RIGHTS OF WATER USE IN BRASIL AND ECOLOGICAL ECONOMICS SUSTAINABILITY

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Summary

Although Brazil has one of the largest fresh water under reserves in the world, its availability to different uses, especially in urban aereas, is discussions' point on conflict management. Water is the most important resource for sustaining life at all levels, from the most basic ones, such as supply and production of human food, for the most complex, the result of economic processes. The water in Brazil is considered a public good, belongs to the state that has the responsibility to regulate its use to the community. Thus, the current Brazilian legislation related to water management is characterized as a modern and innovative legal device regarding the management process. Its main framework based on decentralization, integration and participation that should permeate the whole process. Another important factor is to determine the guarantee of sustainable development as one of its objectives. However, the concept of sustainable development set by the legislation is vague as the definition of sustainability. The main instruments used to promote this goal, the "Outorga" is one of the main tools that leads the use of water by the various stakhokders. Like a license agreement issued by the executive, this command and control instrument has a range of criteria for the granting of use, depending on each federal unit in Brazil.

In this context, this paper aims to propose an analysis of this instrument from the perspective of the definitions of weak sustainability, associated with neoclassical economics, strong sustainability associated with ecological economics and sustainability from the perspective of an evolutionary bias, also associated the ecological economics point of view. It has been used definitions of the main criteria for licensing, namely the "reference curve", "Q7, 10" and "dynamic criteria".

In São Paulo, for example, the standard used to determine the reference flow and hence the minimum flow, or ecological function of flow is known as Q7, 10, which sets out a maintenance of minimum flow on the average of a minimum 7 events with return period of ten years from setting a minimum flow over the period. As the standard of "retention curve", which simple consists in a percentage determination of occurrence of certain flow, it is understood that such criteria can be interpreted from the weak sustainability point of view, wich advocate the multiple uses optimization for current and future generations, maximizing the utilities generated from water resources at the expense of maintaining a minimum natural capital. This parameter does not consider aspects such as seasonality flow, floods and droughts as a natural way to ensure the maintenance of natural capital. Therefore, these standards allows the replacement of natural capital for manufactured capital.

On the other hand, the standard adopted by the State of Rio Grande do Sul, the "dynamic criteria", define the strengthening of institutions responsible for the management of each water resource in order to guarantee the best approach to set criteria for reference flow and the minimum flow. In other words, by strengthening those institutions that can determine better and

more specific conditions for the area as a whole. Thus, it is possible to relate this criteria to sustainability from the evolutionary bias, where the focus is strengthening social institutions and the maintenance of coevolutionary processes between the natural and social environment. Finally, the paper discusses the relationship between those concepts of sustainability defined and the criteria used to define the reference flow and minimum flow, pointing out some limitations and possibilities for improvement, considering aspects of seasonal and climatic fluctuations as determinants for maintenance of biophysical functions ecosystems services and proper maintenance of water availability in the long run

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1. INTRODUCTION

1.1. The paradigm of sustainability

Much has been written on new lines of thought concerning the environmental crises currently experienced by humanity. New theories, new "solutions", insights and notes. In fact, the accumulation of work is inherent in the process of evolution of scientific thought and social development as a whole. However, when dealing with environmental conflicts, it is essential to clarify the discussion of how human reasoning and thought unfold, while scientific work, because the environmental conflicts show increasing the limit of certain paradigms and the prospect of building new arrangements under scientific the prospect of these new paradigms. As pointed out by KUHN (2011):

> "In its established usage, a paradigm is a 'model' or 'standard' accepted. [...] Is an object to be better articulated and clarified in new or more stringent conditions. "(KUHN, 2011 pag 43)

The nature of normal science consist in a method by which the paradigm is based in reproducible standards and models, which should be improved and articulated to new situations or phenomena. By placing the discussion of economic thought, the way to address the new problems is the main issue to be addressed. In other words, the idea that we have, or paradigm that we are included, according to KUHN (2011), is a major factor in how to analyze the phenomena and problems apparent. As defined by BRANCO (2002), our conceptions are closely linked, or "framed" in "conceptual structures" or "pre-existing paradigms," characterized by our country and our culture. Sustainable development is the concept which is essential to any discussion of issues involving the environmental sphere. The discussion on sustainable development, as the focal point, begins to be polished, especially in the second half of the twentieth century with reference to the definition given in the " Brutland's Report " in 1987. This report sets out:

"Sustainable development is development that meets present needs without compromising the ability of future generations to meet their own needs."

From the 90s, the concept of Sustainable Development has begun to permeate the discussions at various levels of society. Associated to this fact, the institutionalization of this concept also began to influence the private sector and public sector in the processes of decision making and formulation of strategies aimed at environmental conservation or associated with competitive advantages in the market (MORETTO, 2008). Therefore, "Sustainable Development" became disseminated and understood by a series of principles which enshrine it. However, as pointed out (VEIGA, 2008), the concept carries with it a constant discussion of what means "development" and what "sustainable" is.

