

FROM REVINDICATION TO PROPOSITION: CAPACITY BUILDING IN NEGOTIATION ABOUT WATER MANAGEMENT IN PERIURBAN AREAS. THE "TERAGUAS" APPROACH IN SAO PAULO, BRAZIL

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1. Introduction

Water resources management is associated with different types of conflict, either related to management itself, or to the way conflicts are handled. Among the first type, the most recurrent are conflicts related to water development projects (dams, irrigation schemes, water services) and their effect on the water resources, on the societal system, competition between multiple water uses and/or different areas, and disagreement over the management of the water supply under different agreements, the implementation of new policies and regulations, changes in water ownership, or new external stresses such as the impact of climate changes (Dorcey, 1991; Nandalal, 2003). Because of the complexity and dynamics of peri-urban catchments, the range of human interventions and activities that are being developed, these areas are particularly prone to such conflicts. While conflicts generally have a negative connotation as an indicator of social dysfunction, they can also have positive social outcomes i.e. they can help build the community and promote economic and social changes (Upreti, 2000). The problem lies more in the way conflicts are handled. Various approaches or “forums for conflict resolution” can be mobilized to solve environmental conflicts, depending on the situation; the most traditional are political mechanisms, legislative or judicial mechanisms, or bureaucratic mechanisms that rely on administrative decision making (such as licenses, guidelines, planning procedures), market mechanisms, the press, and mediation. The role of negotiation processes in resolving environmental conflicts is being increasingly advocated. Its role in environmental management has been strengthened by the development of planning processes. Strategic planning is viewed less as the elaboration of an enlightened plan than as a participatory, flexible and adaptive social process (Cecchini, 2001) that relies on negotiation and collective decision making. In this type of process, using negotiation and collective decision-making processes is viewed as a way to develop and implement more sustainable policies and avoid subsequent conflict (Amy, 1994). Two types of negotiation situation can thus be differentiated: (i) negotiation to solve an issue or a time-specific conflict; (ii) negotiation developed for strategic planning and for the management of the natural resource, is the negotiation generally taking place within multi-stakeholder platforms (Steins and Edwards, 1999). Improving such negotiations and new planning processes can be achieved in various ways: creating or strengthening the multi-stakeholder platform; improving negotiation

procedures within the platform; providing facilitation or mediation support; building capacity in mediation skills; enhancing the negotiating capacity of the stakeholders and developing their negotiating skills (Bruns, 2000; Walker, 2001)

This paper presents a method to increase the capacity of local community leaders to participate in negotiations concerning land and water management. In the first part of this paper we describe the context of the spring water catchment of the metropolitan region of São Paulo where this intervention took place. In the second part, we present the method, how it was elaborated, the content of a series of workshops, the context of the implementation tests and the method of evaluation. Finally, in the third part, we present and discuss the results of the implementation tests.

2. Towards more participatory management of resources in the peri-urban areas of São Paulo

Sanitation conflicts in the peri-urban spring catchment of São Paulo

The Metropolitan Region of São Paulo (RMSP) is the most highly populated and industrialised region of Latin America. In 2000, a conurbation of 39 adjacent cities was home to around 18 million inhabitants (Braga, 2000). The Alto-Tietê catchment, upstream of the river Tietê, includes most of metropolitan São Paulo. Urbanization processes have had an enormous impact on the catchment, especially its peri-urban areas. While population growth has fallen to 1.4% per year city-wide, peripheral areas are continuing to grow at an average rate of 3 to 5% (FUSP, 2000). The water supply system in the metropolis (six centralised and interconnected production systems) is managed by a public-private enterprise, SABESP (*Companhia de Saneamento Básico do Estado de São Paulo*), which is also in charge of the sanitation. While drinking water distribution has an excellent coverage rate (close to 100%) in regular urban areas, it is more precarious in peripheral areas. The collection of domestic effluents remains incomplete. Despite recent investment, in 2000 only an estimated 65% of effluent was collected and only 32% treated (Porto, 2003). Domestic wastewater collection is especially low in peri-urban areas, which are particularly affected by the rapid development of sub-standard settlements. A large part of this periurban area is located in the headwater catchment (*mananciais*) where springs arise and have been protected by legislation since the 1970s with the aim of controlling land occupation. However, the measures failed to significantly contain the urbanization processes or to reshape city growth (Bellenzani, 2000; Marcondes, 1999). Illegal settlements without sanitation infrastructure continued to spread and contribute to the rapid degradation of the quality of water resources.

The problem is particularly acute in the Cotia-Guarapiranga catchment, an area of 905 km², which comprises seven different municipalities. It includes the Guarapiranga reservoir which provides 15% of the domestic water supply of the metropolis with a direct catchment area of 643 km². Home to 3.8 million people, this is the most densely populated catchment in São Paulo (4,275 inhabitants/km²) and one of the most severely affected by urbanization. About 15% of the total catchment area is considered urban, nearly completely surrounding the upper third of the catchment. The reservoir has suffered from high organic pollution rates since the 1970s, mainly due to inadequate sanitation and wastewater collection in illegal settlements. To rehabilitate the reservoir, improve the quality of water, and reduce treatment costs of the water supply, in 1990, a large-scale investment programme, the *Programa Guarapiranga*, was implemented with the support of International Development Bank. This programme was in itself quite innovative from an environmental, urban governance, and institutional point of view (BELLENZANI 2000; MARCONDES 1999). In contrast to regional planning, it promoted inter-sectoral cooperation and discussion in a new form of integrated intervention at municipal level (Porto, 1999). However, it also gave priority to structural activities over participation, capacity building and support of economic activities. The inevitable result was that, in the face of population pressure, the programme did not manage to reduce water pollution in the catchment. However, it did allow the

