Propuesta de estructura para la generación de un marco lógico para la gestión integral de cuencas

Proposed structure for the generation of a logical framework for the integrated management of watersheds

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Resumen

El devenir del manejo de cuencas ha tomado tres vertientes principales: la colecta rigurosa de datos ambientales para la modelación numérica; la administración de recursos, en particular el agua, para la distribución equitativa a los diferentes usuarios; y la gestión integral o integrada, donde se pone un fuerte énfasis en la participación de entidades sociales que se encuentran en desventaja frente a usuarios como la industria o la energía. Estos tres escenarios, que se supone trabajan para un solo concepto –el manejo integral de cuencas- se encuentran desvinculados, lo que ha provocado que se perciban como conceptos antagónicos.

Aunado a este problema, tenemos que conceptos tales como sustentabilidad, desarrollo sustentable, o desarrollo integral han aportado al debate más elementos de distanciamiento, que de convergencia. Así, tenemos que en la actualidad estos temas se abordan desde la economía, la administración, la sociología y antropología en el marco de las ciencias sociales; en cuanto a las ciencias agronómicas, están la edafología y las ciencias forestales, mientras que en el marco de las ciencias duras están la metrología, la hidrología y las matemáticas desde la modelación numérica. Esta diversidad de saberes se antoja suficiente y robusta como para generar un sistema eficiente de gestión integral de cuencas, sin embargo, no es así.

El objetivo de este documento es revisar los tres diferentes marcos conceptuales –monitoreo, administración y gestión- en los que se desarrolla actualmente el manejo de cuencas, y a partir de los elementos de cada uno, establecer un marco lógico innovador que permita transitar desde la base de la medición, hasta la gestión, como un solo sistema de análisis complejo, que derive en una hoja de ruta para la gestión eficiente de los recursos naturales.

Palabras clave: manejo de cuencas, gestión de cuencas, sistemas complejos, sustentabilidad, administración de cuencas.

Abstract

The evolution of watershed management has taken three main aspects: the rigorous collection of environmental data for the numerical modeling; the management of resources, in particular water, for equitable distribution to different users; and management comprehensive or integrated, where there is a strong emphasis on the participation of social entities found as a disadvantage against users such as industry or energy. These three scenarios, which are supposed to work to a single concept - the integrated management of river basins- they are unrelated, which resulted that they perceive as antagonistic concepts.

In addition to this problem, we have to concepts such as sustainability, sustainable development, or integral development they have contributed to the debate more elements of alienation, that convergence. Thus, we have that at present these themes are addressed from economics, management, sociology and anthropology within the framework of the social sciences; with regard to the agricultural sciences, are the soil

science and forestry Sciences, whereas in the framework of the hard sciences are metrology, hydrology, and mathematics from numerical modeling. This diversity of knowledge seems sufficient and robust to generate an efficient system of integrated management of river basins, however, it is not so.

The purpose of this document is to review three different conceptual frameworks monitoring, administration and management- where is currently developing watershed management, and based on the elements of each, establishing an innovative logical framework to allow transit from the base of the measuring, up to management as a system of complex analysis, that it will lead to a roadmap for efficient management of natural resources.

Key Words: watershed management, watershed management, complex systems, sustainability, watershed administration.

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Introduction

Persistent poverty and inequality is a result of the disparity of development in regions traditionally marginalized from the planet, where have we tested many of the regional development strategies, sustainable development, integrated management, inclusive management, management of resources and watersheds, resources and watershed management, and despite various experiments, the evolution of these concepts has not generated the necessary knowledge base to establish minimum strategies that help the design, implementation and achievement of objectives of integral development.

More than ten years of the establishment of United Nations Millennium Development Goals, where there are goals to combat environmental problems and lag in the equitable development of countries, the first results are hardly glimpsed. The United Nations Millennium Development Goals (ONU, 2010) they have a level of acceptable compliance. In each of the eight sections, raised goals have some degree of execution. It is to be noted that aspects of education, fighting poverty, health and access to safe drinking water they are presenting the greatest degree of progress, above all in the

poorest countries and in developing; however, this progress is not homogeneous, and even presents disparities within the same country and region.

On the other hand, climate change is a problem that attacks all of the planet; it modified hydrological patterns, agricultural processes with the intensification of droughts and intensifying natural disasters In 2009, the Land Uses Change and Forestry (LULUCF), defined climate change as a complex phenomenon, which highlights the change in the hydrological patterns. The change in the hydrological patterns is the broader causes effects, generating increases in runoff (flood), droughts, landslides, loss of agricultural production, loss of species and ecological systems, contamination of water supply systems drinking, silting of drainage and sewer systems, issues that show the relationship between hydrologic pattern and environmental degradation; these phenomena depend on the change and intensification of land use for the growth of cities, agricultural and industrial production and so on. This means that changing the response of physicists rain events systems affects all aspects of human development: drinking water, agricultural production, public health, among other events that are supposed nature, they are based on the impoverishment of populations, which in turn leads to the migration of communities for the loss of environmental capital (Sen A. J .; Stiglitz 2008).

This process of exploitation of environmental resources-loss-impoverishment of communities-migration capital generates a cycle in two ways decapitalizes communities, first in the field of basic resources (raw materials), and second in human capital, as labor that he emigrates. According to the concept of sustainability, which includes a social base, economic base and environmental basis, poverty in two of them just makes untenable system.

The way this process has faced is with interventions from the government sector, aimed at mitigating the effects in any of the three areas, however, relations that tie in with the other two subsystems are established; moreover, all the interventions are targeted to reduce the backlog and poverty in any of the three axes, and not to: a) identify the problem, b) establish strategies for solving the problem, and c) improve capital.

The main objective of this document is to establish a conceptual framework, a basis for a marcológico, allowing evaluation design strategies, planning and management of watersheds, in a structured way, identifying the conceptual and methodological aspects of each step and items the concatenated (analysis of complex systems). To achieve this objective and performance review of these concepts is made, in order to establish a logical framework to place them within a system of concepts-values, where social, economic and environmental aspects are interrelated in a complex system interactions.

COUNT HISTORICAL CONCEPTUAL WATERSHED MANAGEMENT

WATERSHED MANAGEMENT

The term watershed management begins to be applied in relatively extended shape in Latin America and the Caribbean in the late sixties. Free and comes from a literal translation of the term coined in the United States of Watershed Management, according to the literature, begins in the year 1930. The initial goal was to control the discharge of the water collected by the basins in quantity, quality and time occurrence. In the US, watershed management techniques were applied mostly in mountain watersheds, areas devoted to forests and pastures and sparsely populated and rainfall. With this paradigm to maintain a healthy basin must consider the conservation and sustainable use of forests and biodiversity, soils keep living through terracing and use of organic matter. Consideration should also keep the water as high as possible in the basin, such that water is slowly seeping into the underground phase. That is, the objective of water management and basin is to prevent soil erosion, the original vegetation is quickly lost and empty.

