

Landscape Conservation and Social Tension in the Brazilian Atlantic Forest: Challenges for Implementing Sustainability

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Abstract—The study is based in the Environmental Protection Area of Guaraqueçaba located in the Atlantic Forest of the State of Paraná, southern Brazil. EPAs in Brazil allow private ownership, resource extraction, and agriculture according to predefined land use laws. A systems' approach was adopted to define the main interacting variables needed to understand the local socio-economic context and the causes of an observed increase in illegal activities. The Atlantic Forest is of particular importance as it was declared a "hotspot" in 1992 for its endemic biodiversity and high risk of destruction; today only 7% of the original cover remains as scattered fragments. A series of increasing social and environmental conflicts have been observed in the EPA because the Law restricted traditional agricultural practices without defining alternatives to sustain locals. As a result, new forms of illegal behaviors emerged, such as indiscriminate extraction and hunting, with devastating effects. The methodology adopted herein assists in understanding the core of these conflicts and permits the formulation of strategies to minimize them. Based on the redefinition of the perception of sustainability both from the local people and law enforcement perspectives and through the reconciliation of traditional practices and cultural issues, it allows the reconnection of people to their place and its ecological dynamics.

Introduction: Ecological System

The Environmental Protection Unit (EPA) of Guaraqueçaba was created in 1985 under the Law Decree n° 90.883/85. It has an extension of 191.595 ha located in the coastal region of the State of Paraná, southern Brazil. The EPA contains the largest continuous fragment of the 7 percent of the remaining areas of the Brazilian Atlantic Forest ecosystem (Floresta Ombrófila Densa) and the so called Coastal Biome composed of dunes, mangroves, and estuaries. The Atlantic Forest was declared a hotspot in 1992, by Conservation International due to its high endemic biodiversity, imminent danger of destruction and established social conflicts. The EPA also contains archeological sites; traditional populations defined by indigenous groups, fisherman and subsistence agriculture peasants that inhabit the region for over a century (IPARDES, 2001). In that sense, the EPA of Guaraqueçaba is characterized by a vast heterogeneity of social and environmental systems that are in constant dynamic exchange.

The importance of the EPA of Guaraqueçaba relative to the State of Paraná is also evident when analyzing its history in retrospective. At the beginning of the 20th century, 80 percent of the original landscape of the State was covered by forests, namely the "ombrófila mista" with its characteristics Araucaria Pines (*Araucaria angustifolia*) and semi-deciduous forests in altitudes superior to 900 m, and the "ombrófila densa" or Atlantic Forest in the hill slopes of the Serra do Mar alongside the Atlantic Ocean's coast (fig. 1). Today, the State has only 8 percent of its original Araucaria forest cover and only 3 percent of the original Atlantic Forest cover, with the EPA containing the largest continuous fragment of that biome of the country (SOS Mata Atlântica 2002).

According to Maack (1968) in Jacobs (2002), the greatest forest loss occurred between the 1960s and the 1980s decades (table 1), a period that coincides with the greatest deforestation cycles observed in the Amazon region and with the dictatorships regimes in Brazil.

With the aim of protecting the endangered forest areas and natural resources, several conservation units were established in the Brazilian territory since 1938. Nevertheless, problems persisted due to land tenure

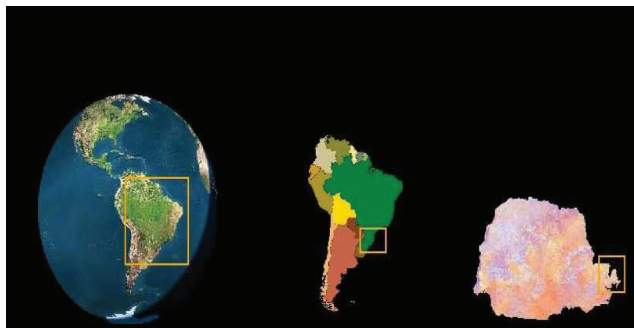


Figure 1. Location of the EPA of Guaraqueçaba at global, regional and local scales. Source: SPVS, 2000.

conflicts and poor demarcation techniques that in many cases resulted in superposition of land titles and border inadequacies. The State of Paraná addressed these problems only in 1980 through the creation of the EPA, a category of conservation unit that allows human settlements and restrictive natural resources' exploitation according to pre-established laws.