testing of a number of tools that were later included in the legislation passed on *mananciais* and it promoted effective sectoral cooperation in the discussion of both the tools to be used and the legislation (Gondolo, 1996). It made it possible to elaborate one of the first models to simulate the impact of changes in land use on water quality and to develop the first specific legislation for catchment management, the Specific Law of Guarapiranga (*Lei Especifica de Guarapiranga*). After years of discussion, the law was finally approved by the state legislative in 2005 and is included in the new water framework, though it is already being criticised. This newly developed water framework is part of the promotion of the development of more participatory modes of management of natural resources at national level including both land and water. Thus, in the study area, participation has been promoted at different levels (figure 1).

Figure 1: Land and water management instruments and participation at three different scales

	Metropolitan level	Local	Microlocal level
Water management	Catchment planning (by the Alto Tietê catchment committee)	Sub catchment planning (by sub catchment committee)	Communities represented in the sub catchment committee and participative planning process at municipal level
Land management	<i>Not really operational</i>	Spring catchment protection instruments (planning, zoning) at sub catchment level Municipal territorial and budget planning	

Municipalities are in charge of land management and, in 2001, a Federal City Statute (*Estatuto da Cidade*) was adopted to try and reverse urbanization mechanisms in a different way. The legislation recommends the use of incentives rather than sanctions, and promotes new urban management practices ranging from participatory planning at municipal level to a process of legalising illegal settlements based on the specific context of each case (Rolnik, 2001). Similarly, a new water policy based on integrated water management principles was implemented to promote more participatory management of the resource at catchment level. In each catchment, a river basin committee was created as a discussion and consultation body. Because of the complexity of water management in this urban catchment, the Alto Tietê catchment was divided into five sub-catchments, each with its own sub-committee. The Guarapiranga-Cotia sub-committee is one of them.

But interaction between actors remains problematic

The new water and land governance framework strengthens the need for discussion between different stakeholders and levels of management, but the successful functioning of the discussion bodies is weakened by the limited representation of local communities, high social inequalities and asymmetry of information and decision power.

One third of the members of the catchment and watershed sub-committee are representatives of State institutions (such as the State Ministry), one third of municipalities, and the remainder of organised bodies of civil society (such local universities, local corporations, unions, local environmental NGOs, district associations, etc) (Porto et al., 1999) with between 8 and 14 titular members of civil society. These bodies thus include representatives from different backgrounds, but even representatives of the same sector can be very heterogeneous.

For example, the Guarapiranga sub-committee includes representatives of the politically and financially powerful municipality of São Paulo, as well as of smaller municipalities which may be completely rural (Sao Lourenço da Serra) or currently undergoing urbanization (such as Embu

Guaçu). The smaller municipalities often lack the human, technical and financial resources to tackle the issues raised by urbanization (Puechberty, 2006) and coordination between municipalities in the sub-committee is all the more difficult because alliances are often more related to political orientation rather than to shared development or environmental concerns. Coordination between Sabesp and the municipalities is also insufficient partly because of the lack of strategic planning in the case of some municipalities and/or adequate coordination of planning and development between Sabesp and the municipalities. There is also marked asymmetry of information and economic resources between the representatives of civil society, which includes organisations as different as the local branch of Engineers or *Arquitect Syndicate*, fragile local environmental NGOs or inhabitants who belong to associations of illegal settlements. Moreover, the representativity of participants can also be questioned. Thus the composition of these discussion bodies appears to be far from the ideal composition of a multi-actor platform (Faysse, 2006), which necessarily undermines the efficiency of decision making and information exchange.

Local communities that only comprise inhabitants of the settlements are very heterogeneous and are organised to varying degrees. By analyzing different settlements in the Guarapiranga area we were able to differentiate different types of settlement as a function of how they were formed and of their inhabitants. A variety of small and more or less clandestine settlements may be located next to luxury 'closed settlements' (*Condomínio de Alto Padrão*). Some of the former are low-middle class settlements which have resulted from the progressive division of land that occurred over a few or even over many decades and which are generally better preserved in terms of environment, even if they may lack certain urban infrastructure such as transport or waste water collection. Depending on the extent of division (minimum size of the plots) the settlements may or may not be legal. Others are illegal settlements resulting from pure speculative processes. Even in this case, the level of organization of the residents, especially at the start of the operation and/or the integrity of the speculation process, directly affects their urbanization characteristics: the better organised the community (or the less fraudulent the speculator), the more likely are they are to display urban municipal characteristics other than density that will eventually facilitate their legalisation (Bueno, 2004). Actually, the illegal land market that developed since the 1970s is now well institutionalized. Some irregular communities have developed a strong sense of territorial appropriation with time. On the other hand, areas close to the core urbanization frontier that are facing rapid urbanization are subject to migration and population rotation, which weakens social links within the community. The settlements are sometimes heterogeneous: the areas preserved for future regularization such as land reserved for schools, public health centres or forested areas are often invaded and transformed into precarious settlements (*favelas* within the irregular settlement). However different they may be, the main concerns of the population of these settlement are more focused in securing land titles and better housing conditions, household welfare, health, education, security and violence control, than water preservation and sanitation (Barban, 2005). Even local environmental organisations may not be well informed about the impact of sanitation on health.