This discipline born from the mechanization of farming systems, understanding that a discipline is defined as the set of concepts, techniques and technologies that allows the handling of factors that make up a phenomenon, while a science encompasses knowledge and disciplines allow the understanding of a field of nature. In the late nineteenth century the first collections of data related to the subject were made; these were directed mainly to develop plans for river management, since at that time the bulk transport of raw materials and products was done by river.

After the First World War, demands for commodities-food, wood and steel and energy were seen as an element of growing interest, coupled with the urge to produce more and more, faster and better. From this paradigm large tracts of open land to implement agricultural systems, in addition to that hydrological flooding events impacting the agricultural districts, with the consequent loss of crops. Confronting the management of large areas with limited manpower, forced to resort to intense mechanization and newly acquired on chemical research in two areas: pest control and increased productivity.

The world food production increases from two to five times compared to traditional systems, through improved use of grains, cultivating one species throughout the year (monoculture) varieties, and with the help of the application of large amounts of water, fertilizers and pesticides. The main motivation was to eradicate hunger and malnutrition in developing countries (Hazell, 1985).

The history of watershed management in Mexico is considered begins with the intervention of Borlaug (Borlaug, 1949; Borlaug, 1950) in Sonora, and has focused on three specific approaches: the production of water for human use, agricultural production, and very recently, water management (Lira et al., 2012). The first phase of development in Mexico began in the post revolutionary era, which aimed to generate the necessary economic development of the country, where stands the construction of roads, railways, aqueducts and dams infrastructure. In 1942 the Soil Conservation Department of the National Irrigation Commission with emphasis on agricultural production is based.

In this context, 1950 has been created 7 Great Commissions of Cuenca: Cuenca del Río Lerma, Balsas River Basin, Basin Lake Chapala Basin Papaloapan, Rio Grande Basin, basin of the Usumacinta River and Valley Basin Mexico, these systems were aimed at building dams which together totaled 150 km3 of storage overall, and 6.3 million hectares of irrigation, drinking water supply and power generation. However, the problems of siltation in dams, compacting and soil salinization, and overall soil loss in the irrigation districts was such that the concept of watershed management is reoriented, from agricultural production to research in soil loss and runoff assessment with a view to the rehabilitation of water systems, which include the experiences of Lake Texcoco

Project and Rescue Area Xochimilco-Tláhuac. Passing an applied research approach, government entities Watershed Management delegated to the educational institutions (SAGARPA, 2005; Dourojeanni, 2005).

This scenario changed when opened for civilian research, military and space technology, through the application of Geographic Information Systems (GIS) and advanced computing. From the eighties with hydrometric models, rain and soil drag validated with observational data, the work of remote sensing and geographic information management begin.

Globally, in the second half of the nineties, technological advancement in computer systems enables the advancement of knowledge in Europe soil evaluation criteria coupled systems hydrometric evaluation under the figure of the numerical models are established ; initially they are conceptual order, because the numerical evaluations require a volume of data that researchers themselves can not collect, in addition to that, there are technologies very difficult equipment to implement for the collection of such data in the field, especially for hydrological factor. The first attempt to rigorous phenomenon on impact factors and measurement methodology coupled analysis is the Universal Soil Loss Equation (USLE) (Wischmeier et al., 1978).

In this decade, the French school integrates the time factor USLE through runoff variables (RUSLE), directing the gaze of a last element analysis not yet considered: the time; with such inclusion, information needs to intensify the proposed models in quality and quantity (Williams, 1990 EPIC; Eswaran et al., 2000).

WATERSHED MANAGEMENT

In parallel to the development of the concept of Watershed Management, at the global level, so the economic-expansionist tendencies are pushing the accelerated production of goods and food, due to rapid population growth in the postwar period, entering a race against of the nature. Overall, between the years 1940-1984 world grain production increased by 250%. With irrigation districts in monoculture appear concepts market saturation, falling prices, threshold price, price supports, in this scenario, small farmers became representatives of technological inefficiency, and condemned to disappear

(Pérez Haro, 2013). At this stage, management science and the economy generating tools such as planning and the cost-benefit balance, until now applied in natural resource management: optimizing yields, crop optimization systems, commercial monocultures above diversified subsistence crops.

For the decade of the seventies, although the results of the Green Revolution, in terms of productivity growth were spectacular, the negatives were evident: problems for storage of products and surpluses, excessive cost of seeds and complementary technology, technological dependence, removed traditional cultures and the appearance of new pests. For all this, the Green Revolution was criticized from an ecological point of view, to the economic, through the cultural and even nutrition. Added to this, a rigged the rise of the free market, which goes to the North American Free Trade Agreement (NAFTA), the new geopolitical boundaries impose new trade rules that call for a new order in terms of process, products to promote and how to operate the irrigation districts.

Trade imbalances that had naturally, by the loss of crops in floods and droughts, and crop diversification and small owners, together with the commercial constraints of each country, will lose to the large irrigation districts and new agricultural techniques of mass production. This causes the lost non-economic factors that had kept the market in balance, you must re-analyze the cause-effect relationship between the productive and economic processes, to establish new production strategies-commerce global.

Modern management is a discipline that began with classical economists such as Adam Smith and John Stuart Mill, who provided a theoretical basis for the concepts of resource allocation, production and pricing. At the same time, innovators like Eli Whitney, James Watt and Matthew Boulton developed technical tools of production, such as standardization, quality control procedures, accounting and strategic planning. Clearly, in the field of natural resources, these concepts are hardly applicable, given the high variability of environmental responses. However, they were assimilated by the call School of Management Systemic represented by Norbert Wiener, John von Neumann, Ludwig von Bertalanffy, Daniel Katz and Robert L. Kahn Stanford L. Optner.

The systematic school proposes a new way to analyze production systems, giving more importance to relations between the system components that would achieve the objective. This aspect of the administration sees for the first time, the need to integrate the social aspects of the exploitation of natural resources. In particular, strategic planning became the tool that allowed addressing the management of natural resources, defined as:

> "the determination of the basic objectives (of exploitation of a resource) in the long term an organization (community, or government entity), in order to identify courses of action and allocate resources (financial, structural and human) necessary for their concretion" (Solís, 1976).