In the definition of "Sustainable Development", the word sustainable or sustainability, is also indicated as a broad and full of interpretations and complexity. For example, from the economic perspective, there are those who believe that there is no dilemma or conflict between economy and environment, but on the other hand there are those that indicate that economic growth is extremely harmful to the environment (VEIGA, 2008). This definition is also addressed from different values and views of different stakeholders. Basically, the clash on sustainability is understood on the interface between environment, economy and society in order to understand the extent to which the environment can be degraded, or to what extent can the economy grow.The understanding of sustainability also seeks to examine the interface between technology and biophysical limits and, in addition to discussions on immediacy, the discussion raises a reflection on which are the values and goals of human societies, our needs and perspectives today.

Thus, the definition of "sustainable development", "Development" and "Sustainability" are indeed changing concepts and construction. Is included in the collision theory and the political tensions arising from social and environmental conflicts. As pointed out by NOBRE and AMAZONAS (2002) apud VEIGA (2008):

> "[...] Is precisely the weaknesses, vagaries and ambiguities of the concept of sustainability that lies the reason for his strength and total acceptance.This notion could only become almost universally accepted because it gathered under its own theoretical and political positions and even contradictory opinions. This concept does not come set. Its meaning is decided in the theoretical debate and political struggle. Their strength, therefore, is to delimit a wide enough field in which the political struggle about the direction

> that it should have the environment in the contemporary world. " (VEIGA, 2008 pg.164)

The environmental crisis experienced by the society in the twenty-first century can be explained mainly by conflicts related to water use. BRASIL has one of the largest water availability in the world, however not all of its water is available for use. Not only as quantitative and qualitative availability of water, but also the conflicts are established by the functions and ecosystem services that water, or water bodies, provide or fail to provide.

With this challenge established, new proposals take the scene in many areas of knowledge. The Ecological Economics as a area of knowledge, seeks conceptual alternatives to the current structure of the hegemonic strand neoclassical economic paradigm the main generator of asymmetries in the relations between environment, society and economy. Due to this, in response to the evolution of the discussion about the economy and environment, society, through the process of construction and development of public policy and management tools, now add to the discussions and decision-making the issue of sustainability.

2. MATERIALS AND METHODS

This paper aims to clarify some questions about the discussion on Sustainable Development and Water resources management in BRASIL. From analyzes based on secondary bibliographies, discussion will be the instrument for the Granting of direct use of water resources compared to the paradigms of sustainability advocated by the lines of thinking of ecological economics and neoclassical economics. It should be noted that this paper is part of a monograph submitted to obtaining the graduation degree in Environmental Management.

3. RESULTS

3.1. Sustainability Weak and Strong Sustainability Sustainability by evolutionary bias

With the primordial understanding that the economy is the main factor of transformation of the environment, it is indispensable to understand the political struggle about the definition of sustainable development from the perspective of economy, the activity which generates major changes in society and nature. In the framework of neoclassical economics, the current paradigm and dominant economy, the way that means sustainability is aligned with a vision strictly reductionist and mechanistic. The theoretical core of neoclassical school is centered in the trade and in the allocation of scarce resources among alternative uses. The school believes that neoclassical resource allocation and price of goods as dependent on their scarcity and the interaction between supply and demand (PRUGH, 1999). In this conception, it is assumed that all agents of the economy, in trade, have perfect information, are free of restrictions, and are motivated by the maximization of personal utility, given as a simple material satisfaction of basic human needs.

The mathematical rigor and abstraction to the real world gave relative success to the neoclassical model. Concerned with the articulation of this paradigm economists in this area sought to perfect their instruments and consolidated such a model as dominant during the twentieth century. Several analytical procedures were based, and even extended, the physical mechanics. This characteristic has led the school to one of the main conclusions of the slope, namely the belief in economic growth. (CECHIN, 2010) The Environmental Economics is an extension of neoclassical economics. Originally started to address environmental issues to realize that economic activity would generate negative externalities, or positive, that would not be internalized by specific agents, but by society as a whole. It was the precursor from the theories of "Economics of Pollution" and "Natural Resource Economics" which began to articulate the neoclassical paradigm in order to find out alternatives to specific market failures arising from such externalities (CECHIN, 2010; NUNES, 2010 .) The current environment of neoclassical economics preaches, fundamentally, among other assumptions, the optimization of relations between agents. However, as pointed out by MUELLER (2007) and AMAZONAS (2002) apud CECHIN (2010), attempting to strike a "good" balance between economic activities and the negative environmental externalities revealed the failure of the approach in resolving such conflicts.