There is almost no tradition of participatory interventions in these peri-urban areas and little previous communication between representatives of government and research institutions. In each study area, residents interviewed said that the Negowat intervention was the first direct contact with research they had had. As for relations with institutional actors, the real-life role of residents' representatives is generally limited to listening to presentations of plans or explanations by the water company or the municipality, while the attitude of these actors and of the government is often paternalist. This traditional attitude, added to the lack of financial and human resources of local municipalities, explains the lack of in-depth discussions with local communities. Local residents' associations, for their part, have little interaction among themselves, and instead compete with one another to obtain greater material advantages from the municipality. As they are often connected with the local electoral system, they tend to develop a political discourse that is not well grounded in reality.

In such a context, promoting a real dialogue between actors on a complex issue is particularly challenging. There is a need to build trust between the different actors, as well as to improve the capacity of local actors to efficiently interact with institutional actors both during negotiations and opposition phases.

The Teraguas process in São Paulo was intended to support the *rapprochement* of different stakeholders interested in the local planning and development process in a protected peri-urban catchment area. It was designed to build the capacities of local stakeholders in related negotiation processes and to help them assess some alternative local and shared solutions as well as to contribute to water quality preservation in the *mananciais*, taking advantage of the possibilities offered by the new legislation to protect the Guarapiranga spring catchment.

3. A two-step companion modelling approach

The method is based in a companion modelling approach that was applied in two steps. The first step involved developing tools that combined the interests and point of views of the different actors. In the second step, the tools were integrated in an approach called the ‘Teraguas approach’ comprising a series of workshops including a role-playing game named Ter’Aguas, that can be replicated in a relatively short time, which is an important feature when intervening in such a heavily populated area. This approach was tested in two different areas. Its implementation was monitored to evaluate the proposed method.

Elaboration of the tools and method of intervention

A theoretical computerised role-playing game called JogoMan was designed to train partners in the development of computerised role-playing games and in how to implement and monitor such games, based on a review of the literature and preliminary interviews with institutional actors (Adamatti, 2004; Camargo, 2006). Test sessions with students revealed flaws in the conceptual basis of the game and the need to better understand certain interactions, which led to the implementation of thematic field studies. A new general conceptual framework was collectively elaborated during the field studies to facilitate dialogue between and integration of the different disciplines involved.

The framework included: (1) a representation of the spatial dynamics, in particular the evolution of land use, (2) presentation of the actors differentiated according to their residence and land tenure, and their direct or indirect influence on land and water resources (3) a simplified representation of the hydrological processes, in particular changes in phosphorus pollution organised around spatial representation, water allocation for different uses and a simplified representation of quality dynamics focused on changes in phosphorus content in the water bodies.

Though highly simplified, this framework underlined different key elements in understanding land and water management in peri-urban areas such as : (1) the relationship between the dynamics of land use and land markets (depending on owner strategies) (2) the role and the development of urban infrastructure (3) the impact of these dynamics on the quality of the water resources (5) the difference in social interactions and the impact of direct or indirect actions by resident and non-resident actors on the resources. Permanent residents are supposed to be integrated in local social networks that strengthen possible social control. The stronger these social networks, the better they facilitate local long-term residence and minimize the chance of migration. The framework identifies only three main types of non-resident actors: owners of week-end houses; businessmen with economic strategies, and large landowners with land speculation strategies. These actors were considered to have weaker links to local territory and to be mainly motivated by economic strategies and thus identified as interacting differently with the land and water resources than local residents.

While the framework was being developed, a series of workshops was held for representatives of local residents from some settlements of the Guarapiranga catchment. The group was formed on a voluntary basis after the report of a thematic study that identified the main organisations in a small study area. The study focused on household and environmental associations. Other types of organisations, such as religious associations, were not included in the study. This series of meetings enabled us better identify the representations of local actors on environmental issues, on the dynamics of development of the different areas, on the urbanization process and on their negotiation strategies with the municipality and with the water company. To facilitate the interaction, different methods were tested during these workshops such as graphic representation of the settlements' main problems and assets, and comparison with neighbouring areas, discussion of landscape changes using scale models, etc. Some of these methods were later adapted and used in the first steps of the Teraguas approach.

These workshops revealed that local residents tend to only pay attention to problems that are visible (such as release of solid waste into rivers or invasions of rats). Even links between pollution and health problems were mainly linked to visible sources of pollution (chemical leaks for example), rather than to domestic effluents, which are in fact the main problem in the area. When asked to list difficulties connected with water or environmental problems, many residents who were migrants from the north-eastern semi-arid region of Brazil spontaneously mentioned the water scarcity or salinity problems of their area of origin. Environmental issues were spontaneously linked with deforestation. This indicated that access to water and pollution are not necessarily perceived as serious problems. Actually, local residents are mostly hoping for improvement in their quality of life which includes improvement in transport, health and education infrastructure and are eager for information that would allow them to legalise their situation (Barban, 2005).

