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Facilitating Negotiations Over Land and Water Conflicts in Latin American Peri-urban Upstream Catchment: Combining Agent-Based Modelling with Role Playing Game

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FACILITATING NEGOCIATIONS OVER LAND AND WATER CONFLICTS IN LATIN AMERICAN PERIURBAN UPSTREAM CATCHMENTS: COMBINING AGENT-BASED MODELLING WITH ROLE GAME PLAYING

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TABLE OF REFERENCE.

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I ABSTRACT AND SUMMARY

Project NEGOWAT

Facilitating Negotiations Over Land And Water Conflicts In Latin American Peri-urban Upstream Catchment : Combining Agent-Based Modelling With Role Playing Game

1 Abstract

In our rapidly urbanising world, providing safe water for cities is an enormous challenge, especially in the south. Competition for water, often associated with a struggle for land, tends to be exacerbated in peri-urban areas because of the wide range of users with different interests, a dynamic land use pattern and specific hydrological functions provided to the city. The NEGOWAT project (Facilitating negotiations over water conflicts in peri-urban areas) was a four-year (2003-2006) research initiative involving partners from Europe and Latin America. It focused on developing simulation and modeling tools to better understand competition and conflicts over water in peri-urban zones of developing country cities, and to help facilitate negotiations between different stakeholder groups in the periurban areas of two cities of Latin America: Sao Paulo in Brazil and Cochabamba in Bolivia. The use of these methods was, in each of two case study cities, linked to multi-stakeholder dialogue processes with the objective to: i) To develop, test and validate methodologies to facilitate discussion and negotiation over water access and land use problems between stakeholders in peri-urban areas; ii) To improve the participation and negotiation skills of communities and social organisations commonly marginalised in decision making processes.

In Bolivia, a general diagnostic phase provided a baseline of land and water issues in Tiquipaya (on the edge of Cochabamba city). A subsequent analysis of local competing claims and conflictive issues led to the selection of three processes that were later supported: i) a technical roundtable about a planned water and sanitation project; ii) improving drinking water committee management; and iii) addressing the impacts of urbanization over irrigation canals. In the two last processes, specific role playing games were developed and used in a multi-step methodology to mobilize grassroot stakeholders, including some of the most marginalized such as women and young people. In Brazil, two specific processes were supported: i) capacity-building of local representatives for their participation in negotiation processes related to land use planning in protected headwater catchments; and ii) capacity building and support to the catchment committee to integrate water quality and water allocation issues in a complex catchment involving discussions about the place and role of agriculture. The work was based on the use of both computerized and non-computerized modeling to support capacity-building. The building of the modeling tools was also used as a method to promote integration of the research team and stakehoders.

As a research initiative, the project contributed to: i) a better knowledge of the hidro-social functioning of periurban areas; ii) an analysis of the limits and interests of multi-stakholders platforms for natural resources management; iii) new insights about the use of simulation tools in negotiation processes. A specific focus was given to the design, use and evaluation of role playing games as tools to support capacity-building and discussion within a negotiation process. Four adapted methodologies facilitating the capacity building of local representatives for participation in negotiation process or interaction with other organizations were elaborated.

As an intervention project, the project contributed to capacitate and empower local representatives in negotiation and interaction with other organizations. It also helped raise awareness on different aspects related to land and water management in periurban areas at national/regional level, e.g., the potential benefits of supporting drinking water committees in Bolivia, or the need for specific agricultural policy in Sao Paulo's headwater catchments. It contributed to reduce tensions between locally competing groups: between urban residents and farmers in Bolivia; and between local communities, the water firm and municipality in Sao Paulo. However, in both case countries, the impacts of the project were limited by the typical institutional and organizational weakness of periurban areas. To partly address this, a comprehensive and innovative communication strategy was used to share results with different groups. The project published a wide range of publications, from articles in peer-reviewed journals, to guide for NGOs and booklets for local community leaders. The Negowat project contributed to the definition of new water regulation and institutional arrangements either directy or indirectly by capacity building and supporting specific negotiation processes.

Finally, the project enabled new research partnerships between participants, from development of new methodological and thematic perspectives in partners' research agenda to renovation of academic training course and elaboration of new research initiatives (Alfa project GovAgua).

