Habitat Assessment – Children Education), Victor Bermudez[1] (Master Student – Stream Morphology – Emergy Analysis), Santiago Restrepo[1] (Master Student - Wetland Vegetation – GIS - Birds), Juan Camilo Berrío[1] (Master Student - Instrumentation), Norma Castro[1] (B.S. Env Management. Young Researcher – Water Resource Management Modeling), Carlos Rodríguez[3] (B.S Biology Program -Frogs), Marisol Cardona[5] (B.S Biology Program -Mammals), Laura Velez[5] (B.S Biology Program, -Mammals).

[1] Universidad Tecnológica de Pereira, Facultad de Ciencias Ambientales. [2] Ohio State University, Department of food Agriculture and Biological Engineering
[3]. Universidad Nacional – Sede Amazonas. [4]Aguas y Aguas de Pereira [5]. Universidad de Caldas, Departamento de biología.

Introduction

Colombia is one of the most vulnerable countries to Climate Change. Recently the effects of the extreme climatic events caused several deaths and economical loses to the country (Jaramillo-Robledo et al 2009).

The adaptation to Climate Change based on ecosystems is focused on how to use the environmental services they provide to adapt society to a changing climate (Vignola et al, 2009; Locatelli, 2015). Under this perspective, mountain wetlands are important no only by their capacity to regulate water flows and improve water quality, but also because they can be used as a central part of an early warning systems of anomalies in the ecosystem functioning.

The objective of this project is to develop an early warning system based on long term monitoring and modeling of water environmental services of mountain wetlands located in a small watershed in the central Andes of Colombia.

Materials y Methods

Base line

A base line of three components has been conducted: instrumentation and hydrological monitoring (Rainfall gauges network and flow gauges); fauna (frogs, aquatic macro invertebrates, birds, mammals), flora (wetland vegetation).
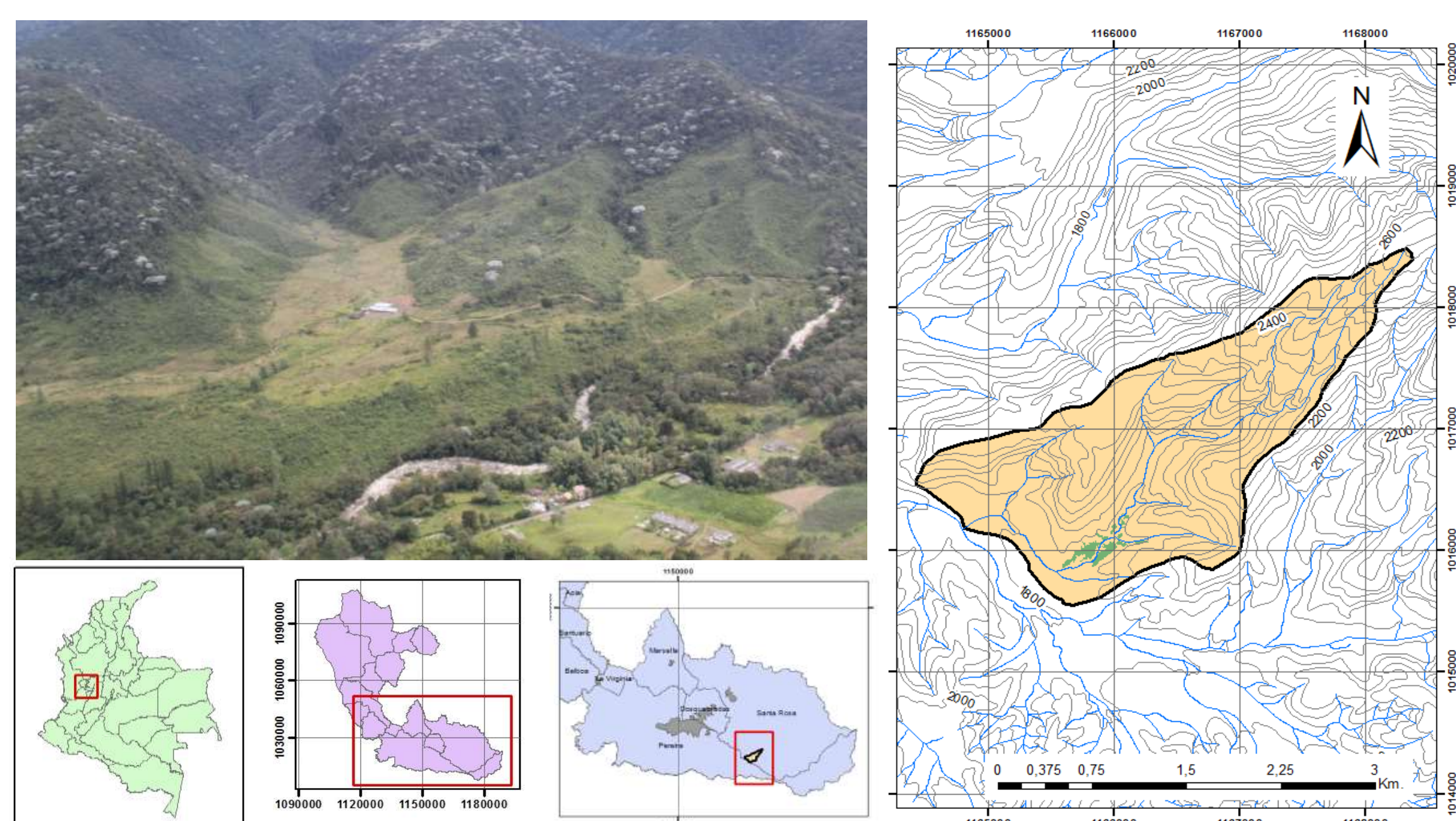
Study site location

Early Warning System

With the capture of hourly images of the wetlands area, with digital cameras, the variation of primary productivity of wetland vegetation is tracked through the estimation of green chromatic coordinate (gcc) index. These changes are then correlated with climate and hydrological changes to develop the base of an early warning system.