3.2. Weak Sustainability

What guides what is meant by the criterion of "Weak Sustainability" is the guarantee of intergenerational equity by maintaining the pattern of consumption constant, or total capital constant. Rescuing Solow's postulates, the production function can be understood through a mathematical function, where:

$$P = A.\ f\,(Kn, Km, Kh)$$

The product formation is linked in the relationship between Kn, defined here as Natural Capital, Km, as manufactured and Kh Capital as Human Capital (CECHIN, 2007; AMAZONAS & NOBRE, 2002). Natural Capital is an extension of the traditional concept of land, of classical economics. Means Capital Stock (collection or aggregate) of something that can produce a flow of goods or services (PRUGH, 1999). In the case of Natural Capital, any asset that can produce natural flow of ecological services. Capital represents the assets manufactured from production processes and, finally, human capital represents the set of knowledge, skills and abilities of individuals (PEARCE and ATKINSON, 1995 apud AMAZONAS & NOBRE, 2002; PRUGH 1999).

The neoclassical assumption, from the weak sustainability, interprets sustainability as the maintenance of constant capital. This indicates that as capital is a function of another, its scarcity can be overcome by the increase in other capital. As an example, to the extent that decreases the capital natural, human capital and / or produced capital must be increased to the useful and well-being the end to be secured. Therefore, money can be replaced entirely from this view. So, what should be sustained is the ability to produce, not any particular component of capital (PEARCE and ATKINSON, 1995 apud AMAZONAS & NOBRE, 2002).

This conception that the substitution of natural capital for other capital is infinite leads to the conclusion of the natural system is irrelevant to the economy, if there is compensation by other capitals. However, it is impossible to consider this assumption as totally true. According PRUGH (1999), manufactured capital can not entirely replace the natural capital since the thermodynamic point of view, the capital manufactured is

made of natural capital. In other words, natural capital is the basis of the production chain as an input of low entropy. Manufactured products are made of such products with low entropy energy. This source is depleted, it is inevitable production of manufactured capital, even considering the technological optimism. Another important point to be relieved is that natural capital also performs functions that are not necessarily tied to the economic process. While a forest can be converted into paper, its function as a product can be replaced, however, their functions relating to the biophysical system (ie, air purification, soil stability, microclimate stability, among others) will be lost. According AMAZONAS & NOBRE (2002), capital and labor are perfectly substitutable, because they allow each other qualitative aspects. In the case of natural capital, there is not always the proximity of qualitative capital. The technology is seen as a major factor regarding the improvement of the effect of substitutability. According to PRUGH (1999), however, technological progress has been used for growth, development of how to extract resources more efficiently, rather than use it for development, the efficient use of resources.

3.3. The Ecological Economics (EE)

In the 60 and 70, as previously seen, the concern with environmental issues and the emergence of various environmental movements associated with the oil crisis and the discussion of exhaustion of nonrenewable natural resources, led to the introduction of environmental subjects as the focus of analysis in the economic, social and political (AMAZONAS & NOBRE, 2002). It is interesting to note the emergence of papers on this area not only in the economic area, which is the main area generating such conflicts, but also from non-economic areas.

EE requires a more comprehensive, holistic, integrative and systemic relationship between the economy and the environment. According AMAZONAS & NOBRE (2002), is constituted as an approach to economic thought since 1980 with the founding of the "International Society for Ecological Economics."

The EE recognizes the importance of biophysical and ecological foundations of the economic system as the guiding principles of the analysis. (AMAZONAS & NOBRE, 2002). Unlike neoclassical economics, EE seeking greater efficiency in resource

allocation processes, whether matter or energy. However, not only seeks the efficiency of those involved in direct transactions, but also takes into account the limitations imposed on such transactions (DALY & FARLEY, 2003). That is, consider the qualitative aspects of such allocation of resources and energy, and prioritizes not only quantitative aspects. Also according to the authors, the quantitative increase, recommended by the neoclassical approach, the EE is not itself an end or an end goal of economic processes.

What really sets the EE, as defined AMAZONAS & NOBRE (2002), is the "purpose of analyzing the economic system taking into consideration the conditions of the biophysical world on which it takes place." The most important influence comes from the physical view associated with economic processes, as regards the transformation of matter and energy as well as relations between agents and the biophysical system, focusing on the interconnections between environment, economy and society. As defined by Constanza (1994) apud AMAZONAS & NOBRE (2002): "The ecological economs is a new transdisciplinary approach which includes the full range of inter-relationships between economic and ecological systems."

