

WATERSHED AS SCENARIO FOR ADAPTATION TO CLIMATIC CHANGE WITH SOCIAL RESPONSIBILITY: A PROPOSAL

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Summary

It is proposed that watershed areas, as planning units, are the adequate scenario to reduce the vulnerability of the territory against impacts such as global climate change and biodiversity loss.

The adaptive potential to climate change depends on factors such as the ecological integrity of watershed areas, the cultural adaptation of the communities and the management capacity of institutions. This generates a framework of responsibilities aimed to build a joint vision of land-region, to choose the best adaptation and education process, to sustainable use of resources, to food safety and to management biodiversity threats.

As a methodological framework for adaptation, we propose a joint strategy in the context of landscape modeling. Such strategy aimed to reduce ecosystems vulnerability, should promote not only the resilience of natural and transformed ecosystems, but also promote activities that involve a cultural change in the use and transformation of the territory. Such actions can be developed through a documented process and steps of social participation to stimulate the level of community social organization and generate discussions on watersheds adaptability to climatic change.

Keywords: Watersheds, Adaptability, Climate Change

1. Introduction

This paper discusses the application of the concepts of ecological integrity, ecosystem-based adaptation and cultural adaptation to spatial planning and in particular of a watershed, taking as reference the social responsibility for impacts such as global climate change and the biodiversity loss.

It starts from the idea that the provision of ecological services on which society depends for its well-being and self sustainability is supplied by natural ecosystems and the watershed as natural strategic ecosystem, provide ecological services of which depends highly viability social processes, as is the case for example of the river basin and Guatiquía Ocoa that provide water to the city of Villavicencio, Meta. The concept of ecological integrity of a river is a bit Masalla strategic ecosystem concept discussed by authors like Marquez and Acosta (1994) and Marquez (1996), as it implies that an adequate supply of ecosystem services depends on maintaining the structure and ecosystem functioning. In relation to climate change adaptation in the context of a watershed, this must not only maintain the supply of environmental goods and services to local human populations, but also to assimilate environmental changes and transitions in the structural and functional organization and diversity of associated natural systems and production activities within the tolerable variation ranges generated by climate change. In this respect the integrity of a watershed refers not only to the maintenance of functional ecosystem processes associated with it within a permissible range of variation, but also to improving the quality of life for residents of the basin. Only when these two elements are able to withstand and recover from natural and anthropogenic disturbances, we can say that a watershed is maintaining its ecological integrity.

We present the conceptual basis of this formulation, for use in the construction of a

study that aims to advance the Environmental Research Center José Antonio Candamo of the University Corporation of Meta. It is an ecological restoration plan and Cultural lower middle basin of the river Ocoa Articulated Planning and Management Plan POMCA the same river basin which is led by Cormacarena.

2. CONCEPTUAL

2.1. Regulatory aspects of watershed management

Decree 1729 of 2002 regulates the Management Plans and Watershed Management - POMCH / POMCAS, and determines that:

"The management of a watershed is primarily intended use planning and sustainable management of renewable natural resources, so as to get maintain or restore a proper balance between economic use of these resources and the conservation of the physical and biotic structure basin and particularly in water resources. "

"The management thus conceived is the framework for planning the sustainable use of the basin and the implementation of specific programs and projects designed to conserve, preserve, protect or prevent deterioration and / or restore the watershed."

"The watershed management will take into account, inter alia, the following principles and guidelines:

1. The special nature protection areas of moorland, subpáramos, births and water recharge areas, because they are considered areas of special ecological importance for the conservation, preservation and restoration of renewable natural resources.
2. The areas referred to the preceding paragraph, are of public and social interest and therefore should be subject to programs and projects of

conservation, preservation and / or restoration of the same.

3. In the use of water resources, human consumption has priority over any other use and should be considered in the management of the respective watershed.

4. Prevention and control of degradation of the basin, where there are physical or chemical imbalances and ecological environment that threatens the integrity of it or any of its resources, especially water.

5. Provide supply and current and future demand of renewable natural resources thereof, including actions for the conservation and recovery of the natural environment to ensure sustainable development.