A small group of scientists was in charge of drawing up specifications for the underlying computer model of a role playing game that was intended to be the core tool of the interaction between the actors, using the “actors-resources-interaction” framework proposed by the companion modelling group (Etienne, 2006). After identifying the actors involved, the resources at stake, and the impact of their actions on the resources, the model specifies the tasks, indicators and information used by selected actors for their decisions, the relationship between the actors, and the management reference framework. At the local level of our study, the most important mechanisms were changes in land use and the group thus focused on eliciting the mechanism that governs the land market and land use changes, its relations with urbanization processes, and the resulting impact on resources. A similar study carried out at catchment scale focused on water allocation mechanisms and changes in water quality (Clavel et al., 2008). But these dynamics were not relevant at the level of the settlements we studied. The representations of the local actors in the focus group were indirectly integrated by the mediators of the focus group participating in the elaboration of the underlying model.

The underlying model was then used to develop the materials needed for the game (board, paper, computer model, rules, and letters). Two games were developed and tested with the focus group using the same conceptual basis. The first game was entirely manual, using coloured marbles to simulate water dynamics. This game proved interesting as a didactic tool but was not enjoyable or dynamic enough to sustain discussion and interactions between actors. Another version called Ter’Aguas was developed using Cormas multi-agent software to simulate population dynamics, some social indicators and water quality evolution.

Box 1: the Ter’Aguas game

Ter’Aguas is a computer role-playing game used to simulate negotiations related to land-use planning in a peri-urban municipality. It is based upon the Specific Law of Guarapiranga. Six types of actors are represented: the mayor of a municipality, who is in charge of the development of urban infrastructure (roads, school, health centre etc); a water company, which is in charge of the development of water and sanitation infrastructure; four district representatives, who defend the interests of local inhabitants (different types of district in terms of access, type of settlement, homogeneity, proximity to rivers); two small-scale farmers from

the surrounding district; two big landowners with speculative and electoral strategies; and one owner of a weekend house who also defends environmental issues in the catchment.

The players take decisions concerning investment strategies in urban infrastructure or water and sanitation, subsidies and taxes on land, buying and selling of plots, developing property, land-use activity, licensing land uses and activities, and allocating land to local migrant families. The computer simulation rapidly assesses the impact of land-use changes on the quality of the reservoir water (with the help of an adapted version of the Mqual model), on the cash assets of the players, social indicators (employment) in the municipality and the possible settlement of migrant families. After one round of decision-making, all the players get together to try to find a more cooperative planning strategy and try to implement it in the following round. A new round is then started following the same pattern of individual decision making followed by a collective planning meeting. The interactions can focus on strategies for urbanization, investment in urban infrastructure (sanitation, piping, wells, roads etc), land-use planning and land market dynamics.

The game was tested first with students and scientists to assess its playability and practibility. The game was then played with the focus group, and with representatives of the municipality and of the water company to validate its contents. These sessions resulted in the integration of some components that had not been previously integrated in the game such as superficial wells. The spatial representation that was based on a SIG representation of land use was stylised leading to a more virtual landscape than in the original version. But participants asked to focus on the diversified aspect of their settlements, which generally includes land of which they are the institutionalized owners, along with public areas or even conquered land. The test also revealed how difficult it was for the representatives to distance themselves from their everyday life and to get involved the game in the presence of high level representatives of spheres that are normally very difficult to access. They viewed the meeting as a unique opportunity to express their real demands and needs using their traditional methods of interaction, which put an end to the first round of the game. They decided to play on a different occasion using a simplified version of the maps. When the second test was conducted a month later, not everybody who had participated in the first game was able to play, and there were also new players. This time the roles were intentionally inversed. This turned out to be interesting for the players who had already played the game before, but was resented by new players who found it hard to play a role that did not match their real life situation and that they had expected to play after talking with the people who had already played. However, the game did lead to fruitful discussions about legalisation and negotiation processes and enabled the players to discuss the attitudes and behaviour of the different parties in a negotiation, and thus validate the game as a discussion platform for local management issues.

Method and tools

Our aim was to assemble the different steps of the development phase into a structured method that could be replicated at a larger scale and in a shorter time. We wanted to develop a suitable companion modelling approach that would allow local stakeholders to analyse and understand the interactions between land/water and actors and to prepare them for interaction with other actors.

The “Actors resources interactions” method was used to structure a series of six workshops. The two or three first workshops aimed to help local representatives to analyse the resources and their dynamics, and to identify the relevant actors and the impact they had on the resources. To facilitate analysis, the structured interaction tools that had been tested with the focus group were mobilized. Participants were asked to identify the main resources of their settlements using a predefined board game representing different types of resources (related to land and water but also to an urban environment such as transportation and schooling) and a schematic map. Comparative analysis between different settlements was encouraged to help participants identify permanent key elements (for example access to potable water, transportation) and specific elements. They were asked to trace the evolution of the settlement and at the same time, to analyse changes in resources due to population dynamics. A third session concentrated on identifying the main actors and their impact on the resources using a card system. Particular attention was paid to identifying all possible actions, not just legal actions, although at the end of the session the discussion did distinguish illegal activities from others.