The EPA of Guaraqueçaba was officially demarcated in 1985. It is believed that the creation of such conservation units has, to some extent, prevented greater losses of biodiversity in the State of Paraná (as in the entire Brazilian territory). However, forest degradation is still taking place. Research is showing that agriculture pressure over these areas remains high. In spite of law enforcement and monitoring efforts, selective extraction of woods, plants, and endangered animal species continues and, in some cases, it is reported to have been accentuated. According to Jacobs (2002), this is due to the small extent of some of the Paraná's conservation units and small or inexistent participation of local populations in the management and profits generated by tourism and research undertaken in these areas. In this paper, we investigate these and other factors that might have contributed to the increasing deforestation and natural resources' depletion observed in the EPA of Guaraqueçaba. The main aim was to establish the nature and causes of these actions that resulted in activities that

are actually contrary to the ones expected when the legal implementation of the EPA.

Systemic Approach to Understand Social and Environmental Conflicts

It has been said that when adopting a systemic approach to a given problem, simulations that do not have a real basis are constructed. Nevertheless, it is argued that these are constructed and compared with what is known about a given reality, thus allowing the testing of various hypotheses (Marzall and Almeida 1999). Clayton and Radcliffe (1996) argue that the intrinsic complexity and chaotic nature of systems determine the difficulty in predicting their behavior. Nonetheless, it is also argued that a systemic approach does not provide solutions but unveils problems that might go unforeseen other way (Morin 2001).

The first step to implement the systemic analysis of the conflicts observed in the EPA is to identify the characteristics of main systems operating there – namely the social, environmental, and economic. In sequence, as proposed by the Lalone Scheme (1974), the main interaction flows between these and other operation subsystems should be identified. Main subsystems can be defined as educational, health, agricultural, religious, legal, law enforcement and physicosocial. The interaction between systems and subsystems can be illustrated better as taking place in an imaginary sphere where exchange flows are constant and occur at three main scale levels: local, regional and global (fig. 2).

The social subsystem of the EPA is composed by a series of actors that are involved in the Guaraqueçaba situation and that have sometimes conflicting interests. Main actors are described as governmental (State environmental agencies, Law enforcement, Monitoring Agencies such as IBAMA and IAP and Research Institutions such as universities and research centers), local communities (indigenous communities, fisherman, land owners and

peasants) and civil society (tourists, NGOs, enterprises, industry and others). When assessing just a few of the main expectations of each of these groups, some important aspects were uncovered:

Governmental: protection of natural resources through clearly defined land use restrictions, law enforcement, preservation of endangered species, regulation of illegal

Table 1. Deforestation dynamics observed in the Paraná State between 1895-2000.

Year	Area (ha.)	Percentage of State	Source
1895	16.782.400	83,41	MAACK, 1968
1930	12.902.400	64,13	MAACK, 1968
1950	7.983.400	39,68	MAACK, 1968
1965	4.813.600	23,92	MAACK, 1968
1980	3.413.447	16,97	PELLICO NETO, 1984
1990	1.848.475	9,19	SOS-Mata Atlântica, ISA & INPE, 1998
1995	1.769.449	8,79	SOS-Mata Atlântica, ISA & INPE, 1998
2000	1.594.298	7,98	SOS-Mata Atlântica Atlas of 2000

From: Jacobs (2002).