6. Saving measures and promotes efficient water use.

7. Consider the condition of threat, vulnerability and environmental risks that may affect the management of the basin.

8. Hydro schemes in watershed management.

Management Plans and Watershed Management are strategic planning tools renewable resources which are articulated in the management plans of protected areas, the POT's Municipalities and other regulations associated with specific ecosystems such as wetlands, moors, forests as the representativeness of these and other protection, indigenous reserves, Afro-Colombian community councils and others.

2.2. Ecological integrity

The approach of ecological integrity and specifically related to adaptation to climate change in a watershed, refers not only to the maintenance of ecosystem functional processes within certain ranges of natural variability but also the maintenance of adequate levels of quality of life residents of the watershed.

The analysis and management of a river basin as a territory and within the context of adaptation to climate change is not only synonymous with conservation of their singularities only. The ultimate goal would be to generate management strategies that allow the coexistence, within the normal range of variation, from the exploitation of the benefits that provides the watershed and maintaining the physical, chemical and biological processes associated with maintaining quality of life. That is, the maintenance of ecological integrity.

In this context, not only the traditional scientific knowledge but also the perceptions of local residents of a watershed, are important for maintaining the ecological integrity of a river (natural ecosystems and water resources). Understanding the perceptions of local residents regarding a watershed ecosystem services are not only useful in the design of efficient mechanisms for environmental conservation, but also in generating support for these mechanisms for ensuring local people in some As the continuity and sustainability of the processes in time.

From the analysis of ecological integrity develops modeling territory called Ecosystem Based Adaptation which must operate from a landscape context and from the dynamics and processes of social, cultural, ecological, economic and institutional.

According to Parrish et al (2003), Ecological Integrity refers to the ability of an ecosystem to support and maintain a community of organisms whose species composition, diversity and functional organization comparable to natural habitats within a region particular.

Additionally, ecological integrity not only obeys composition patterns and functional relationships within and between complex systems, but its modeling for socio - economic, political and administrative, where man as an integral part of ecosystems alters and is altered as the rest of the

components, by changes in the natural dynamics of your environment (Parrish et al 2003).

The modeling of the territory from the ecological integrity of three main criteria, namely connectivity, functionality and representative ecosystems ecosystem both natural and anthropogenic those (Montenegro 2007).

2.2.1. Connectivity

Connectivity is a landscape-level attribute indicating how they respond ecological flows (eg migration, dispersal, prop gules or spores, pollination, and nutrient fluxes) at different scales of biological organization (ecosystems or landscapes, communities, species or populations. This concept integrates landscape level, the definitions of broker and barrier, and depends on the physical aspects of the landscape (ie wind, water currents) and its structure (number patches or fragments, patch size, matrix structure). In the case of species and populations considering its size, behavior and daily or seasonal movements, movements of juvenile dispersal, migration or movement to escape disturbance (Montenegro, 2007).

Connectivity is established from runners that correspond to any space, linear or not, which aims to maintain the continuity of the landscape and minimize or eliminate the negative effects of fragmentation product, for example. A key feature of ecological corridors is that the intensity of the flows of matter and energy is higher than in the rest of the territory.

2.2.2. Functionality

The functionality is related to the degree of heterogeneity of the landscape, which in turn is based on the state of conservation of the ecosystems and ecological processes that take place within it, and especially with the distribution of biodiversity. Equivalent to the wealth of land use and vegetation types that coexist in a landscape unit. In general, species diversity is greater in more heterogeneous

landscapes, because the coexistence of species in different compartments is a richer ecosystem and allows the coexistence of groups exploiting different niches and therefore greater overall diversity (Montenegro, 2007).

To understand the heterogeneity and dynamics of ecosystems must be recognized that these are open systems, and remain unstable communities are also dynamic, with continuous exchange of matter and energy and influenced by external changes affecting its structure and functioning. In fact, the peak of species diversity is achieved when an ecosystem está sometido natural disturbances moderately intense and frequent (Montenegro, 2007). Heterogeneity, visible in time and space, is expressed in a greater diversity of habitat types and environmental supply for wildlife.