From this concept to build a management system, consisting of a) fulfills the definition of objectives, b) management goals, c) the routes or activities associated with each strategic objective established d) definition of the areas of action. This method of analysis of production systems highlights a fundamental aspect of current watershed management, which is the evaluation of the performance of administrative management (Latin American and Caribbean Institute for Economic and Social Planning Limited, 2003). This aspect is the concern of decision makers in both the private sector and government and all levels of management as it enables the monitoring and improvement of management, it is essential to have reliable information.

The performance evaluation is part of the planning process and includes the control, which requires a necessary activity assessment indicators. This involves measuring, evaluation and if necessary, correction of shares through forward variables (direct measurement) or indicators (indirect measurement). The process is to establish comparison parameters, measuring results, compare the results obtained with the defined parameters to identify the degree of deviation of the activity with respect to planning and defining the level of correction required, or where applicable, the reformulation of objectives. Since it is impossible to measure all aspects (variables) of a production system, you must define critical functions and identify strategic checkpoints, to decide how and what information to collect. This entire measurement process is defined as the construction of indicators of efficiency. (Wilson, 1974).

With these concepts, the administration contributes to watershed management principles, techniques and practices, whose application to the production of goods arising from the management of natural resources, particularly water and soil, possible to establish rational systems of cooperative effort, to achieve the exploitation economically rational for those resources that individually would not be practicable. Note that at this point the index and indicator concepts are used equivalently, because the discipline is in development, however, they are not.

Finally, over the past decade, most countries whose agriculture is based on the mechanization of agriculture, are facing a reality that during gestation was glimpsed but was considered unattainable, at least for that generation, industrial agriculture relies four pillars, agricultural machinery, transport food, agrochemicals, and biotechnology and irrigation systems; the first two are directly related to oil production, so the exhaustion is a global food crisis. This condition of energy availability and the depletion of natural resources overexploitation is a concern of all governments globally, since it is a source of conflict and displacement of people.

SUSTAINABILITY

Current social and environmental policies were never designed to address in an integrated manner poverty and ecological deterioration, much less to promote economic development and conservation of natural resources. However, since he began to formally implement programs for the poorest regions, the need to maintain and improve the resources soil, water and vegetation as a requirement to sustain production increases long term was assumed, as it has been to the conclusion that there can be no economic growth without social and environmental well-being. Environmental policy, was later in the recognition that the conservation of natural resources is the basis for long-term development, defined as sustainability. According to the UN Sustainable Development it is:

> "….that meets the needs of today's populations without jeopardizing the survival ability of future generations to meet their own needs, preserving its heritage over time "(UN 2003 Millennium documents).

However, the need to provide food, housing and other satisfactions to the growing world population, has been making intensive use of arable land, displacement and

disappearance of native vegetation and replacement with entirely man-made spaces. The most obvious changes in land use effect, by the human being is the "climate change"; according to Land Uses Change and Forestry (LUCF) under the UN (Pieri et al, 1997).

> …" climate change is a function where the most immediate answer is on hydrological patterns, which in turn impacts on agricultural processes and intensifies natural disasters."

The change in the hydrological patterns is the effect more easily perceived by the human being, such as floods, droughts, landslides, water pollution, silting of drainage systems and drainage. That is, the modification of the response of physical systems, the rainfall events, affects all aspects of human development: drinking water, agricultural production, public health, human settlements, among others.

The worldwide population growth soared from the seventies; This increase has forced people and governments to seek development alternatives for new settlements. The pressure on land for human uses require the opening of land which usually contain biotic systems as undisturbed forests, jungles and mangroves, which keep the same balance and own internal health (Odum, 1998). These systems are characterized by exchanges of mass and energy always positive, ie, provide the environment of the mass-energy needed for sustenance, while offering environmental services such as the conversion of pollutants.

As a natural evolution of open land to human exploitation, they are required to provide infrastructure such as roads, population centers and collection-distribution centers, increasing encroachment on the area and its fragmentation. Clearly, the environmental services originally offered by the system are reduced or disappear and in some cases reversed, becoming an element of global pollution.

Watersheds are closed to the mass flow in terms of water, soil and vegetation systems, however, they maintain its influence outside environment through wildlife, oxygen production and carbon sequestration. Usually, it has been thought of them as conservative systems, whose domestic production of mass and energy is continuous and inexhaustible. However, experience tells us that it is not; throughout the country they have made normal predation landscapes from areas with small agricultural plots to large

semi desertified areas; Another constant is its presence in almost all kinds of earrings, from the flat areas, even the mountains folded and particularly on areas with significant presence of rain.

The weather, plants and soil within a watershed are linked together so that are unique combinations of physical and biological characteristics that result in the environment; Also, each combination is able to assimilate and transfer matter and energy in specific rates and therefore each combination represents a specific potential productivity (Oswald, Galvan, 2011).

In 2010, the (LUCF), determined that climate change is a complex phenomenon, which brings different problems: increased solar activity, greenhouse gas emissions, the thinning of the ozone layer and, above all, changing hydrological patterns; the latter depending on the change and intensification of land use for growing urban settlements, agricultural and industrial production, communications and transport (Pieri et al., 1997). These events represent natural, are based on the impoverishment of the people, by the loss of environmental capital, as well as loss of productive infrastructure investments, given the high possibility of not achieving its economic recovery if natural systems They were able to maintain their production levels for long periods of time.

Added to this, to certain social groups integrated into the productive dimensions for successful environmental objectives own actions were required. Back in the eighties was fully recognized the need for such integration, although there were no programs that explicitly and formally they tried (Dourojeanni, 2005). Since then, and to sustainable development as guidance, it has been assuming that overcoming poverty and environmental protection are compatible aims, but with few concrete attempts to apply simultaneous policies to both objectives (Provencio, 2003). The political basis of climate change is linked to regional development models; equitable development policies intended to avoid confrontation by the exploitation of natural resources, and take gas emissions as an index of technical and technological management of the countries. China denies accession to the Kyoto Protocol to consider limit their economic development.

Finally, the internationalization of sustainable development and environmental issues, driven by the FAO, the territory of a watershed is defined as the appropriate basis to build capacity for governance and management of natural spaces. Which until 10 years ago was territory for water management becomes a territory on integrated environmental management by incorporating the social and economic dimensions of sustainable development.