Because it is an interdisciplinary area, different ways of approach can be found in EE. Joan Martinez Alier (2007), on his book "The environmentalism of the Poor", causes a series of discussions and reflections on the interface between EE and environmental distributive conflicts, strongly associated with chronic social problems. From this approach, the author proposes the model of the social and economic systems are understood and limited by the environmental sphere, and biosphere. Likewise, the subsystem "economy" is understood in the subsystem society, as it is unfolding economic relations from the set of institutions that support them. ALIER (2007) emphasizes the importance of the social sphere by the fact that environmental conflicts are exacerbated by chronic social asymmetries. As stated by the author, the movement for environmental justice, environmentalism of the poor, environmentalism are popular movements that seek a balanced and equitable sustainable development, but above all, "a material interest in the environment as a source of subsistence condition."

Basically these movements are inherent in the political processes of social, environmental conflicts stemmed primarily local, regional and global caused by the clash between economic growth and environmental conservation associated with social

inequality. The relationship proposed here by the author concurs with the analysis proposed by STROH (2003) regarding the relationship of cause and effect of environmental degradation and social inequality. According to the author, such a relationship, although not directly perceived, has indirect effects explained in environmental conflicts (STROH, 2003).

Thus, as pointed CECHIN (2010), established the understanding that the sustainability sought by the school, lies in maintaining the conditions of production and consumption of generations, in other words, the maintenance of production factors in the production process.

3.4. Strong Sustainability

The criterion of strong sustainability argues that what must be understood as justice between present and future generations is to maintain a minimum stock of natural capital and constant. From this perspective, the focus of sustainability is concerned with the beginning of the production chain, not just the end result, consumption. On the other hand, natural capital consists of non-renewable resources and renewable resources, ecosystem services, in addition to the amenities associated. The question that is asked is how to proceed in the maintenance of natural stocks when we treat these two categories, non-exhaustible and exhaustible.

Somehow PEARCE & TURNER (1990) apud AMAZONAS & NOBRE(2002), define that for exhaustible resources should consider what is the efficiency of use of this resource and investment income, fostered by its extraction to the lower their dependence. Moreover, for the renewable resources, must maintain the ability to assimilate and regeneration of natural resources. What has to be determined, hereinafter, are conditions for natural resilience of the systems and also the minimum or critical which must be maintained over time. According AMAZONAS & NOBRE(2002):

> "[...] The point that opens in EE, not as a premise, but as head of research, it is precisely the determination of scales or levels of use of environmental resources that match the conditions maintaining sustainability within a timeframe and spatially delimited as relevant "(AMAZON & Noble, 2002, p. 231).

Accordingly, it can be inferred that the maintenance of natural capital is the minimum goal of society, from the paradigm of EE, while inter-generational justice, or, in other words, sustainability. The discussion about the concept of natural capital can at least contribute to the understanding and application of the concept of strong sustainability in practice. As previously noted, the vision of strong sustainability advocates the maintenance of minimum natural capital for future generations. Natural capital minimum, or critical, as defined by BRANDE (2008), emerges from the perception that natural capital can not be totally replaced by produced capital. Mainly natural resources that play vital ecosystem services to life, such as water, climate settings and soil fertilization.

3.5. Ecological and economic sustainability: The evolutionary bias

This approach, in its current state, is not consolidated in a definite and can be identified through various formulations by different authors. However, the focal point of this approach lies in the analysis on the relationship between environment and economy by looking coevolutive, driven by the dynamics of technological and institutional (PRUGH, 1999; AMAZONAS & NOBRE, 2002).

Basically the understanding of the evolutionary process associated with the logic of the thermodynamic theory is the underlying evolutionary bias. According to BRANCO (2002), E. Morin discusses the concept of "creative disorder" as a source or direction of more complex organizations. The concept of "negentropy" explains the organizational capacity of the systems as opposed to the increase of entropy.The introduction of information from the association of parts of a system, which generates emergent properties of such a system could lead to a condition of their support and maintenance activities. This is how, as advocated by BRANCO (2002), biological systems are still alive. From the synthesis of its parts, functions, or emergent properties arise and can decrease the "chaos" generated by the natural law of entropy. In conclusion, the medium external to the system receives the entropy inexorable increase, however, inside the system remains in a state of low entropy, in relation to the external environment. It is precisely this relationship between the degree of entropy of the external and internal, or

potential difference, which facilitates the accomplishment of work, in this case, the maintenance of life.(BRANCO, 2002)

According NORGAARD (1984, 1988 and 1994) apud AMAZONAS & NOBRE(2002), negentropy is the basis for the evolution process. Living organisms are constantly pressured by the process of entropy. Those who gain at random, their systems with greater complexity and specialization, which create order and predictability in a system (negentropy), will be positively selected. This concept, biological character, can be interpreted in a social sense, but not so subjective. Is related to a historical objectivity pointing in one direction, order, organization, whose goal is energy efficiency and equipment.