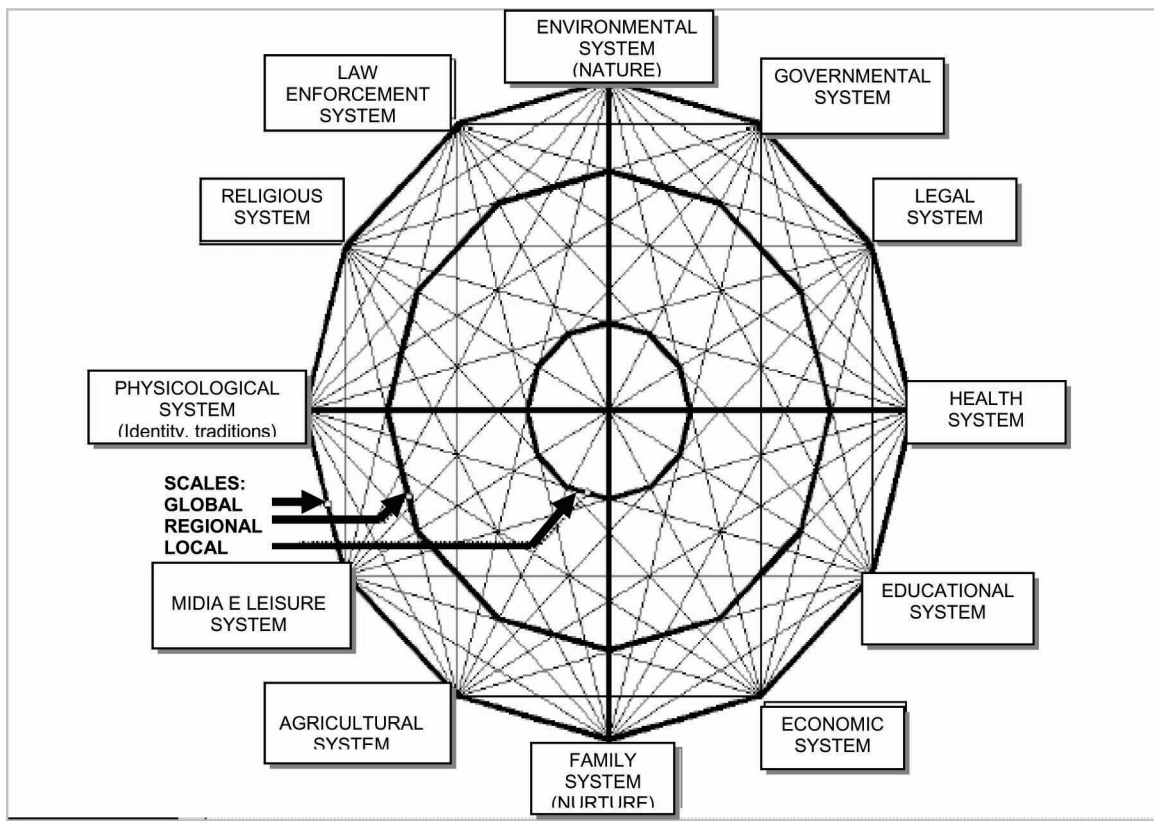


Figure 2. The Lalone Complex System Model. Adapted from Lalone 1974 in Chaves, M., 1998.

activities, information, research and scientific knowledge generation, regional sustainable development.

Local communities: improvement of living conditions through better access to goods and services, modern comforts, desire to practice their traditional economic activities, access to education, information and technology, freedom to decide their future, participation in decision making, safety, more communication with urban centers, development that brings income.

Civil society: preservation of natural heritage and cultural traditions, access to natural areas, information, participation in decision making, participation in revenues if any, leisure, education, recreation, sustainable development.

Since it is known that deforestation and other illegal activities in the EPA are said to be taking place as a result of social and economic interests conflicting with environmental preservation purposes, a study on the interaction flows between the social, economic, and environmental subsystems was undertaken.

Social, Economic, and Environmental Dynamics in the EPA of Guaraqueçaba

When assessing the demographic evolution in the Guaraqueçaba region, it is observed that in 1980 only 17 percent of the total population lived in the urban areas and by the year 2000, 31 percent of the population was living there (table 2). This represents an increment of 205 percent of urban population increment in two decades.

Although rural areas in the EPA still embrace the majority of the population, there has been a considerable emigration from the rural to the urban areas in that region. These results are contradictory to the purposes of the EPA where traditional rural economic activities are said to be an asset to be preserved and the rapid expansion of urban areas can trigger unwanted changes in traditional social and economic practices.

A study conducted as a PhD thesis in the Federal University of Paraná (UFPR-MADE 2002), examined the type of economic activities conducted currently by the

Table 2. Demographic evolution in the EPA of Guaraqueçaba, 1950 to 2000.

Population	Year						
	1950	1960	1970	1980	1991	1996	2000
Total	7174	7713	7648	7662	7751	8035	8288
Urban	707	1134	1348	1298	1742	2239	2582
Rural	6467	6759	6306	6372	6020	5776	5706

Source: Demographic Census of IBGE, 1950 to 2000.

Table 3. Main and Secondary economic activity of populations of the EPA of Guaraqueçaba.

Occupation	Main		Secondary	
	Nº	%	Nº	%
Agriculture	434	19,41	337	15,07
Fishing	65	2,91	28	1,25
Employed in Agriculture	120	5,37	78	3,49
Artisan	59	2,64	20	0,89
Small business	29	1,30	16	0,72
Employed (not in agriculture)	79	3,53	37	1,65
Employed by Government	67	3,00	9	0,40
Employed by landowner, maid	59	2,64	15	0,67
Retired*	317	14,18	0	0,00
Student	487	21,78	10	0,45
Housewife	298	13,33	202	9,03
Other	64	2,86	477	21,33
Not declared	13	0,58	0	0,00
Unemployed	145	6,48	1	0,04
Without secondary occupation	0	0,00	1006	44,99
Total	2236	100	2236	100

Source: UFPR-MADE / CNRS - Relatório de Pesquisa (2003).