This has to do with ecological processes (colonization and extinction rates) and intensity and persistence of the shocks affecting (Montenegro, 2007). But landscape heterogeneity is not immune to fragmentation, a very heterogeneous landscape and equitably distributed but highly fragmented necessarily diminished species richness. In this sense, ecological integrity in light of the heterogeneity and dynamics of a given ecosystem, maintain their characteristics are maintained as long as the following environmental credentials:

1. Resilience, or the capacity of the ecosystem to overcome changes in environmental conditions (Camargo, 2007).the system can regenerate itself to a state similar to the state or alternate predisturbio. In other words resilience equals the magnitude of disturbance that can be absorbed by a system before it changes state, recognizing the existence of multiple states in which equilibrium is reached (Andrade, 2007)

2. Provision of ecosystem services. "Assessment Millennium Ecosystem defines" ecosystem services "as those benefits people obtain from ecosystems. These benefits can be of two types: direct and indirect. Direct benefits are

considered production-water supplies and food (provisioning), or regulation of cycles as floods, soil degradation, desiccation and salinity, pests and diseases (regulatory services). Indirect benefits are related to the functioning of ecosystem processes that generates direct services (support services), as the process of photosynthesis and the formation and storage of organic matter, nutrient cycling, the creation and assimilation of soil and neutralization of toxic waste. Ecosystems also provide non-material benefits such as aesthetic and spiritual values and cultural and recreational opportunities (cultural services). There is, then, a wide range of ecosystem services, some of which benefit people directly and others indirectly.

2.2.3. Representativeness

Representativeness is one of the criteria for the selection of conservation areas and answer questions about the range or variation of ecosystems, biogeographic districts, landscapes or other ecological systems covered an area or territory (Montenegro, 2007).

The representation selects large sample areas of each ecosystem, avoiding repetition or absence of protected areas (Montenegro, 2007). The representative would be given by how much of that ecosystem is currently included in protected areas, so it is always in his assessment, is required to establish the comparative scale of reference (national, regional or local). (Adapted from Montenegro 2007).

2.3. Ecosystem-based Adaptation

Using the concept of Ecosystem-based Adaptation (IUCN, 2009), identifies and implements a range of strategies for the management, conservation and restoration of ecosystems to ensure that they continue to provide services that enable people to adapt to the impacts climate change. As a component of adaptation strategies and development,

ecosystem-based adaptation aims to increase the resilience and reduce the vulnerability of ecosystems and people to climate change. In this sense, ecosystem-based adaptation adaptation seeks territory which seeks to reduce vulnerabilities through an adaptive strategy line called Cultural Adaptation (Medina, 2010) (Medina, 2009).

2.3.1. Cultural Adaptation

Conceived as the most important adaptation strategy, this model seeks recognition from the territory by the communities and institutions achieve effective processes of appropriation of it.

An improvement in the knowledge and ownership of land is the basis for identifying the vulnerability of the same face of threats and climate change. This adaptation strategy is based on the principle of joint construction as the best option.

The development of cultural adaptation strategy responds to the scheme of Figure 1, in which through knowledge of the territory and its ownership by communities and institutions with competence, allow processes to achieve effective planning. Adaptive life plans are a documented process of organizational strengthening initiatives for the community to be reconciled among themselves and with their environment and are designed as a formal social body social and institutional participation in defining agreements on adaptation to climate change (Medina, 2008). Adaptive Life Plans - PVA, start from the planning, management and farm adaptations adding together the planning, management and adaptation of the villages that make up the territory (Municipality - Cuenca).



Figure 1. Flow diagram for the cultural adaptation strategy.

3. Methodological

The proposed methodology consists, essentially, to establish an adaptation strategy of the territory of a watershed to the impacts of climate change on the basis of valuation, with a sense of social responsibility, ecosystem integrity, achievement of ecosystem adaptation (read ecological recovery of the landscape) and cultural (read cultural changes in land use and transformation developed through adaptive life plans) and institutional readiness in terms of analysis and management of planning and management tools.