Likewise, the complexity and specialization are fundamental to the success of society. From the human point of view, according to NORGAARD (1984, 1988 and 1994) apud AMAZONAS & NOBRE(2002), "Knowledge and learning are central to evolutionary attributes to be incorporated in the perceptual systems of individuals and cultural systems of society." Also according to the author, value systems, institutions, technologies evolve with the environment characterizing a process of "social negentropy." We conclude that the defining institutional and technological dynamics are the basic mechanisms of response to the process of entropy, the social point of view. These are the basic mechanisms that can, by analogy, to keep human systems with low degree of internal entropy.

Therefore, more important than conserving natural capital stocks constant, which is shown for some cases primary, the coevolutionary approach defines as sustainable use of resources that best contributes to the perpetuation of coevolutionary trajectories developed in response to such pressures (AMAZONAS & NOBRE, 2002). Finally, the primary question that arises is how to define what are the relevant environmental feedbacks and what important answers that must be taken in what timescale and space. Thus, not only underscores the importance of environmental limits, or the resilience of such systems, but also the "ability" of social institutions, technological innovations and the appropriation of such information by social groups and political systems that surround them, to transform the information in most appropriate responses to ensure the process of coevolution. In the words of NORGAARD (1994), which is looking is increased liability associated with a community decentralized power. The

challenge is therefore to develop and strengthen the society to understand, interpret and execute the processes of the answers quickly and efficiently.

3.6. Legal and institutional aspects of water resources in Brasil

The planning process of water use in BRASIL is the first record actions in the nineteenth century, shortly after the declaration of independence. Generally speaking, the consequent actions aimed at ordering the use of water as a strategic resource with regard to transport and, more recently, the production of electricity (SILVA & PRUSKY, 2005, BRAGA et al., 2006; ELEMENTOS 5, 2009).

It is only in the 1988 Constitution that water resources are raised to a condition of special care, not only for the energy sector as hitherto had been conducted (SILVA & PRUSKY, 2005). The idea of reforming the system of water resource management began to take power in the 80's mainly because the rules ordering the water resources management is still based in the Water Code of 1934 (BRAGA, 2006). The emergence of the needs to capture the technical sector of society with the technical sectors of government, arising out of work and workshops sponsored by government agencies, pointed to a new management perspective, no longer purely technocratic, but with the involvement of other sectors of society (BRAGA et al., 2006).

Only in 1997 that is enacted Law No. 9433 establishing the National Water Resources Policy and creates the National System of Water Resources Management. From the states' initiatives, the Union now takes leading role in setting guidelines and planning of public policies on water resources in the country.According to BRAGA et al. (2006): "The country may face, with a modern and innovative instrument, the challenge of balancing the increasing demand for water to cope with urban growth, industrial and agricultural potential conflict of uses generated by the binomial-demand availability and advancement of worrying environmental degradation rivers and lakes, among other things "(BRAGA et al., 2006 p.646).

The National Water Resources Policy (PNRH) was established by Law 9433/97, the Water Law defines main objectives:

> Article
>
> I - to ensure the current and future generations the necessary availability of water quality standards appropriate to their uses;
>
> II - the rational and integrated water resources management, including transport, with a view to sustainable development;
>
> III - prevention and defense against critical hydrological events of natural origin or from the inappropriate use of natural resources. (BRSIL, 1997).

Interestingly, the first time, the rational and integrated water resources should assist sustainable development. The integration of the environmental perspective, however vague it is such a definition allows us to observe the opening of the new legislation not only a utilitarian approach of water resources, but also concern the various uses compatible with the environment.

Also noteworthy is the concern in the prevention and defense against critical hydrological events, natural or of anthropogenic origin, somehow assuming a systemic perspective that understands the vision hydrologic, or water system, as a major factor in water availability random fluctuation and that their contributions may have natural variations in anthropogenic.

With regard to your objectives, defines PNRH:

> Article 1 The National Water Resources Policy is based on the following grounds:
>
> I - water is a public good;
>
> II - Water is a limited natural resource with economic value;
>
> III - in situations of scarcity, the priority use of water is for human consumption and watering livestock;
>
> IV - the management of water resources should always provide the multiple use of water;
>
> V - the watershed is the basic unit for implementation of the National Water Resources and the activities of the National Water Resources Management;
>
> VI - the management of water resources should be decentralized and rely on the participation of the public, users and communities. (BRASIL, 1997)

In his first paragraph, the definition of water as a public good and in the second paragraph, the association of the term "natural resource" with economic value. Does not specify what the scope of the term water, but considers its use as a public, no longer giving territorialities for private users of water bodies (SILVA & PRUSKY, 2005). The adoption of the concept of river basin as a territorial unit of analysis and management highlights the systemic perspective and a focus of hydrological relationships between water resources and the environment around them, whether biotic or abiotic. This definition, therefore, is associated with a modern perspective, the administrative point of view, as it relates to not only the body of water, but also their relationship with the various systems that surround it within the watershed as a unit analysis.