INTEGRATED WATERSHED

Watershed management is an issue that was initially associated with controlling the water catchment basin, as areas of major investment in water projects aimed at increasing the supply of water, energy and navigability, then the protection and conservation of resources and, finally, improving the quality of life of its inhabitants (SAGARPA, 2005), which is the basis of the Integrated Management of Water Resources. At this point, the concept of integration or integrity is derived from the combination of techniques for obtaining different targets simultaneously.

Among the goals of the Millennium Development Goals it is to address the problems related to the development of nations, understanding by development the positive growth in the trade balance as well as the production of goods and services that people need. The population growth that is fired from the seventies, forced the opening of land for human settlements and food production, but being an unplanned growth, these settlements were located in ecosystems such as forests and jungles, changing its structure , health and ability to generate intrinsic mass and energy, breaking their natural balance.

Currently we are facing a fundamental contradiction, because we want to preserve at thirty million species with whom we share the planet, but also our culture and its model of production and consumption insist that the world is made for the exclusive service human interests. In this context, the threat of international terrorism and the prospects of war are not the only element of uncertainty for man, so are the economic upheaval, environmental degradation and scarcity of natural resources (Haro Perez, 2010). Confrontations between communities, regions and countries stewardship and

exploitation of resources that are the basis of economic development is the aspect that this global policy seeks to avoid.

In this scenario, the management concept is the latest contribution of the social sciences to Watershed Management. The sociological focus on equity, inclusion, environmental protection and human development, to outline the current concept of Sustainability, faithfully represented by the Millennium Development Goals in its review 2010 (UN, 2010). Lagestión the environment comprises a series of actions and measures necessary to maintain the environmental capital sufficient to raise as much as possible the natural heritage and quality of life of people, all within the complex system of economic and social relations that determine the target (Ortega et al., 1994). However, environmental policies Integrated Watershed Management are still evolving in the world, especially the lack of global consensus on concepts and how to use them.

At this point Watershed Management acquires conceptual and current methodological: the basin is the unit space-time where factors physiography, vegetation and climate create unique combinations of mass transfer and energy, which are modified by human needs economic output to sustain it is the administration phase, giving rise to the integration of social relations between regions to move to integrated watershed (Cotler, 2008; SAGARPA, 2005) management.

VS GOVERNANCE GOVERNANCE

The term governance is used to describe the efficiency, quality and good orientation of state intervention, which gives this much of his legitimacy when it is defined as a "new form of government" in the globalization of the world. Especially, it is used in economic, but also social and institutional performance, essentially to describe the interaction between different levels, especially when large jurisdictional transfers up and down the social or organizational structure occur. Also it used the term to designate the form of interaction between the public administration with private organizations and civil society, who do not obey a hierarchical structure but a network integration (Stiglitz and Sen EEC).

The Commission on Global Governance, governance is "the sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuous process through which various interests can be accommodated, even in situations of conflict, to reach the creation of a strategic plan. It includes formal structures (government institutions) and regimes empowered to enforce obedience (civil society) as well as informal arrangements that people and institutions agreed (Pahl, 2008).

In the last two decades it has increased the perception that relations between the institutions and civil society have been changed from possession and use of energy, water and natural resources in general. This change was invariably directed towards areas of conflict and confrontation, so there is a tendency in favor of granting a greater opportunity to participatory instruments of civil society; thinking towards greater inclusivity is gaining ground, with citizen participation one of the cornerstones of the new style of governance. However, the implementation of tools and participatory processes have not yet been fully generated.

Contrary face, governance refers to two main meanings: the first reports emerged from World Bank (1993), which defines it as a style of government characterized by a greater degree of cooperation and interaction between state and non-actors state, within social networks that allow the taking of public and private joint decisions. And the second is defined as a set of procedures for coordination of individual actions, understood as primary sources of construction of the social order; by extension, governance is defined as any form of social coordination (Pahl, 2008).

Governance from a simplistic perspective, is a series of procedures such as legislative support to the executive or the absence of systematic obstacles that spoil the effectiveness of public policies aimed at providing basic services (drinking water), education and security to the population . That is why international organizations interested in governance, as it has concrete implications for how governments achieve the objectives of environmental protection.

Therefore, governance is the result of cause-effect relationships between society, the state and economic forces, so that governance is related to the exercise of government

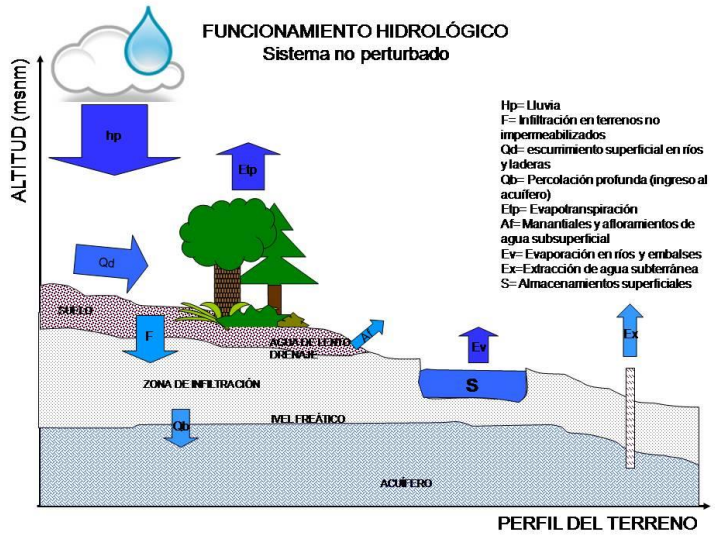
and all those structural and social institutions necessary for the government You can work efficiently and legitimacy in its leading role. It can be expressed as a set of solidly structured government institutions, which results in the free exercise of the will of the Executive Branch, through civic obedience and tacit agreement did all his actions by the people.

By foregoing the need for further efforts aimed at reducing the aforementioned problems follows. Therefore this paper is based on combating this problem through a comprehensive development proposal, where the social, economic and environmental aspects are associated with each other so it does not fall in attempts excessively specialized in one aspect, and which exclude the dynamics of systems in which it interacts.

BUILDING THE LOGICAL FRAMEWORK

WATERSHED MANAGEMENT: THE PHASE DEMONITOREO

Watershed management is a system of subsets entire contents each other, but above all, states that watershed management in its traditional approach, observing only three resources: water, soil and vegetation (Figure 1).



Tomado de: Arquitectura solar. Lacomba, Galván 2012.

Figura 1. Monitoreo de cuenca.

> "The basin isa territorial unit defined by a hydrological criterion: the water drainage where water trickles down one point and flows into the sea or inland water body; its vertical dimension, extending from the atmosphere to underground structures

> geohydrological and inside humans interact with each other and biotic factors of their territory (Vich, 2010)".

