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Socio-ecological Systems of the Orotoy River Basin

Bases to identify territorial management strategies

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TO PROPOSE INTEGRATED MANAGEMENT STRATEGIES, IT IS ESSENTIAL TO CONCEIVE THE TERRITORY AS A SPACE WHERE DIFFERENT SOCIAL AND ECOLOGICAL SYSTEMS CONVERGE.

Some initiatives of integrated management of biodiversity and ecosystem services in Colombia have been developed based on planning units of biophysical (p.e. basins) or political (p.e. municipalities) aspects, assuming that these are appropriate units for such purpose^{1,2}. On the contrary, these planning units have proven to be a limiting factor when describing territorial dynamics in a holistic sense.

The Humboldt Institute has been implementing a methodology of territorial management that is based on the integrated valuation of ecosystem services³. The methodology originates in the perception of the territory as a socio-ecological system in which the relationships and interdependence of ecosystems and human societies is identified⁴. Such socio-ecological focus is converted into a conceptual and methodological tool for analyzing interrelations of systems. Due to its versatility, it may be implemented in different areas and contexts. This is a key and necessary aspect for integrated territorial management and the prevention of environmental conflicts.

An example is the basin of the Orotoy River, which is located in the Orinoquía. In the basin three different socio-ecological systems exist: 1. A system in the higher

part, with high mountain ecological functions where the greatest amount of forests and areas of water provision are found. This part is inhabited by small landowners and peasants dedicated to small-scale cattle raising, fishing, and recreation and tourism in the river. 2. The system of the middle zone, where petroleum extraction and palm and cattle agricultural systems in the foothills are predominant. There are dynamics of urban and industrial expansion where communities resemble urban centers, and workers associated with the hydrocarbons sector have settled. 3. A system in the lower part of the basin where there is a landscape characteristic to the Llanos Orientales. It is dominated by the expansion of palm and cattle agricultural systems and contains a rural population dedicated to traditional activities of cattle raising and rice crops, even if there is a large and new floating population that arrives with surges in the palm oil industry.

It is evident that the characteristics of socio-ecological systems inside the basin are not homogeneous. Nevertheless, the ecological connection between the systems, and especially the links between ecosystem

services of water regulation or quality and the cultural similarities between the zones, must not be ignored. As a result of such connections, there currently is a growing demand for ecosystem services that has caused environmental conflicts between local and regional actors, chiefly those linked to productive activities and the use of water resources⁵. Conflicts may be addressed from a socio-ecological systems perspective to develop actions of conflict resolution, increase the adaptive capacity⁶ of each system, and reduce the risk of degradation or collapse of ecosystems and their associated services⁷.

Using such socio-ecological perspective may function as a response to address or prevent environmental conflicts because it considers a broad set of variables in planning that allow for greater detail of the territory.

High basin
High Mountain



Peasant farmers
Social



Fishing
Economic activities



Small-scale cattle raising
Economic activities

Middle basin
Urban foothills



Workers and wage-earners
Social



Industrial: hydrocarbons and mining
Economic activities

Lower basin
Plains



Regional peoples and new palmers
Social



Agroindustrial: Cattle raising, palms, and rice
Economic activities



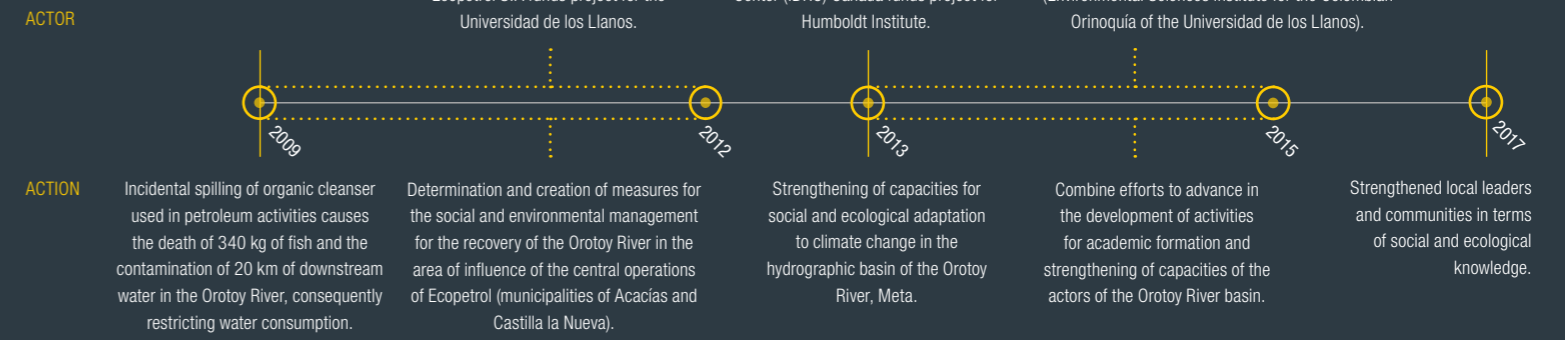
Potential areas for nature tourism

- Agricultural ecosystem of rice
- Basal flooded gallery forest
- Humid Sub-Andean forest
- Fragmented forest with secondary vegetation
- Agricultural ecosystem mosaic of crops and grasses
- Agricultural ecosystem mosaic of crops, grasses, and natural spaces
- Agricultural ecosystem mosaic of grasses and natural spaces
- Agricultural ecosystem of palm

- Agricultural ecosystem of cattle raising
- White water river
- Secondary vegetation

Timeline with beginning of conflict and responses

| In a specific year | Between many years



Ecopetrol S.A funds project for the Universidad de los Llanos.

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Incidental spilling of organic cleanser used in petroleum activities causes the death of 340 kg of fish and the contamination of 20 km of downstream water in the Orotoy River, consequently restricting water consumption.

Determination and creation of measures for the social and environmental management for the recovery of the Orotoy River in the area of influence of the central operations of Ecopetrol (municipalities of Acacias and Castilla la Nueva).

Strengthening of capacities for social and ecological adaptation to climate change in the hydrographic basin of the Orotoy River, Meta.

Combine efforts to advance in the development of activities for academic formation and strengthening of capacities of the actors of the Orotoy River basin.

Strengthened local leaders and communities in terms of social and ecological knowledge.



SOCIO-ECOLOGICAL SYSTEMS OF THE BASIN OF THE OROTOY RIVER.

The identified socio-ecological systems of the basin are divided in three zones: high, medium, and low. These zones are differentiated by ecological and social characteristics as well as economic activities. In the map the differences in land covers for each one may be visualized, making evident the decreasing presence of forests in all of the basin. Additionally, in terms of ecological aspects differences were identified for landscapes of high mountain, urban foothills, and the plains (high, medium, and low zones, respectively).