Last but not least important, the triad proposed by challenging this law. The management of water resources should be based on a decentralized, integrated and participatory. According JACOBI & FRACALANZA (2005), decentralization refers to the adoption of the concept of river basin as the unit of regional planning and administration. Participation, in turn, considers the importance of the presence of government agencies and civil society in the system of management of water resources. The integration, finally, considers mainly the act of unifying, part of a whole or complete, regarding the environmental management system as a whole regarding quality and quantity of water between institutions and between the legal provisions available.

The PNRH is itself an embryonic process in which it proposes to build a participatory model in a decision process that is necessarily linked to the dynamics of production of space and use and occupation of land by human activities within the context of a comprehensive review the role of institutions like the State, civil society and the proper user of water (FRACALANZA & JACOBI, 2005).

It should be noted, although the authors note, that given the complexity of the conflict around the theme of water associated with a technical limit on the part of agents, makes decisions, even if decentralized, integrated and participatory, are still in the sociotechnical interface in order to prevail as a reference to a technical process control (FRACALANZA & JACOBI, 2005).

Among the instruments that PNRH proposes, we have the "Granting rights of use of water resources" as the focus of the present work.

3.7. The Granting of rights of use of water resources

According to Resolution 16, 2001, the National Water Resources Council (CNRH), is defined:

"Art The first grant of rights of use of water resources is the administrative act whereby the licensing authority shall provide the previously granted or by right of use of water resources, for a specified period, on terms and conditions expressed in the respective act, considering the laws specific force (CNRH, 2001)."

According to SILVA & PRUSKY (2005), Grant's "consent, grant, approval, consent." In the legal sense, the procedure for award requires the intervention of the federal executive and state governments to express their will, and to indicate, under the rules of law, the criteria that will integrate the structure of the grant. It is therefore an instrument of command and control that regulates the use of water resources and aims to preserve the quantity and quality of water.

According to legislation, are subject to the granting process uses capitation or bypass water, extraction of water from aquifer discharge of sewage and other waste and use of electrical potentials (BRASIL, 1997).

3.8. Criteria for definition of Grant

For the criteria to be followed for the approval of the Grant, we have to water availability as essential in the decision-making. According to Kramer (1998) apud CRUZ (2001), water availability can be understood as the total flow that varies temporally and spatially within a basin and part of it is used by socio-economic activities as well as the use of the system itself to the conservation of its integrity, or for

activities that do not require changing the amount of water. It is also important that the water supply is not only related to the amount of water present in the basin, but also quality. However, the quantitative aspect is also a major factor in determining the degree of water quality. Accordingly, for the purpose of this paper, we analyzed only the quantitative factors.

The determination of water availability is the primary step for defining the amount of water available for use in the watershed. According to CRUZ (2001), the characterization of variability, seasonality and randomness of the hydrological behavior should be included in the assessment of water availability in the system.

A key component of the study of water availability is the hydrology of a watershed.The series hydrological or water regime of the water body are composed of variables such as basin geomorphology, soil type, land use, intensity and temporal distribution of rainfall. The fluviograma or hydrograph demonstrate the behavior of the body fluid flow over time.

It is from the study of hydrological series associated with probabilities of occurrence are formed about the availability of water (CRUZ, 2001). In other words, the study on water availability in relation to the hydrograph, is performed by statistical analysis of data. It is noteworthy that from this, so you can see that such determinations have certain statistical uncertainties inherent in the analysis.

The hydrograph, for example, may lead to a function of minimum flows, related to direct mathematical combinations between values and frequency of daily minimum flows that can be variable over time, depending on the sample. Highlight this role, according to CRUZ (2001) is the function Q7, 10 which represents the average annual minimum average seven-day turnaround time in 10 years.

The analysis of frequency of occurrence of flows, represented by a function defined as "curve residence" relates to flow with the percentage of time that she is second on the entire historical period in which it was built. It should be understood as a certain guarantee or probability of occurrence during the year or during the study period for planning purposes (CRUZ, 2001). Examples of use values from the curve of stay are the Q90 flow, which represents the flow in 90% of the time, which is adopted as a criterion for the determination of Grants for the National Water Agency.
The reference flow is the term used by several brasilian states to define a flow value that

represents the upper limit for water use. It is therefore the legal definition of the method to be chosen as a basis for the decision making process for the Grant.

According to CONAMA Resolution 357/2005, which provides for the classification of water resources for the purpose of its environment, defines: "XXXVI - reference flow: flow of the water body used as a basis for process management, in view of the multiple use of water and the necessary articulation of instances of the National Environment (SISNAMA) and the National Resources Management Water (SINGRH) "(CONAMA, 2005).