2 Summary

2.1 Objectives

In our rapidly urbanising world, providing safe water for cities is an enormous challenge, especially in the south. Competition for water, often associated with a struggle for land, tends to be exacerbated in peri-urban areas because of the wide range of users, the rapid changes of land use as well as the specific hydrological functions provided to the city. As a consequence, the water systems supporting traditional and new livelihoods in these areas are increasingly under pressure. This competition is often associated with the growth of slums with inadequate sanitation arrangements and increased pollution. In these areas, management of upcoming conflicts that involve very heterogeneous types of stakeholders calls for carefully crafted multi-stakeholder processes.

The NEGOWAT project (Facilitating negotiations over water conflicts in peri-urban areas) project was a four year (2003-2006) research initiative involving partners from Europe and Latin America[1], with the overal goal to reduce the growing tensions among competing groups of interests, and to develop negotiated approaches to improved water management for multiple uses with better participation of civil society in decision-making processes. It focused on developing tools to better understand competition and conflicts over water in peri-urban zones of developing country cities, and to help facilitate negotiations between different stakeholder groups. This included the testing and implementation of modeling tools such as role playing and scenario development to support participation and more effective negotiations in integrated water resources management. The specific objectives were:

- To develop, test and validate methodologies to facilitate discussion and negotiation over water access and land use problems among social organizations in peri-urban areas.
- To improve the participation and negotiation skills of those communities commonly marginalised in decision making processes.

The project adressed specific conflictive issues in the periurban areas of two cities: Cochabamba in Bolivia and São Paulo in Brazil. In Brazil, the upstream catchment of the Metropolitan Region of Sao Paulo is responsible for 50 % of the city water supply and is partially protected by specific legislation aiming to control the urbanization. However, development of illegal settlements takes place without any sanitation infrastructure. This leads to direct pollution of the reservoirs used for drinking water for the city. At the same time, the demand of an ever growing population leads to increasing competition with local irrigated agriculture, one of the few land uses compatible with catchment protection. Since the 1990s, catchment committees involving representatives of the state, municipalities and civil society have been in charge of the management of water resources, while land planning remains under the responsibility of municipalities.

In Bolivia, the valley area of Tiquipaya is part of the peri-urban area around Cochabamba City. This area was once among the most productive agricultural areas of the region, but now faces a very fast urbanization process. The municipality does not control this process, and is faced with an explosion in demand for water and sanitation services, which is neither met by State nor Municipality. In such a context, alternative modes of service delivery have developed to fill the gap, such as community-managed water systems. There is no consensus over the best institutional model for delivering water and sanitation services, and this has led to various conflicts. Moreover, water resources are not administered by the State and are managed to a large extent by irrigation farmers, with no space to discuss opportunities of changes in water use in such a rapidly urbanizing area.

In each country, specific conflicts that were representative of problems in periurban areas were selected and specific methodogies using role playing games were developped and tested. The activities were undertaken in three different phases. The first phase aimed to better understand the dynamics, stakes, issues and problems in the areas studied (mainly WP1 and WP3). The second phase was devoted to the building of methodologies and tools for intervention, testing and validation (WP2 and

[1] The Negowat project Latin American part was mostly funded by INCO program. It was also implemented in Chennai (India) with funding from DFID.

WP4). The third phase was focused on implementation, monitoring and dissemination, i.e. scaling-up activities (WP4 and WP5). All these activities were implemented parrallely in both countries, but the work and its timing have been very different in Brazil and Bolivia with a different focus in issues and methodologies. The activities will thus be presented in each country separately.

2.2 Activities in results in the periurban area of Cochabamba (Bolivia)

2.2.1 Preparation of processes and thematic field studies (WP1, WP2 and WP3)

Initially, the Negowat team wanted to organize an overarching dialogue or multi-stakeholder platform on development in Tiquipaya Municipality with specific reference to urbanization and water resource management.

With this global objective, an initial theoretical model was designed, as well as a joint role playing game (WP2) and a series of thematic field research studies were undertaken (WP3). These provided an evaluation of land use changes and farming activities in the municipality and an analysis of the very active land market. The performance of self-organized peri-urban drinking water committees that had been unstudied until then was assessed, as well as the water demand for multiple uses of water at household level. Wastewater re-use which is a vital source of water for some farmers was also investigated. This general diagnostic phase provided a baseline assessment of land and water issues in Tiquipaya. With better knowledge of the dynamics and stakeholders involved, the team realized that it would be very difficult to directly address some issues of water management and urbanization for different reasons, such as the resistance to open up dialogue about water rights and the lack of willingness from the municipality to regulate the urbanization process. It was thus decided to focus for WP4 and WP5 on more specific processes where real change was considered possible.