* 60,88 per cent of retired persons were previously involved in agriculture.

rural populations in the EPA of Guaraqueçaba (table 3). Data was divided into two economic activities' categories: main and secondary. Results showed that although a significant number of main and secondary activities were related somehow to agriculture, a more complex scenario started to emerge, which could be described as an "economy defined not by agriculture (as traditionally was), but through agriculture. This was called a defined as a new rural pluri-activity (Hugues Lamarche in Ferreira 2002).

Data shows that in the past most inhabitants of the EPA were directly involved in agriculture (almost 61 percent of retired people declared that). Today economic activities seem to be more varied. Currently, just over 19 percent of the EPA's population does have agriculture as a main activity and 15 percent as a secondary activity. These are owners and/or employees practicing subsistence and commercial agriculture. Results also show a proportion of almost 8.5 percent of people indirectly employed with agriculture either as a main or secondary economic activity.

It is possible to conclude that most people of the rural areas of the EPA, more than 65 percent, are not involved in any agricultural activity, either as a main or secondary source of income either because these are students, house wives, artisans, fisherman, etc., while 21 percent of the population declared to be involved in 'other' activities. These results are intriguing, given the remoteness of the place and the very limited offer of alternative jobs and activities that can be developed in the region. So how are people surviving in the EPA?

These findings are also supported by evidence that show that only 12 percent of people living from agriculture in the EPA are really making their livelihoods from it. According to that, most people in the EPA are obliged to sell their labor to be able to sustain themselves (Rodrigues and others 2002). The question as to how these people are managing to do that in such remote areas and in face of the land use restrictions imposed by the Law that applies in that conservation unit remains still unanswered.

At the same time, increasing allegations of illegal activities are being reported by law enforcement agents, forest police, and NGOs members. These activities range from the illegal extraction of palmito (*Euterpe edulis*), wood, plants, and animals that are commercialized through an intricate web of transgressors to accusations about the existence of illegal agricultural plots in remote areas in the forest interior. Again, studies show the need that the local populations have to diversify their economic activities shifting from an agricultural base to a pluri-activity base.

Legal Land Use Restrictions and Social Conflicts

In order to address further the impacts that land use restrictions are having on the social and economic dynamics operating in the EPA, some aspects of the current Law are enumerated below:

- Compulsory authorization for opening new agricultural plots – This is granted by the federal or local environmental regulating agencies, namely IBAMA and IAP.
- Agriculture alongside river margins (20-50 meters) and in riparian(?) forest and areas of water wells is forbidden.

- Agriculture in hill slopes and river floodplains is restricted and subjected to previous approval.
- Activities of hunting and extraction are considered illegal.

Some studies (Zanoni and others 2000, Rodrigues and others 2002) indicate that these restrictions have affected directly the traditional economic practices. Main impacts are described below:

- Bureaucracy has in many cases prevented families to establish their subsistence agriculture plots.
- Restrictions to plant in the river margins have affected banana and corn plantations, main commercial cultures in the region.
- Restrictions to plant in hill slopes have reduced slash and burn activities affecting the traditional cycles of production.

Quality of Life Indicators for the EPA of Guaraqueçaba

In order to assess further how the legal interventions have benefited or affected negatively the quality of life of the traditional populations, a series of indicators were established through quantitative and qualitative studies conducted during 2003. Main results are presented below in the form of simplified negative and positive scores:

Negative indexes included aspects such as high criminality, high stress levels, alcoholism, reported use of drugs, high incidence of infecto-contagious diseases such as HIV, high migration indexes, low education standards, high unemployment, lack of job opportunities, precarious infrastructure and services, low health assistance, lack of information, poor access and transport, high incidence of resentment against governmental actors, ignorance about the relationship between natural preservation and tourism.

Positive indexes included high eco-tourism potential, high associativism and self-management potential, strong desire to remain in the region, high awareness about the local problems, high environmental quality, high biodiversity and natural resources potential, access to electricity.

This study also established that aspects such as cultural preservation, local productive potential, and human and ecosystem carrying capacity were not considered important by the local populations.