The PNRH defines that each state has autonomy to define the criteria for granting procedures in the specific case, the criteria for the definition of flow. As the resolution of the 16 CNRH according CRUZ (2001), just this fact, several interpretations characterize a situation is not homogeneous for the definition of reference flow. So, still defines the author, it is important to emphasize the uniqueness of each state in determining criteria for the reference flow.

The reference flow, therefore, acts as a guarantee of maximum flow bestowable, may be inferred that the case may be, acts as a factor that ensures a certain amount of water that must remain "intact" in the body of water. From the above table, it is interesting to note the definition of some states. Only two states use minimum parameters as the Q7, 10 for definition of its reference flow, as is the case of Sao Paulo and Minas Gerais. In particular, in the case of Sao Paulo, there is no legislation defining such criteria, leaving it to the Department of Water and Energy of São Paulo (SP-DAEE). In the case of Minas there is an ordinance that defines this criterion. On the other hand, is in Rio Grande do Sul which is the broader definition and dynamics present in their legislation, the non-static definition, but its relationship to the reality of each basin.

3.8.1. Method Q7, 10

As seen above, the function Q7, 10 is the average annual minimum average seven-day turnaround time in 10 years. According BENETTI; LANNA; COBALCHINI (2003): "This flow is obtained by computing the moving averages of daily average flows with window 7 days over a hydrological year. The minimum of these averages is retida.O process is repeated for each year of hydrologic time series, yielding a series of

minimum values of average flow rate in 7 consecutive days for each year. These flows are sorted in ascending order of magnitude, and estimated their probability of occurrence and return periods "(BENETTI; LANNA; COBALCHINI, pag.151 2003). This flow function has been used to determine the minimum flow to dilute effluent.As pointed LANNA & PEREIRA (1996) apud ARNEZ (2002), the method Q7, 10, and its fractions, indeed maximize the predictability of the availability of flow.Unlike the setting of a nominal value, setting the reference value based on a percentage basis of the Q7, 10 may provide a greater assurance of meeting the demand and that there will be failures, generating economic and social benefits.In the brasilian case, is used by the states of Minas Gerais, Paraná and São Paulo as a parameter for determining the reference flow.

As pointed out by ARNEZ (2002), the model Q7, 10 in fact provides greater predictability of the availability of flow to be used insofar as it restricts the likelihood of failures. Yet it must be noted that is a conservative method, compared to other methods hydrological considered as a lower flow value in case the average of seven consecutive minimum flow during a return 10. Finally, a method is linear static fixing a flow value, or a limit so as not to consider the natural variations, and essential to maintaining the balance of the water system in question, particularly in times of scarcity.

3.8.2. Curve Method of Residence

The method of stay or residence of the curve is used to establish a flow on a monthly or annual basis. It is, as previously calculated on a historical basis of the occurrence of flow and its curve is characterized by the frequency of service or overcoming a percentage observed (BENETTI; LANNA; COBALCHINI, 2003).The following figure shows the construction of a curve remain associated with the data hydrograph. This method is widely used by most BRASILian states in setting the reference flow.This method is simple to use and that it broadly reflects the flow behavior of the flowing water body. However, as the method Q7, 10, curve establishes a permanent value. That determination, therefore, establishes a simple relationship of the flow behavior of flow in addition to not fully internalize the main peaks of scarcity. Finally, it can be considered a more generic method than the Q7, 10 because it is based on empirical analysis of the flows recorded. Associated with this, the curve is constructed

from a statistical generalization that somehow ignores undermines the trust of the data since it does not consider certain variants (CRUZ, 2010).

Therefore, this technique is widely used because of its applicability and ease of recognition of the frequency of occurrence of flows on monthly or yearly. However, neglecting interannual variations and generalizes the periods of scarcity.

3.8.3. Dynamic method: the case of Rio Grande do Sul

It was possible to observe two broad categories of methods of determining the reference flow, namely curve permanence and Q7, 10. However, the state of Rio Grande do Sul was the criterion used is not exactly setting a reference flow.

Its legislation predates the establishment of federal legislation. The State Law 10350/94 establishing the State Policy on Water Resources. Decree 37033/96 regulates the instrument of grant, recommended by such state law. It is the seventh article of this legislation that has the definition of the criterion to be adopted, namely:

> Article 7 - The technical parameters needed to guide the grants will be defined by HRD in order to match demand and water availability.
>
> Paragraph 1 - Basin plans establish the values for the technical parameters mentioned in the "chapeau", specific to each basin, to be followed in the award.
> Paragraph 2 - While not established a Watershed Plan, the DRH set these values (Rio Grande do Sul, 1996).

As to interpret CRUZ (2010), this criterion can be characterized as a dynamic criterion, since it gives the definition of its discretion to the Basin Plan, which must be rebalanced periodically. Therefore, even according to the author (op. cit.), This criterion indicates a dynamic nature to preserve the integrity of the water body.