This approach suggests that resource management is one of these three, one contained in the other, to reach a comprehensive management assume the integrity of the ecological environment, not human, to bring the system: where other and where not to grow (Dourojeanni, 2005) .This concept is represented by the general mass balance equation (Chow, 1964):

$$\frac{\Delta S}{\Delta t} = \frac{I - O}{\Delta t}$$

Where:

- ΔS= Change in storage
- I= Mass entry
- O= Mass departure
- Δt= Time interval

The basin is a complex system which tends to inner balance, so that in a watershed basin could exist leave either water, soil or vegetation, while in another watershed exists simultaneously shortage of some resources, but if you join two subsystems, the sumase expressed:

$$\frac{\Delta S}{\Delta t} = \frac{I - O}{\Delta t} \left| \begin{array}{l} < 0 \text{ déficit} \\ = 0 \text{ equilibrio} \\ > 0 \text{ superávit o excedencia} \end{array} \right.$$

That is, the production of water, soils or biomass of a watershed can be positive, negative or be in balance. But the assessment by the watershed management of these resources is not sufficient for the administration, since it only takes into account the overall balance, and not internal remnants of each subsystem. In other words, this concept does not take into account domestic availability and production rates in time, which are the basis for the management of any resource (Lacomba Galvan, 2012).

Availability is the amount of a resource existing within a geographical area, depending on the scale and timing that produces a basin; the production process in the natural system has a strong random component, which depends on meteorological variables such as rain, wind, pressure, among others; in varying land we altitude, geography,

topography, soil type, while vegetation variables are vegetation type, density, health, such that:

$$Disponibilidad = f(condiciones\ meteorologicas, condiciones\ fisiográficas, cobertura\ vegetal)$$

At this point, a space availability is variable, which can match the mass balance; a second constraint is that this is always greater than zero, ie, it is required of "something" to manage, then:

$$Disponibilidad = f(meteorología, fisiografía, cobertura\ vegetal) > 0$$

The last element of the construction of the concept is that this first definition of availability refers to spatial aspect. The equation of balance sheet of dough is resumed, it is seen as dependent on the time, this means there is a period of time to leave, and during extra time, there is a shortage, achieving over a cycle balance, so the availability in a more complete form is:

$$Disponibilidad = \boldsymbol{f}[f(meteorología, fisiografía, cobertura\ vegetal)]\ dt > 0$$

Therefore, the availability, within the current concept of sustainability is:

$$Disponibilidad = \iint_{dx,dy}^{dt} f(meteorología, fisiografía, cobertura\ vegetal) dx\ dy\ dt > 0$$

Finally, the combination of both conditions -space-time- generates a fragmented system where there will be time and space, or temporary shortage or space. This means that the availability is defined as the amount of resource use feasible in a given for a given time interval territory.

This construction of the concept of availability, argues that the appeal should be in an eternal state of evaluation in space and time. This approach simplifies the model of the environment assessment of natural resources, and justifies the existence and operability of watershed management in its current phase, but does not consider the interference of man, especially with the cultural, economic and political aspects , ie, the social dimension in the phases of practical-theoretical productive cognitive, or knowledge is not considered. This conceptual model would represent by Figure 2:

Modificado de Dourejeanni, 2005.

Figure 2. Conceptual Model.

Then, to manage any resource one evaluative basis determined by the amount of resource to exploit susceptible required, and is an activity outside the scope of watershed management.

Natural Resource Management

Administer is to govern, direct, order, arrange and organize. Is required to manage a reliable and organized data set that constitutes the framework of a specific phenomenon, that would prevent and / or solve problems and make decisions. The information gives meaning and sense of things as through the dataset so thought patterns that can project the future, resolve in time and accompany processes for the realization of objectives.

Administration refers to the planning, organization, direction and control of resources (human, financial, material, technological, knowledge, etc.) resources of an organization in order to obtain the maximum benefit; This benefit may be economic or social. Whereas the definition and applying it to natural resources:

Planning: The process that begins with the vision we have of a specific event, such as the acquisition or distribution of water; This vision is set, since they are (agricultural, industrial, urban) communities that benefit or are responsible for the activity. In the case of natural resources, social, political, climatic, economic, technological, factors generate a turbulent environment where planning is difficult and time limits thereof are

shortened, and require organizations to review and refine their plans systematically and permanently.

Organize: design involves, first, the road map where all actions and possible contingencies surrounding each activity, defining responsibilities and obligations are translated; in a second step how to perform the tasks set and in what time sequence, identifying the elements capable of conditioning the achievement of objectives (critical path)

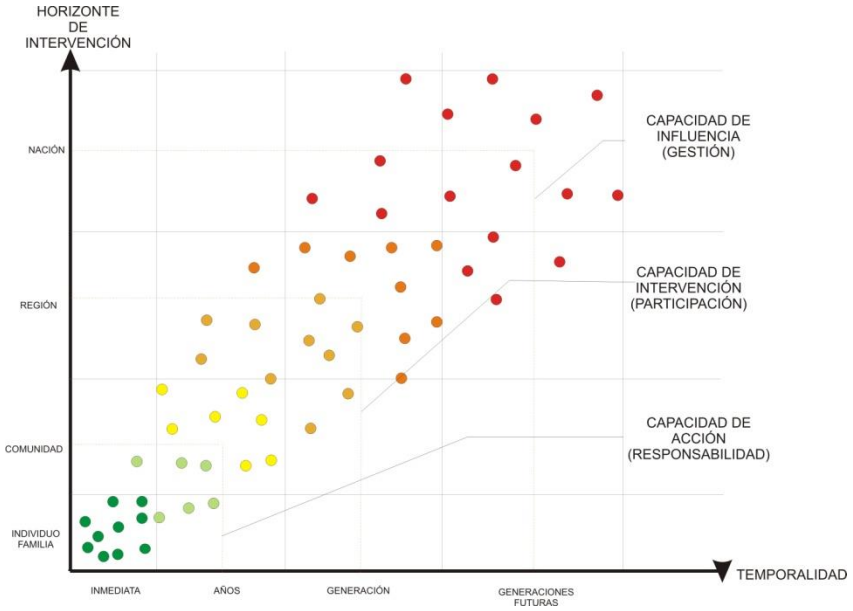
Direct: The influence or powers of persuasion exerted through leadership on individuals to achieve the objectives set; in the case of the administration of natural resources, this point is absent. Since the beneficiaries are many, and economic impacts, this process is exchanged for social intervention where the actors agree mutually beneficial actions. One way to ensure the success of this step is to make the decision based on agreed decisions using logic models.