Networking

This collaborative approach is developed in three dimensions: One institutional, with the local drinking water and sewer company and the state environmental agency (CARDER), focused in natural resources conservation and risk management of the Otun River watershed. Another academic, with University of Caldas and National University of Amazonas, focused in research.. One last, with children of schools and Scout groups, focused in education.

Resultados

Base line

To date we have a hydro-climatic network that gather rainfall, temperature, humidity, radiation and flowrate data every 5 minutes. In addition, a set of water level meters monitor the hydro period within the wetlands.

Instrumentation			
Aquatic Macro-invertebrates			
Frogs			
Mammals			
Vegetation			

Project Activities

With respect to biodiversity, the study site allows the development of a rich community of aquatic macro invertebrates with high structural and functional diversity which is commonly found in Andean aquatic systems with low human intervention. The study of frogs has identified endangered and vulnerable species (*Hypodactylus latens, Centrolene savagei*). The mammals study shows the presence of top predators as ocelote (*Leopardus pardalis*) and puma (*Puma concolor*). Finally, the vegetation study shows an structural gradient in plant composition across the wetlands. With dominance of grasses in zones with previous higher human activity. It has been identified a total of 56 genres and 34 families with Asteraceae (8), Cyperaceae (6) and Poaceae (5) as the most representative.

Early Warning System
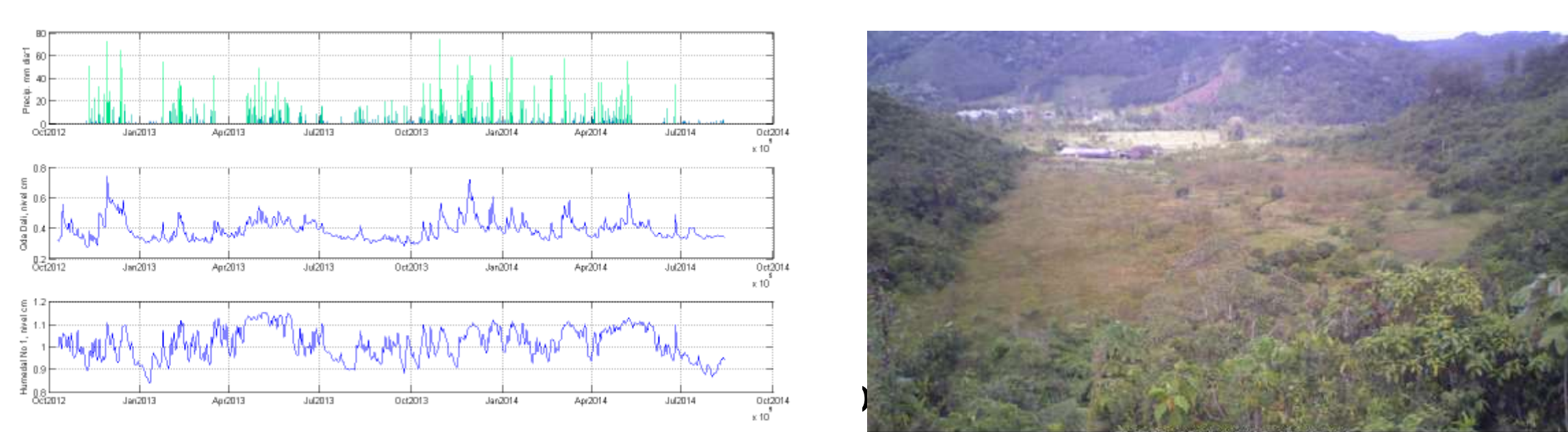
From January 2015, we began to gather simultaneously climatic and hydrological data (every 5 minutes) along with the phenology variation of wetland plants (hourly) with digital cameras. Given the amount of data that will be collected during this year, to date we are developing, coding with Matlab, an automatic interphase to conduct digital image analysis for phenology variation of the wetlands areas and its correlation with climatic data.

Networking

Joined with local institutions we have developed activities to enhance the study site as a place for conservation, research and education. With University of Caldas we have an agreement to study fauna (Frogs, Mammals). With Universidad Nacional with are working together in preparing a couple of grants to find supplemental funding sources. Since the beginning of the project the study site has been visited, for research and practices purposes, by six grad students (two PhD and four master), two young researchers and ten undergrads.

Workshops with Children

Finally, to date we have conducted five workshops with an attendance of more than 100 Children from schools and scout groups of the region. We have showed them, in a didactic way, the importance of conservation of our local natural resources within the watershed for our communities and future generations.

Conclusions

The knowledge of ecosystem structure, function and its relations is needed to make decisions that better prepare our communities to the effects of climate variability and change. This knowledge must be the result of an interdisciplinary approach that helps us to understand ecosystem changes and the variations in amounts and quality of the goods and services they provide to society. This understanding is our long term goal, and we walk through the right path to it with this project.

Besides this, we face the enterprise of improving the study site as a long term ecosystem research place. In order to achieve this goal we must to build and institutional network that goes beyond the results of this particular project. In this sense, the educational strategy with children has shown to institutions, such as the drinking water company of the city of Pereira that owns the study site, how relevant is to support over time the goal we are working for.

Additional Information

Juan Mauricio Castaño Rojas, PhD
E-mail: jmc@utp.edu.co
Tel: 57 (6) 3137246
Universidad Tecnológica de Pereira
Facultad de Ciencias Ambientales
Oficina 205

Referencias

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