Main Contradictions Identified

Some contradictions generated by the above mentioned factors:

- The illegal extraction of palmito increased after the demarcation of the EPA. It has been reported that this illegal activity is coordinated by people from outside the community that serve as a middle man between the extractivists (locals) and the companies that process and commercialize the product (Santos, 2001).
- Illegal deforestation has also increased. Local families are opening clandestine agricultural plots in remote forest areas without respecting the traditional cycles and rotation schemes thus degrading the local ecosystems.
- Illegal hunting has also increased since populations are still hunting for subsistence purposes but also to commercialize endangered species animals in an established black market. Hunting is now taken place without regarding age, sex and species as it used to be practiced in the past. (Zanoni and others, 2002).
- Tourism related economic activities have increased but the local populations have not yet established a direct link between the local ecosystem preservation and tourism.
- Local populations allegedly report not having seen improvements in their quality of life, nor have they received access to services and infrastructure after the creation of the EPA.

These considerations suggest that local ecological limitations (environmental subsystems) have imposed restrictions to traditional practices (economic subsystem) without real intervention from the state and/or scientific sectors (government and education subsystems). What we are seeing is that sustainability is a variable directly dependant on social sustainability (Rodrigues and others 2003).

Analysis of the Dynamic Flows Occurring in the EPA

The idea of adopting a systemic approach to assess conflicts identified in the EPA derives from the need to: firstly, establish the main interactions between main aspects and actors involved in the EPA and secondly, to identify areas where these interactions are truncated and/or not flowing properly. In that sense, main problems identified between the analyzed flows can be described as:

- Government and scientific efforts were mainly directed to protect the natural environment with no or poor interest in the local social environment.
- Public policies defined for the area had a strong ecological basis and a weak local social understanding.
- Resources, science and technology has been employed to understand ecosystems specific aspects such as species habitats and characteristics, but have failed to address basic landscape ecological interactions and processes which are the basis to define management strategies by identifying critical areas, areas of risk, fragmented ecosystems, etc. The result is a poor or inexistent knowledge for establishing priorities for development and/or conservation, i.e., which areas can be devoted to agriculture, which are in need to be restored, where to establish ecological corridors, where can urban expansion take place, etc.
- Information has not been produced to be understood and passed adequately to decision makers such as environmental regulation agencies so that they could use it for law enforcement, monitoring and planning purposes.
- Information has not been produced in formats that can be of use to the local populations about ways for them to benefit from their local environment
- When designing laws to restrict land use in the EPA, no other alternatives that were consistent with the EPA ecological limitations were designed to allow the subsistence of local populations
- Initiatives of dialogue between all actors involved seem to have failed due to inability of negotiations and/or lack of understanding about the other needs and expectations
- Although it is now known that one of the biggest potential of the region is based on tourism, information and science produced until now is not organized in a manner to plan that activity sustainably and mitigate its potential social and environmental impacts.
- Local populations are not aware of the importance of their participation to develop and manage tourism in the EPA. They need to be reconnected to their landscape and land.
- Considerable effort is now needed to restore trust between local populations and governmental authorities and research institutions. This can only be done through results reflected in the real improvement of services and income generation.
- Technological knowledge and science need to be directed towards strategies that address sustainable pluri-activities, considering low impact selective forest management, organic agriculture, agroforestry

systems, sustainable landscape design, eco-tourism, and other alternative technologies developments consistent with the EPA's social and ecosystem preservation.

- Local cooperatives and associations need to be adequately implemented and supported by the local governments and public policies until they become self-sustainable.

Basically, what all these considerations suggest is that although science and information has been produced, it has not been adequately generated in order to assess real needs of all actors involved and also, that the necessary dialogue and interaction amongst actors has not been properly established. There seems to be the need to identify a hierarchical scale of information generation, namely starting from the local to the regional and global levels (fig. 3) and through the implementation of a strategy to make this information flow in a multidimensional manner so that it includes all aspects relevant to the systems and subsystems operating in the EPA.

Conclusions

This study has shown a clear breakdown in the information flows that take place between the actors that interact in the Guaraqueçaba situation. In order to assess clearly where these flows should be (re) established they have been organized in three main categories according to their scale of interaction:

1. *Local Scale Information Flow*: relating to information that should be produced and disseminated at the local level, namely in the Guaraqueçaba area. It should be produced with the assistance of local populations, with high technical input and content but derived in a way that is easily digested by the native communities. It should address items such as: local ecological properties and limitations, economic potential, alternatives for natural resource use and agricultural activities that are sustainable, inform about reasons for legal land use restrictions, include traditional knowledge, include local human priorities in preservation strategies, robust technological input to implement sustainability, prepare locals to manage and profit from tourism activities that are educative, sustainable and lucrative.
2. *Regional Scale Information Flow*: This type of information should be derived from the local level information and expanded to address the interests and scope of the regional actors, such as government, academia, scientists, etc. In that sense, it should subsidize development plans, law enforcement, investors, and other decision making processes at a regional scale. It should never be derived using a bottom down