Control: The performance measurement of the run, against the objectives and targets; deviations are detected and the necessary measures are taken to correct them. Control is at the strategic, tactical level and operational level; the entire organization is evaluated by a management control system.

In the case of natural resources we have, that from providing the framework for planning, organization and direction is set, leaving the control phase truncated because natural processes have a random component. In hypercomplex and dynamic systems such as the environment, change is a constant and requires constant review and measurement for improvement and / or adaptation of the administration, leading to an emphasis on control and monitoring phase.

That is, in the management of natural resources, the control phase is replaced by monitoring changes in availability; on the other hand, human intervention expressed as the exploitation of a resource provides the superior element hypercomplex element, derived from the strong disparity between levels of intervention-capacities of actors, so that the horizons of influence are very different from they. So, to achieve some degree of monitoring of the binomial regeneration-operation is necessary to identify on a map

of influence-ability, the horizons of responsibility of each actor, so that the activities planned in the planning phase are executed in time, the right actor (Figure 3).



Modificado de: Bossel, 1999.

Figure 3. Map of influence in the performance of activities.

The map in Figure 3, shows that immediate actions are of the single-family, so the ability to intervene is final, and must implement actions to decide and execute, so it is a responsibility. In the case of the community, the individual only participates in the governing bodies sporadically, and in the case of rural communities in any decision-making through the participation of community assembly, but has no control over these processes. In this case it may decide in some cases, but the execution falls on a government structure designed expressly for its implementation: drinking water, reforestation, agricultural production. In a third level are the large groups, as nations or continents; in this case individual does not have any impact on decision making or execution: it is restricted to management. The individual is to express their views on environmental issues whether or not their geographical area, for example, climate change, and the decision-making move to technical bodies and technologically "trained" to solve this problem in particular. In this case, the individual does not have responsibility for the implementation of the strategies adopted. There is an intermediate element between the size of the community and the nation, which is the region in which there is now a void to determine actions and responsible for such actions.

An important element of this construction is time: it is a measurable and determinant of the performance of any action variable. When a phenomenon apart from being complex, integrated variable time, it is a stochastic process. That is, a bounded relationship between known variables, whose succession and answer depends among other variables, primarily set time.

Taking this influence map in the performance of activities, a system of evolution between the monitoring phase (watershed management), exploitation of resources (administration), and cooperation between the large regions (management) arises. This scheme is presented in Figure 4.

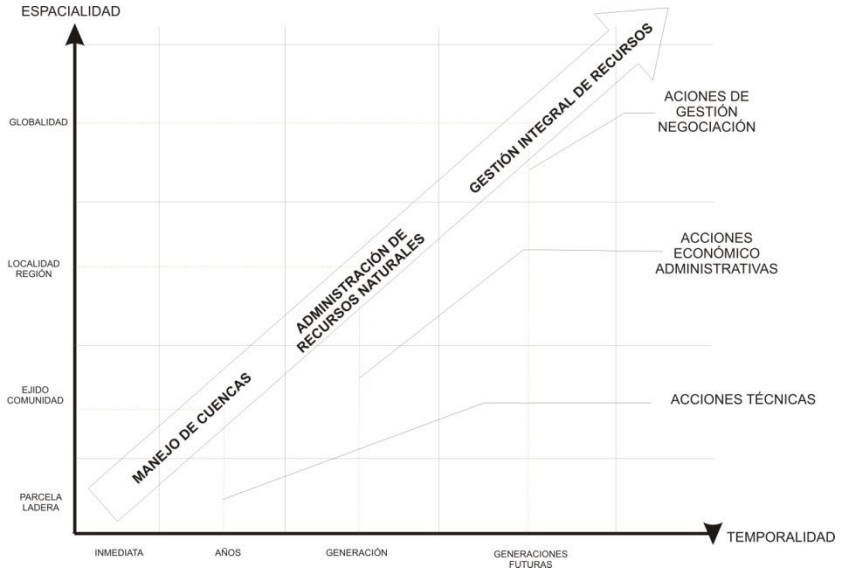


Figure 4. Map of capacity-intervention in the performance of activities.

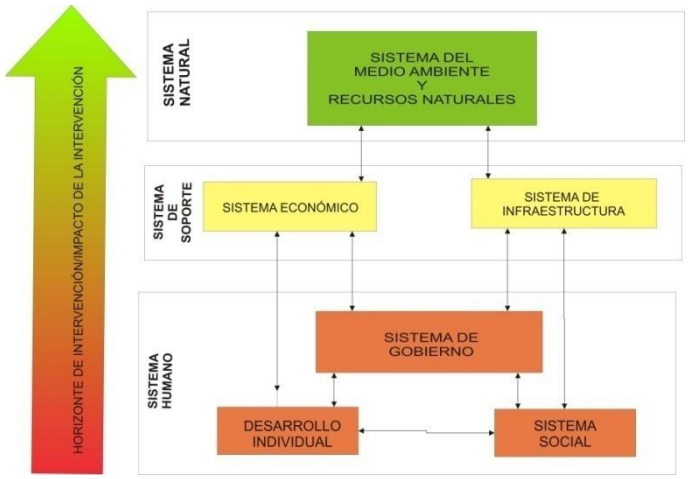
The important part of this construction is a) the limited definition of the concepts that make up each subsystem, b) the definition of capacity-influence of each subsystem c) the concatenation of these capabilities-influence of natural and articulately. The intent of this construction is to avoid overlap and duplication of activities in each subsystem, on the first floor of conflict; on the second floor of conflict prevents the actions defined and implemented in two subsystems are antagonistic.

In short, under this construction it is to make communities able to articulate a management plan with well differentiated responsibilities among individuals, so that they are adopted by regional management systems and everyone can come together in one interest: access alos natural resources.

Integrated Watershed Management

Management concept applied in the business world as the action or effect of managing for the "right" to administer. While their everyday meaning refers to measures that are made conducive to the achievement of the objectives of a business or institution or personal lives, in our area we can say that refers to the set of actions that are planned and executed to achieve the proposed objectives, to ensure sustainable development of natural resources. Manage, according to Puebla (2010), it is to take a series of decisions based on the available information, leading to actions that ensure the achievement of the objectives.

In this context, watershed management should generate information, first, to show a baseline of the state of the resource, secondly, to enable decisions and thirdly, to what extent the implementation of the plans are changing the initial state of the system, including socioeconomic conditions, to determine to what extent can feed the action plan; This is a management system will support a platform of reliable information on the availability of natural resources (Figure 5).