2.2.2 Elaboration and implementation of interventions processes (WP4)

Local competing claims and conflictive issues were identified and characterized, along with related negotiation processes. As a result of this analysis, three processes were selected for support: i) a technical roundtable about a planned water and sanitation project; ii) improving drinking water committee management; and iii) addressing the impacts of urbanization over irrigation canals.

In Tiquipaya, there was no institutionalized space to address these water and land issues, so the Negowat team had to design from the outset the three processes. The interventions were designed from a Habermasian perspective, where win-win solutions were thought possible and sought[2].

Initially, there was a well-defined focus on the twin use of two specific tools for modelling and communicating resource management options: Multi-Agent Systems and Role Playing Games. Previous research had shown the value of this pairing of tools to address natural resource management problems. However, in the three organized facilitation processes, there was no real need to represent the dynamics of natural resource availability and use, and therefore it did not appear necessary to have a computer-based representation of the local reality. Consequently, after initial testing, Multi-Agent Systems were not used. The project finally focused on the use and evaluation of Multi Stakeholder Platforms (MSPs) and Role Playing Games. MSP approaches were tested in the case of the technical roundtable and the process on managing impacts of urbanization on irrigation canals, while role playing games were tested in the urbanisation and irrigation canal work as well as in the support to drinking water committees.

a) A technical roundtable to discuss a water and sanitation project

The official aim of the technical roundtable (*mesa técnica*) was to raise awareness, analyse options and provide a discussion space for a water and sanitation infrastructure project (named the MACOTI project) which was heavily criticized at the time. The objective was to reach a negotiated agreement over the project between participants and proposed changes to improve it. The *mesa técnica* was designed based upon a methodology to design and evaluate an MSP that was elaborated by the Negowat team. Five two-day sessions were implemented that in turn tackled the technical, financial and institutional aspects of the project.

[2] Habermas theory of communicative ethics is the theoretical basis often used by those who see lack of genuine communication as the main stumbling block to efficient negotiation processes.

Several recommendations on improvements to the project were reached by consensus on the technical and financial components of the project, and two models of institutional functioning were developed, namely a federation of existing drinking water committees and a cooperative belonging to end users. However, in 2005 and 2006, these conclusions of the *mesa técnica* were neither implemented nor officially rejected.

An assessment of the *mesa técnica* was undertaken that underlined various weaknesses, for instance powerful stakeholders, with strong stakes in the project, managed to remain outside the debate, and there was limited scope to change a project already in its implementation stage. This MSP did manage however to move the debate to detailed and positive discussions on the different aspects of the project. This experience contributed also to more general conclusions about the use of multi-stakeholders platforms for natural resources management in places where the usual enabling conditions for genuine stakeholder dialogue are not met (Faysse, 2006).

b) Capacity building of community-managed water supply systems

In Bolivia, much work has been done to help design and implement community management for rural water supply, but there is a marked absence of such methodologies for supporting peri-urban committees. These are very different from rural (and urban) systems in term of the complexity of systems, the size of the budget managed, and the challenges faced. Such systems are also very common in Bolivia, expecially in Cochabama where they probably supply more people with water than the utility.

The Negowat team worked to develop and test a methodology to strengthen the management of community-driven drinking water committees in peri-urban areas. Four pilot communities were supported: two in Tiquipaya that have their own groundwater resources, and two committees in the Southern Zone with piped systems that are supplied by private trucks. The methodology aimed to improve the capacity of the management team and grassroots users. A space for discussion was created and a participatory approach was implemented to find locally-specific solutions to the problems faced by the committees, using simulation tools such as role playing game and scenario analysis.

These tools were used for awareness raising and training to help communicate the issues and encourage participants to find better solutions than had been tried in the past. The first tested tool was a generic role-playing game called SosteniCAP (for Sustainability of Drinking Water Committees), that can be adapted to help raise awareness and discuss the problems faced by different committees. This game enabled the project to: i) build capacities of the members regarding the functioning of the committee (e.g. how the accounts of the committee were calculated); ii) create awareness on the problems faced by the committee such as debts or tariff levels; iii) discuss problems in an open atmosphere; and iv) ensure the participation of more marginalised community members, such as women, young people and seniors who generally do not normally express their opinions during formal general assembly meetings.