The aim of the four sessions was to help participants identify possible modes of interaction between actors by means of a brief play: a question concerning a virtual environmental was presented orally and participants were asked to play the role of a specific actor after a short time for preparation. The play was kept short to avoid digression, which can often happen when a situation is too ‘virtual’. More time was spent in collectively analysing how the play went in order to identify the attitudes, argumentation, and relationships that had arisen. It also helped participants grasp the interest of a virtual situation to analyse their real-life difficulties and thus prepared them for the next session, the ‘real’ role play.

During the ‘real’ role play, other actors (representatives of the municipality and the water company) were asked to participate. Other actors were also invited such as representatives of local firms who have close links with local residents. Local farmers were also invited but did not participate. The Ter’aguas game was then played. Local stakeholders were assigned a specific role depending on their profile. For example, a very active representative could be asked to play the role of the mayor alongside the official representatives in order to help them better understand the interests of the other actors. A collective debriefing session was always held at the end of the game.

A final debriefing session was organised to help local stakeholders to link the virtual situation they had been involved in and their real problems and issues. One particular tool was adapted to help them prepare specific negotiations by identifying the other parties in the negotiation, assessing their position and potential interests, inventorying the resources and support (technical, informational etc) they would be able to mobilise for the negotiation, identifying the point of departure, and suggesting points for the discussion.

Box 2: the Teraguas approach

A series of 7 activities took place during one or more of the series of either 4 or 6 workshops:

- Mapping the relationships between resources (land, water, housing, urban infrastructure) in each settlement and comparing settlements to identify similarities and differences.
- Reconstructing the development of settlements and what had led to the present situation in order to introduce the dynamics of resource relationships.
- Reconstructing a simplified version of the dynamics (for example land market or land use); (this activity was only implemented once).
- Mapping actors, responsibilities and activities (legal or illegal) linked with resources.
- Short play created in the basis of a rapid identification of a situation close to the real issue, and adapted from a pre-existing game, “Desafios das Aguas”, in order to introduce multi-party negotiations.
- Playing the Ter’Aguas game followed by a debriefing session. This helped to connect all previous elements, provide a dynamic view of the situation at regional level, and experiment with new attitudes and solutions.
- Planning actions or negotiations related to selected issues. This helped stakeholders to prepare a specific action or negotiation and identify their need for further information, mobilisation, actors, etc.

The two case studies

The approach was tested in its full extent in two areas of the Guarapiranga catchment, (i) one to strengthen the capacity of local stakeholders in negotiations related to urban infrastructure and development, especially sanitation, and the other (ii) to prepare local stakeholders to participate in a local municipal planning process

Local planning in the municipality of Embu-Guaçu

The method was proposed to representatives of the Embu-Guaçu municipality as a way of strengthening the capacity of local leaders to engage in a new municipal planning process. Unfortunately, it was impossible to develop these activities before the “participatory” discussions started as part of the planning process. Thus, the Teraguas process took place at the same time as (and continued after) these consultations. The Teraguas activities, five meetings over two and a half

months, were planned so that they did not clash with the six consultation meetings for the municipal master plan, even if in practice, only a few representatives attended these meetings. Lack of interest, combined with lack of information in what was supposed to be a planning process and a municipal organisation that was not really adapted to involvement of the public may explain why participation was so low.

At the suggestion of the municipality, we decided to work in the northern part of the municipality, in a remote area which has to contend with an influx of illegal settlers from the adjacent M'Boi Mirim urbanized area of the municipality of São Paulo, close to the reservoir. It was not possible to rapidly identify any residents' organisations. The municipality suggested working with health agents who act as intermediaries for activities in this area. Health agents are part of the municipal health movement which aims to decentralize health services in each settlement by recruiting and training local people. The health agents showed a keen interest in water management issues, especially access to clean water and sanitation, as these are closely related to health. They had had little previous opportunity to discuss the origins of pollution or the related problems and dynamics, even if they sensed it was important for their interactions with local communities. Two local NGOs also joined the group but no other movements or organisations participated.

This was the first time the approach had been implemented and it was consequently adapted as we went along. The first two meetings were normal from the point of view of procedure. In the third meeting, we spent time on the collective analysis of the land market dynamics and its impacts on urbanization and ultimately on water resources. As it was the first time we had conducted this kind of collective analysis, the material appeared to be a bit too academic and could have been simplified. It was very difficult to get representatives of the municipality to take part in the game (partially because of their involvement in the development of the master plan) and, when they were available, the water company (SABESP) representatives were not available. Thus during the actual game, the water company was not represented while the municipality did participate, as did a former representative of the planning service and representatives of the agricultural services. The game was enjoyable and dynamic and agents who had participated in earlier workshops did not report any lasting difficulties in playing or understanding the game.

The last meeting of the Teraguas approach held in this area was devoted to a presentation of the main elements of the municipal master plan, its relationship with the specific law of Guarapiranga and the opportunities it might offer in terms of legalising settlements and access to infrastructure.