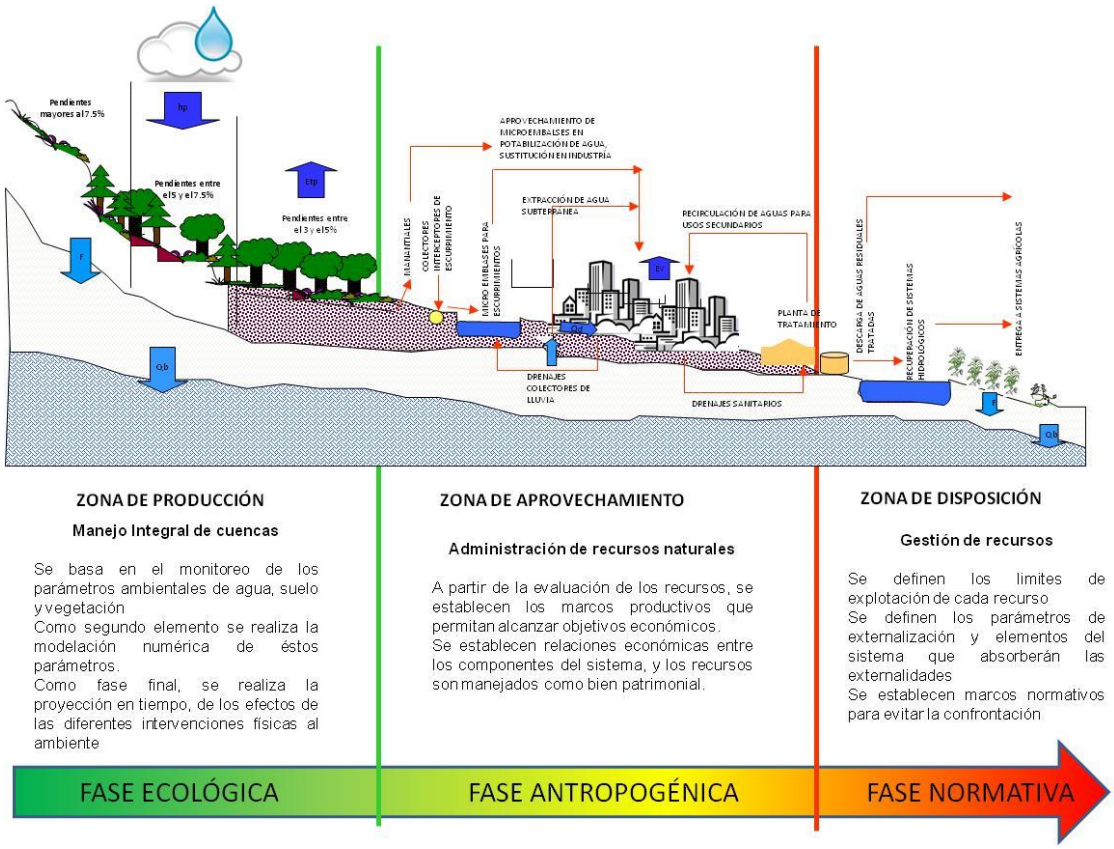
Modificado de: Bossel, 1999.

Figure 5. Structure Management System.

The management of resources should not simply be limited to technical aspects, such as improving water catchment basin, measuring consumption or agricultural irrigation regulation. This management involves linking social, cultural, economic and governance components. But the separation between the 3 stages: assessment, administration and management, and lack of manipulation of concepts, has been

deemed as "integral" to the processes of social participation, above assessment processes resource availability, and management is considered as the process of socialization of the problem, not the consensus decision-making.

As proactive phase is based on land management approach, taking basis the basin, to establish the three subsystems described a) continuous monitoring of the availability of resources, b) the exploitation of these resources from balance production-exploitation, c) the involvement of actors from the individual unit, to the regional, based on reliable information. This construction also provides the spatial and temporal integration of the territory, so as to assess the cumulative effect of interventions in each subsystem, the impact-influence of actions between subsystems in 3 axes of sustainability: environmental conservation , human welfare, and the generation of wealth on a regional basis. 6 shows the proposed structure.



Tomado de: Arquitectura Solar, LacombaGalván, 2012.

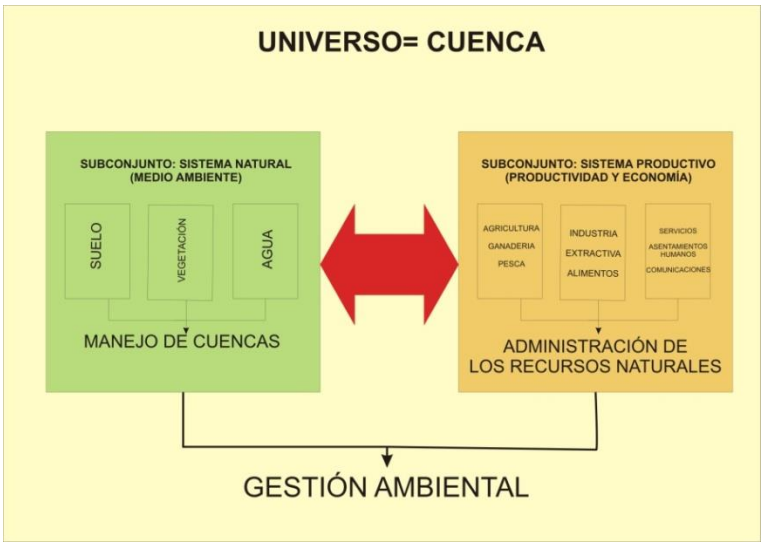
Figure 6. Cumulative effect of interventions.

This approach requires a high level of social cohesion and organization, strong social networks and well structured to include the participation of farmers and the community

in the design of policies for immediate intervention. That is, it requires the integration of agro-ecological and social levels to have a management plan with high potential for implementation and success. In all cases, stands the environmental assessment (water-soil-vegetation). At the regional or upper phase requires effective and assertive communication between base units (community) with highly specialized management companies, to enable two-way flow of information that allows the generation of regulatory frameworks governing public policies aimed at meeting the different demands of different social groups inhabiting the same region

The practical utility of this approach is the generation of indicators that link the physical characteristics with productivity, environmental impacts, health impacts and sustainability, whose initial assessment allows the construction of management plans (management of resources) to lead integrated management (consensus decisions).