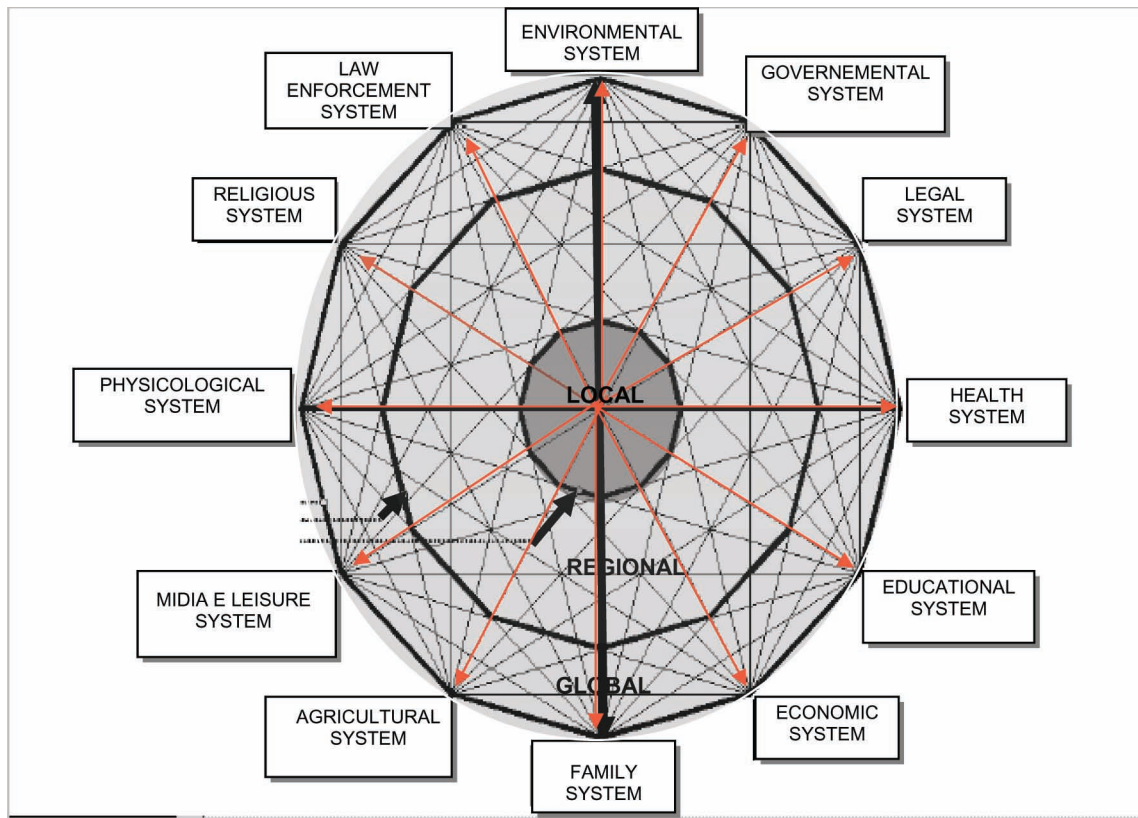


Figure 3. Information generation flow from local to regional and global.

approach (global to regional) and always adopt a bottom-up approach (local to regional). At this level, knowledge and information on how diversify production in Guaraqueçaba should be developed. Regional markets should be implemented and prepared to absorb local production. Tourism activities should be formulated and implemented.

3. *Global Scale Information Flow*: This type of information should be generated always from the local and regional information flows and expanded to meet the demands of the global society. It should provide the global actors with information on the local, regional, and global perspectives of the area in question. It should address the need to promote science, education, and understanding of the importance of adopting a systemic and scale dependant approach to promote a balanced social, economic and ecological sustainability.

Although some initiatives are already taken place, these are still on their onset in Guaraqueçaba. Information is still sparse and actors experience difficulties in negotiating and establishing dialogue. It is believed that dialogue will flow better if from now on efforts are devoted to produce only the right and strictly essential information and shared among actors. Also, in order to achieve the adequate formats to the meet the needs of

the various audiences involved, a hierarchical approach as the one here suggested should be implemented.

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