To include climate change impacts in the planning and management of a watershed is part of the territory and recognition of ecological restoration and cultural landscape. The process can be started from a preliminary diagnosis Participatory Ecological and Sociocultural Context Local Watershed. From this diagnosis together with a mapping of landscape units present, using GIS overlay maps, proposing an arrangement is feasible based on the following main uses of the land: Conservation, Sustainable Use, Rehabilitation and Recovery?

It is essential that adaptation from the ecosystem approach is built together with the social and institutional criteria of social responsibility and aimed at the recovery of the ecological integrity of the basin, which is evaluated by three structural criteria: ecological connectivity,

ecological representativeness of ecosystems and ecological functionality.

In this context, social responsibility implies reducing the vulnerability of human populations and associated increase resilience of ecosystems through rehabilitation processes and ecological recovery. This is possible through achieving the following strategic proposals: a. Cultural adaptation (long-term). b. Participatory Ecological Restoration locally (medium term). c. Joint planning instruments land use, such as Municipal Land Management Plans-POTs and management plans and watershed management-POMCAs (short-term).

3.1. Cultural Adaptation

This strategy is built along participatory processes where human populations in the basin are the agents of their own adaptation. It includes recognition of the territory and the natural and cultural values associated with the basin.

This process is feasible to implement it by building Adaptive Life Plans (Medina 2009), which constitute an instance of social participation around climate change adaptation. Such plans provide a forum for discussions on the development and adaptation of land management with communities and institutions that are conducive to the formalization of agreements framed on principles of social responsibility. It is proposed that this process initiated through conversations of self-reflection on the weaknesses and strengths of the community to achieve organizational processes. This is considered as a way to reduce vulnerability to climate change. Support is given for recognition of the natural and cultural values locally and seeks to strengthen organizational and management and adaptation planning.

3.2. Participatory Ecological Restoration locally.

The analysis of the ecological integrity of the watershed to determine the processes of restoration and adaptation of ecosystems, including agroecosystems and other production areas (Camargo, 2007). Depending on the results of ecological integrity, establishing conservation priorities - participatory ecological restoration locally. These priorities fit into the following categories of management and adaptation:

- Category of maintenance or preservation. It corresponds to the native vegetation areas that offer the potential for ecological connectivity and thus to the permanence of species of native wildlife within the watershed. This category may include rounds zones, wetlands and significant births for maintaining ecosystem connectivity.

- Category rehabilitation. Corresponds to processes that seek to restore the ecological faithfully pre ecosystem disturbance. Medina (2008) proposes a methodology called successional simulation, which is based on the characterization of the series of ecological succession (natural regeneration of ecosystems) depending on isoclines (variations of vegetation at altitude).

- Category of recovery. Corresponds to processes that seek harmony with conservation alternatives sustainable production processes. Productive lands are included with a POP processes, improvement and adaptation of production systems and associated production areas. Among these conservation opportunities - living fences stand production, agroforestry and silvopastoral arrangements among others.

4. FINAL

Social responsibility in the process of adaptation to climate change thus seeks to reduce the vulnerability of local communities within a watershed such as natural and productive systems, through cultural changes. Such changes would allow a better relationship of each person to their community and their environment. It is

considered feasible to achieve these cultural changes through effective processes of environmental education and awareness in areas where communities are reconciled with each other and with their environment.

The adaptation of the ecosystems of the ecological restoration of paisajefundamentada in increasing the resilience of ecosystems. This will search the maintenance and / or recovery of environmental services offered by the basin, which in turn have been characterized and evaluated from an analysis of ecological integrity of the watershed.

Decreasing the vulnerability of communities and their production systems, from identifying organizational strengths and weaknesses of the community, its territory and its productive activities.

The proposed methodology is based formulated then, in the following cases under principles of social responsibility:

- Find solutions cost - effective to meet the challenges of climate change and biodiversity loss.

- Reach local organizational processes and a greater recognition of the territory for greater ownership.

- Adaptation to climate change involves generating cultural changes in the knowledge, use and transformation of the area of a river.

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