Negotiating the development of infrastructure in the Parelheiros district

At the request of Parelheiros sub-municipality, a district on the southern tip of São Paulo city, (pop. 200,000), an intervention was planned to help resolve a conflict over sanitation infrastructure. Thanks to a new decentralised water system based on an artesian well managed by SABESP, three settlements in the area had recently gained access to drinking water. This system was constructed after a judicial order that the settlements were entitled to water services, as they had been legalised a decade ago. However, no sanitation service had been planned and SABESP and the district authorities were willing to promote the use of septic to avoid pollution. The inhabitants of the slum resisted this option as being expensive, not technically appropriate and more difficult to manage than a sanitation network, which was considered as the "normal" option in a place where sanitation is not thought to be an important issue. In the context of this disagreement, the municipality asked the project team to help out, perceiving the proposal as a communication exercise that could facilitate the implementation of the technical solution they proposed. Although there was no open conflict, tension was high and there was a complete lack of mutual trust between the settlements and the municipality.

A series of four meetings was held, one every Saturday, mainly with district representatives, members of the settlement organisation and some individuals, i.e. a core of group of at least 10 and sometimes up to 20 people. Although the involvement and competence of individual representatives

was recognised, many participants regretted the lack of ties between residents and their representatives, and the lack of involvement by residents in any collective action concerned with their immediate interests. The municipality was represented at only two meetings, including the Ter’Aguas game. A couple of people were afraid that the meetings would result in their expulsion, which is a serious concern among people who are insecure about their land title and are more or less aware of being illegal settlers in a protected environmental area. The last meeting (the fifth one) was devoted to drawing up a plan for the negotiation with representative of the communities.

Evaluation

The approach was evaluated in two ways. After each workshop, the intervention team discussed its own interpretation of the outcomes of the meeting and wrote a short report. Each session was also videorecorded, and most interesting moments were partially transcribed in the report. Game sessions were more specifically monitored by two people whose job was to observe the development of the game including the behaviour of the players and of the discussion using a closed questionnaire as a guide. At the beginning and the end of the session, the players were also asked to reply to a short general questionnaire aimed at evaluating their overall representation, as well as their expectations and achievements. At the end of the intervention, a discussion was held with the participants for a collective evaluation of the process. This on-the-spot evaluation was completed by a series of interviews with participants eight months after the end of the intervention.

4. Discussion: Contribution to capacity building

The evaluation underlined the contribution of the approach to building the capacity of community leaders to interact with other actors to deal with problems related to urban infrastructure.

The sequence of work was organised to enable local representatives to change the way they interact with other actors and to present a more global view of the issue of land and water at local level. The first steps were essential for the success of the whole approach and the role playing games and last session would not have been as successful and dynamic without the first steps. The first session was important not only as a description of the development and problems of the district and the identification of key resources, but also as a platform to express and clarify their grievances. It also helped them to understand the similarities between their problems and those of other settlements and thus to have a regional view of such problems, as well as how to initiate a discussion about how housing development and land and water resources are interrelated. The subsequent steps helped them to link and better understand the role of different actors, of which they previously had a very fragmented view. The introduction of negotiation by the short play was a particularly important moment. It helped the players to think about the contents of a negotiation and what kinds of attitudes can help or harm negotiations. For example, settlers often tend to be passive when confronted with the paternalistic attitude of the authorities. This has often led settlers to accept any answer without clear justification or argumentation, and to break off the discussion, especially since their own argumentation is generally not well constructed or informed. The short play also helped to prepare them for the more complex simulation of the role playing game when they face representatives of other parties, whom they are not used to meeting on such an equal footing

The Ter’Aguas game identifies the links between actors’ decision-making processes and resource dynamics (housing development, pollution, etc.) and simulates collective action. The game proved to be enjoyable and dynamic, and players were rapidly involved and very active in the game in spite of its apparent complexity. The game used different types of support (maps, information sheets) which required the ability to read and write. This proved to be very difficult for most of the local actors as there was a lot of information for them to grasp. This is why after the first test, we asked players to focus only on decision making and their strategy, while project facilitators filled in the information sheets needed to feed the computer program. Because the game deals with the usual every-day activities of the players, they were rapidly able to make the connection with their own

activity. Once the rules were clear and players were freed from the writing requirement, they quickly identified with their role and activities. The participants did not report any difficulties that could not be overcome after the first (learning) round, apart for one or two people who needed two rounds (Jacobi and Granja, 2006). However, the game clearly would not have been so successful without the previous workshops.

In Embu-Guaçu, the post-game evaluation session indicated that participants – especially those who participated in the whole series of meetings – benefited from collective learning about what negotiation means in terms of mutual benefits, the different interests involved, the need to come to the table with some proposals and, finally, how to integrate a more global view of development issues including the interests of people living in the settlements. While participants mentioned interesting interactions with the “virtual” authorities, they were very conscious that, in the real world, access to the municipality and public authority is very difficult. At the same time, the representative of the municipality mentioned how hard it was to implement a real participatory process to elaborate a master plan. The interest of the health agents was not limited to the content of the discussion (knowledge and information concerning the relationship between land use and occupation, spring protection, water management, information on the legislation), they were also interested in the method. Subsequently, the supervisor of the health officers asked us to give them formal guidelines for the method so that they could adapt it for use in their work with local people on health issues.