It is also interesting to note that such a model for smaller institutions delegate this responsibility. In a way, it can be inferred that the development process and its results will be best suited for the company involved in the basin since the decision-making power is closer to its jurisdiction. Still, one can infer that such a criterion strengthens

what the law calls for 9433/1997 with regard to decentralization and participation in the management of water resources.

On the other hand, the actors involved in negotiating the criterion of flow may opt for a less conservative model, the environmental point of view, aiming at a maximization of resource utilization. But what is observed is that the Basin Plan, which develop their own methods, have a more conservative than the other parameters previously observed, with the advantage that are negotiated and widely accepted by the community.

4. DISCUSSION

As presented about the criteria for discharge of reference of each state can be observed three main types: the method of curve of permanence, the Q7, 10 and dynamic method of Rio Grande do Sul.

Starting with the method of curve of permanence, its approach is the generalization of the observed data flow to determine the general behavior of the hydrological system. As noted, it deals in a general way the relation of the water body with the ecosystem that surrounds it. Moreover, it ensures the certainty of meeting the demand, because of widespread changes that naturally occur in the hydrological system. It is possible to infer that such a method is closer to a weak sustainability when it comes to trying to maintain total capital, ie, the predictability of resources for use by anthropogenic uses. Does ecosystem aspects, both the relationships and the capacity for recovery, or resilience, which would define an approach with strong sustainability and, ultimately, does not guarantee the strengthening of interactions between society and environment, which characterizes the bias evolutionary sustainability . Yet it is noteworthy that this method may in the long term prejudice the availability of water in the basin in question, just because they do not consider ecosystem aspects, impairing qualitatively the dynamic equilibrium of the system in relation to the ecosystem, the ecosystem services provided, and finally , the very maintenance of the water balance of the water body. In the case of the method of Q7, 10, there is in principle that this method may be more conservative than the curve of permanence. However, the interpretation given by the present study emphasizes that this method has a more restrictive in order to maximize the efficiency of use from a decreased likelihood of failures.This implies in an utilitarian

thought maintenance of total capital over time.Associated to this fact, the way we understand the environment and ecosystem aspects can be assumed that it is not known for strong sustainability because it indicates that the suppression of natural capital can be in relief if maximizing economic and social benefits in other words, there may be complete replacement of the capital.

The term, as the curve of stay, this method may not only impair the quality of service ecosystem related to the water body, but can also affect the water availability in the long term, since it compromises the functioning of the elements of system.

5. CONCLUSION

The paradigm shifts are processes inherent in the construction and development of science and society as a whole. Throughout this work we could show the way hegemonic economic system comprises the relations between society and environment are in an obsolete and outdated perspective. On the other hand, the evolution of new approaches between economy and environment provides a new perspective on relationships, but still lack consolidated methods for their effective applicability. So, therefore, lies the tension between Neoclassical Economics and Ecological Economics. The instrument for regulating water use is the giving of right of use. Such a command and control is supported by methods for determining an amount of water that must be available for use and must remain in the water body in order to maintain their balance functions. In Brasil, each state sets its methods. The three main methods can thus be analyzed as to the sustainability perspective it can provide.

In fact, the methods "curve to Stay" and "Q7, 10" are closer to a logical utilitarian, reductionist and mechanistic, therefore, associated with weak sustainability, this approach stemmed from neoclassical economics. On the other hand, the experience of Rio Grande do Sul is more closely linked to Ecological Economics, since sustainability is associated with the evolutionary bias and also associated with some criteria of ecological economics.

It is possible to infer that somehow the brasilian legislation, which deals with the management of water resources can act as an instrument of inducing paradigm shift described above. Legislation may be an inducer of methods that include sustainability

criteria arising from Ecological Economics, however, beyond the discussion breaks paradigms, attention should be paid to the fact that most brasilian states using methods that do not internalize the complexity ecosystem functioning of water resources.

It is necessary to clarify the limits of water use so as not to compromise the balance of the environmental system and the very future water availability. At this point, the understanding of strong sustainability on the maintenance of a minimum or critical natural capital proves important for the management of conflict of use between the actors. However, the methods used do not recommend this sustainability comprehensively.

Sustainability for modeling of Rio Grande do Sul is a breakthrough especially in relation to the understanding of the relationships between society and environment, as well as the strengthening of social institutions and the empowerment of society on water management. However, both this model and other models, lack of specifications on the maintenance of natural capital minimum or critical to the water body.

In this sense, finally, that it can be stated that the methods used lead to a scenario of ecological imbalance and inherent scarcity. There is a real progress in addressing how the Rio Grande do Sul, but still needed further debate on the maintenance of minimum or critical natural capital and its internalization in new models of management of water resources.

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