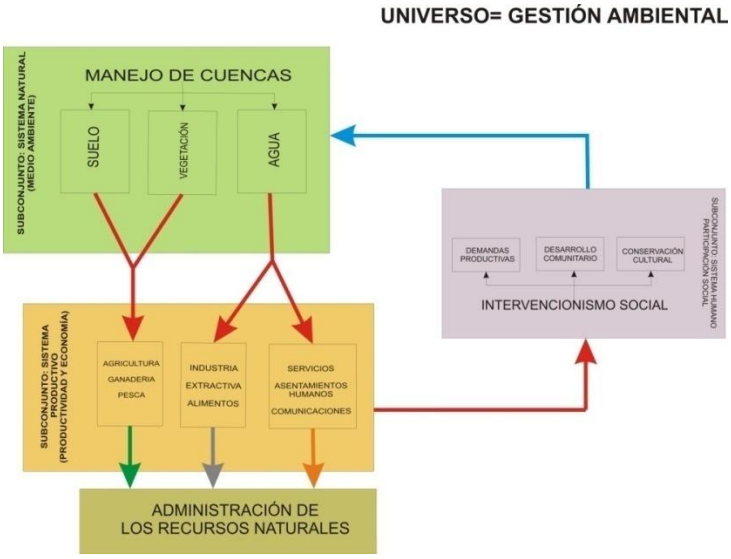
Management of natural resources then will be how they relate to the environment and man through relations a) subsistence b) economic. That is, the operating limits are established based on the environmental dynamics. To achieve this it is necessary to measure environmental aspects such as water quantity, water quality, soil erosion, agricultural productivity; in the exploitation phase productivity, production quality, destination, actual and potential market are measured. The proposed concept is that the function is not unequivocal and directed, but bidireccionada between subsets, and the output function in any of the addresses is environmental management. So synthesized: environmental management depends on the availability of natural resources, and their respective demand from production systems or sustaining human being (Figure 7).



Construcción propia.

Figure 7. Relationship between the environment and economic activities.

In this context, watershed management should generate information, first, to show a baseline of the state of the resource and, second, to what extent the implementation of the plans are changing this state as socioeconomic conditions the same extent and can be fed back into the action plan. This approach modifies the structure of intervention in watersheds, to move from a recursive addressed dichotomous system (above) to one multidirectional, where the permanent monitoring of the variables that make up the system, no longer the "prospective" order or "evaluation returns "to become decisive and obligatory nature of public policies through informed social participation (Figure 8).



Construcción propia.

Figure 8. Managing basin. proposed structure

That is, that the proposed approach is a multi-process (systems analysis), which exists in every step a central element differentiated assessment (environmental, economic and social) and different functions that link. So the social space of the integrated management of watersheds (Figure 9), is restructured as follows:

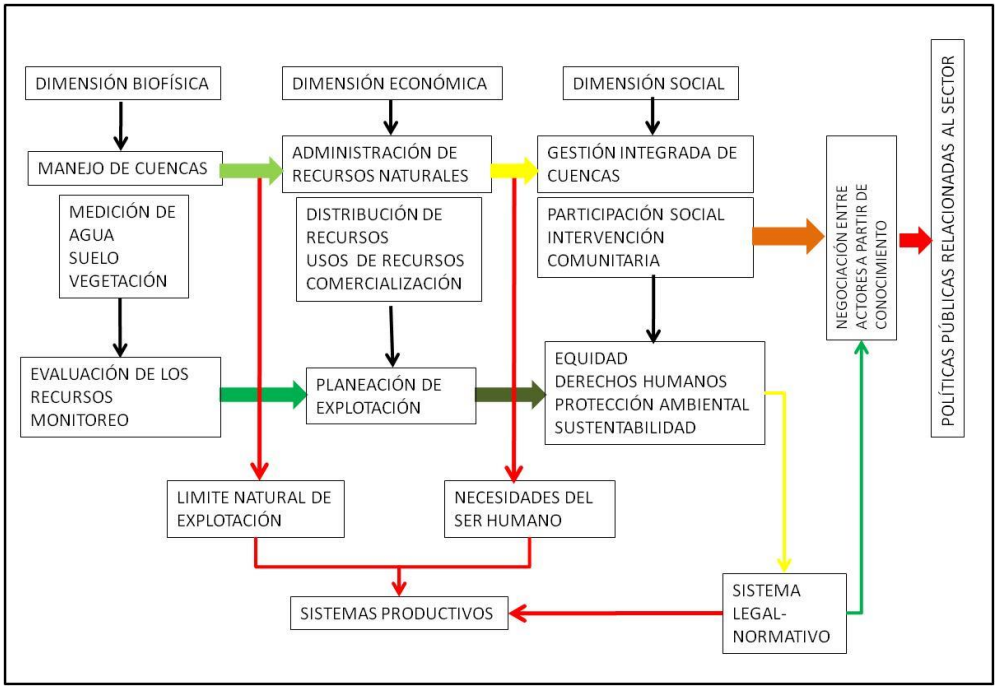


Figure 9. social area of integrated watershed management.

DISCUSSION

The concept of Integrated Watershed Management is a concept under construction; derived from the way the human being as a society relates to its environment. These inherently complex relationships within each community, is more complicated when different groups are related in turn to each other. That is, are compared between companies in the form of access, use and conservation of resources: local versus global.

Is this complexity that the term has been addressed by different knowledge areas, technical disciplines, and even empirical knowledge, without ever fully meet any of the spaces in which we have tried to settle the term. Added to this, we need the development of relations of societies with such diverse environments, over time, has not allowed the concept rehearse their proposals, the time is the dominant variable in the integrated watershed management. However, despite the complex nature, the somewhat slow development of concepts and methods, coupled with technologies that are at a much faster rate, have led to a development in different directions, elements, concepts

and tools to raise a sufficient basis minimum of concepts and methods that interrelate all these proposals and progress on a common methodological and conceptual framework.

CONCLUSIONS

Current environmental stresses force extend moral reflection of modern development project, to conceive of reason and freedom in the draft determination of human development can not escape the determinism of natural laws and contexts of human interaction physical environment. The significance of our abstract ideas of equality, justice and autonomy, and the formal agreements of freedom and citizenship, may also involve dangerous acts of omnipotence if physical and practical meaning the growing race against nature consequences are not valued.

More and more numerous empirical evidence provided by science about the growing gap between the natural world and human, as is apparent decoupling between the concepts of watershed management, watershed management, watershed management, and integrated management basins; this decoupling theme has caused each concept becomes center of an area of knowledge, leading to hyper, that is, the elimination of its connectivity with other issues, and therefore a biased manipulation of the concept.

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