In the long term, the intervention was mainly seen as an opportunity to learn how to interact with other actors and in negotiation processes. The process encouraged the participants to think about interaction mechanisms and about the diversity of interests. It also made them aware of better ways to formalize their claims, to engage in real dialogue and negotiation with public authorities. Technical learning was also occasionally mentioned, such as the relationship between the sanitation infrastructure and the pollution of water resources and health: Before the intervention, sanitation infrastructure was only seen as a convenience that was not directly related to water quality: even if before our intervention health agents had actively recommended filtering water, they had paid little attention to the origin of the water and its consequence in terms of the degree or type of pollution. Globally it helped them to clarify the interaction between land use, the development of infrastructure, and the quality of the water. It helped health agents make slight changes in the way they interacted with the inhabitants in their daily work. For example, the health staff introduced new group techniques based on some of the techniques used during our intervention in training their agents, and the agents pointed out that they had improved their capacity to listen to the local inhabitants when carrying out their daily activities.

In Parelheiros, although the process did not enable identification of detailed alternative solutions to improve sanitation and the related negotiation process, some interesting proposals started to be discussed during the last session. All the participants understood the possibility of collective solutions, for example by creating partnerships between SABESP, the municipality and the communities to share the investment costs of individual septic tanks, and perhaps even maintenance costs. The process also allowed participants to think about and to discuss how they interact with local authorities, and about possible ways to elaborate collective solutions. It shed new light on stakeholder attitudes and modes of negotiation and gave them the opportunity to discuss various aspects of negotiation: ‘free riding’ (by people who benefit from the negotiation without playing a role in achieving it), monitoring an agreement, handling and using information in argumentation, assessing one’s role and responsibilities, and the constraints of the different parties. The process was also important for rapprochement between opposing parties.

There were relatively few references to technical or information learning in the long term evaluation even if the fact representation were mentioned indicates a better understanding of the relations between urbanization and land. Local leaders mentioned that they learned a lot about how to interact with public authorities, such as asking for detailed and justified answers and not accepting just any answer as definitive, having a more proactive attitude by proposing potential solutions or

possible alternatives, increasing their involvement in analysing the different aspects of a question, awareness about expressing their point of view and opinions, awareness of the resolution of problems as a process requiring different steps and different people, better awareness of how to look for and use useful information. It thus completely changed their representations about interaction mechanisms and promoted more proactive attitudes. For the most active of them, it also led them to rethink the role of the different actors in regional development including the role of the local associations and local leaders, as well as individual action versus collective wellbeing. But if representations have clearly changed, no concrete change in daily practices was mentioned, maybe because local inhabitants are still very much engaged in the traditional way of interacting. However, institutional actors (representatives of the municipality and of the water company) mentioned an increase in their ability to listen and in their sensitivity in taking into account proposals put forward by the local population on how to build solutions.

5. Conclusions

The method described here helped to build the capacity of local representatives involved in the process of negotiating the development of infrastructure around a protected spring catchment. But the intervention also revealed many problems that may stand in the way of constructive collective action. Existing organisations are weak, lack structure, and attract little support from local people. In areas characterised by migration and high mobility, there is often no formal organisation and leadership remains weak. The population is often not really involved in collective action, either because of a lack of a sense of community or as a result of ingrained attitudes toward public authorities. Actions to ‘upgrade’ the district are often the concern of just one or two people. If these people have links with local political interests, this only gives rise to further internal conflict. Some of these policies are clearly related to local private interests. Representatives reported a general lack of information about -or interest in- the spring catchment area.

The evaluation indicated that the approach helped participants to make sense of their situations and to discuss how their decisions affect resources and the lives of other players. It also helped them to better understand the roles, responsibilities, interests and positions of other actors and opened up avenues to non-traditional modes of interaction. Ideally, the final step would have been to use what had been learned during this process to elaborate new negotiation strategies on specific issues. Unfortunately, we were not able to accompany this group further in the development and implementation of these strategies within the project’s time frame. Another problem was the difficulty to mobilise other actors, particularly appropriate representatives of the municipality, of agriculture, and especially of landowners. Many municipalities in the area have few human resources, and it proved to be very difficult to mobilise them during our intervention. A paternalistic attitude on the part of some representatives obviously prevents real involvement in this kind of group dynamics. Neighbouring small farmers, even though they are affected by the development of urbanization because of the pollution of their water resources and because of crime, do not really interact with the inhabitants of the settlements. Another important limit of the approach was the difficulty in conveying the representations of the local community to higher-level decision makers who did not take part. For example, the Ter’Aguas game was played separately with the watershed committee: There were huge differences between the two game sessions concerning the content and focus of the main negotiations. While in games with local actors, the discussions focused on negotiations concerning legalising their land title and sanitation, based on the opportunities and constraints of the new legislation framework, institutional actors focused on the role of business activities and environmental police to control the urbanization process and prevent the degradation of water quality. They also considered that the game was very far from being real or at least reality as they perceived it, whereas local actors, while understanding the game to represent a virtual situation, easily made the connection with their own “real” lives. This raises questions about the possibility of finding efficient long term solutions to control the urbanization process and water quality degradation in the headwater catchment of Sao Paulo.

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7. Bibliography

- Adamatti, D.F.S., J. S.; Ducrot, R. 2004. Using Multi Agent Systems and Role-Playing Games to Simulate Water Management in Peri-urban Catchments., *RC33 - Sixth International Conference on Social Science Methodology , Session: The Applicability of Agent-Based Social Simulation.*, Amsterdam, The Netherlands,.
- Amy, D.J. 1994. Environmental Dispute Resolution: The Promise and the Pitfalls. In: Vig, N.J.; E., K.M. (Editors), *Environmental Policy in The 1990s*, pp 211-234. Congressioal Quaterly Press, Washington, DC.
- Barban, V. 2005. Entre o legal e o real – a necessidade de informação para a participação cidadã. In: Dowbor, L.; Tagnin, R.A. (Editors), *Administrando a água como se fosse importante: gestão ambiental e sustentabilidade*. . SENAC, São Paulo.
- Bellenzani, M.L.R. 2000. A APA Municipal do Capivari-Monos como uma estratégia de proteção aos mananciais da Região Metropolitana de São Paulo. *PROCAM*, p 204. Universidade de São Paulo, São Paulo.
- Braga, B.P.F., Jr. 2000. The management of urban water conflicts in the Metropolitan Region of Sao Paulo. *Water International*, 25, 2, 208-213.
- Bruns, B.R., Meizen-Dick Ruth S. 2000. Negotiating water rights : implication for research and action. In: Bruns, B.R., Meizen-Dick R.S. (Editor), *Negotiating water rights*, pp 353-379. ITDG, London.
- Bueno, A.K.d.S. 2004. A lei de proteção aos mananciais e mercado de terras: um estudo sobre loteamentos clandestinos., *Instituto de Economia*, p 151 p. + Anexos. Universidade de Campinas, Campinas, Brazil.
- Camargo, M.E. 2006. Jogo de papéis em dialogo com a educação ambiental: aprendendo a participar da gestão dos recursos hídricos na região metropolitana de São Paulo., *Posgraduação em ciencias ambientais*. University of São Paulo, São Paulo.
- Cecchini, A., Rizzi P. 2001. Is urban gaming useful? *Simulation and Gaming*, 32, 4, 507-521.
- Clavel, L.; Raphaële, D.; Suzana, S. 2008. Gaming with eutrophication: contribution to integrate water quantity and quality management at catchment level. *World Water Congress 2008*, Montpellier.
- Dorcey, A.H.J. 1991. Conflict resolution in natural resources management: sustainable development and negotiation. . In: J. W. Handmer; Dorcey, A.H.J.; D. I. Smith (Editors), *Negotiating Water: Conflict Resolution in Australian Water Management*, pp 20-46. Australian National University, Centre for Resource and Environmental Studies, Canberra.
- Etienne, M. 2006. La modélisation d'accompagnement : un outil de dialogue et de concertation dans les réserves de biosphère. Biodiversité et acteurs, des itinéraires de concertation. . UNESCO-MAB,, Réserves de Biosphère, note technique 1-2006, 44-52.
- Faysse, N. 2006. Troubles on the way: An analysis of the challenges faced by multi-stakeholder platforms. *Natural Resources Forum*, 30, 219-229.
- FUSP. 2000. Plano da bacia hidrográfica do Alto Tietê. Plano 0. FUSP, São Paulo.
- Gondolo, G.C.F. 1996. Bacia do Guarapiranga, região metropolitana de São Paulo. De safios de um sistema complexo à gestão ambiental. *PROCAM*, p 176 p. USP, São Paulo.

- Jacobi, P.R.; Granja, S.I.B. 2006 Monitoramento e Análise dos Jogos - Agualoca e Teráguas. Negowat Project p185 pp. PROCAM/USP, São Paulo.
- Marcondes, M.J.A. 1999. *Cidade e natureza : proteção dos mananciais e exclusão social*. Studio Nobel, Editora da USP, FAPESP, São Paulo.
- Nandalal, K.D.W., Simonovic S.P. 2003. Resolving conflicts in water sharing: A systemic approach. *Water Resources Research*, 39, 12, 1362.
- Porto, M. 1999. Sustaining urban water supplies : the Metropolitan Region of Sao Paulo, Brazil. Keynote Lecture. *Urban Stability Through Integrated water related issues management : 9th Stockholm water symposium*, pp 107-112, Stockholm.
- Porto, M. 2003. Recursos hídricos e saneamento na Região Metropolitana de São Paulo : um desafio à tamanho da cidade. p 84. Banco Mundial, Brasília, DF, Brasil.
- Porto, M.; Porto R.L.L; L.G.A., A. 1999. A participatory approach to watershed management : the Brazilian system. *Journal of the American Water Resources Association*, 35, 3, 675-683.
- Puechberty, R. 2006. Financial mechanisms to manage peri-urban watersheds in the Metropolitan Region of São Paulo. *ENGREF*, p 54 + annexes. ENGREF, Montpellier.
- Rolnik, R. 2001. Estatuto da Cidade. Instrumento para as cidades que sonham crescer com justiça e beleza. In: Saule Junior, N., Rolnik, Raquel (Editor), *Estatuto da Cidade : novas perspectivas para reformas urbanas*, p 64 p. Caderno Polis n°4, São Paulo.
- Steins, N.A.; Edwards, V. 1999. Platforms for collective action in multiple-use common-pool resources. . *Agriculture and Human Values*, 16, 241-255.
- Uperti, B.R. 2000. Resource-use negotiation as an alternate strategy for sustainable water-resource management: Experiences from Nepal. *J. Agr. Educ. Ext.*, 7, 1, 11-20.
- Walker, D.H., Cowell S.G., Johnson A.K.L. 2001. Integrating research results into decision making about natural resource management at a catchment scale. *Agricultural Systems*, 69, 85-98.