With three of the committees, scenario analysis was used with a group of committee members to identify possible future scenarios focusing on financial management of the committee. This work helped to inform a debate on possible changes in the tariff system.

c) Impacts of urbanisation on irrigation canals

In some parts of Tiquipaya, uncontrolled urbanization is affecting the functionning of irrigation canals and creating tensions between urban residents and irrigators. A facilitation process was organized in two communities in order to motivate and facilitate negotiations at the local level between farmers and urban dwellers. It aimed to encourage common management of urbanization impacts over irrigation canals. The intervention was organized into four phases, including diagnosis of communities and their problems, playing of a role playing game (specifically designed and called Larq'asninchej), development of concrete proposals to address problems and dissemination of results.

This work enabled to move from a single use vision of these canals to a multiple use one, thus helping to start discussions on innovative ways to cope with the urbanization process. Agreements were designed and signed to formalize the new acknowledged functions of canals as providers of both irrigation and drainage services (to reduce flooding impacts).

2.2.3 Dissemination of results (WP5)

The last phase of the project focused on dissemination of results through different types of publications, workshops oriented towards informing decision makers, and use of the findings in academic training. Thus, the results were used in a three week specific course within the University at Centro AGUA. Second, a large range of publications were produced for different audiences. A regional workhop about urbanization impacts on irrigation canals and a book about support to drinking water committees raised awareness of these issues at regional and national levels.

2.3 Activities in the periurban catchment of Sao Paulo (Brazil)

2.3.1 Preparation of processes and thematic field studies (WP1, WP2 and WP3)

a) Getting to know role playing games

First, a review was undertaken in order to better undertand the use and development of role playing games for natural resources management. Some Brazilian experiences were assessed (Ducrot 2006) leading to the comparison of three different types of role-playing games (1) environmental education tools for capacitating grassroots stakeholders about new regulations; (2) Governance games for capacitating decision makers in negotiation skills and (3) Companion Modeling games[3], focusing on the interaction between actors and resources and the role of games as a discussion platform. The games developed by the Negowat Brazilian team were explicitly inspired by the Companion modelling approach and methods. These types of games contribute to making explicit the different interests of actors, and help participants to experiment with negotiation processes.

A bibliographic review identified the main aspects of catchment management around Sao Paolo (WP1) and led to the elaboration of a computerized game prototype called JogoMan (WP2). This theoritical model was used to train the Brazilian team on the elaboration and use of computorized role playing games (Adamatti 2004; Adamatti 2005) (Camargo 2006). Its implementation underlined the necessity of specifying better some of the processes that affected the functioning of the periurban areas studied. These studies were undertaken during thematic field studies (WP3).

b) Thematic field studies (WP3) and elaboration of conceptual framework (WP2)

The modelling process and the tests of the JogoMan game with students underlined the need to better specify some of the processes and strategies represented. Therefore, specific research studies were carried out by scientists in the following areas: land use changes in both catchments, analysis of land market dynamics and urbanization, analysis of water quality dynamics in surface waters, analysis of the dynamics rural livelihoods (including farming, fishing and tourism activities), and characterization of water uses. Social studies focused on stakeholder analysis in periurban settlements and analysis of their views about pollution and urbanisation, urban water and sanitation access, and health impacts in periurban settlements. Finally an analysis of catchment (river basin) committee functionning, representation and internal conflicts was undertaken.

The results led to the elaboration a series of thematic reports and papers (Work package 3 report). It also contributed to the elaboration of a general conceptual framework built through a series of internal workshops and regular interactions with the Bolivian team. These enabled discussion of the theoretical and methodological framework of the team as well as the institutional, political and environmental dynamics of the peri-urban catchments in each country. At the same time, work was undertaken to organize the modelling coupling spatial process and hydrological process using a multi-agent basis.

[3] The Companion Modeling approach proposes to develop the use of models and simulation tools (including role playing games) developed in close interactions with stakeholders to support collective decision making dealing with natural resources management and improve knowledge about complex systems integrating biophysical and social dynamics. (www.commod.org).

2.3.2 Elaboration of the tools and methodologies (WP4)

The more salient conflictive issues were selected through meetings with different types of stakeholders and discussions with catchment committee representatives. Two issues were selectected : i) negotiations related to land use planning in protected catchments in relation to urban infrastructure development and pollution processes (called Teraguas process); ii) joint management of water quantity and quality of multiple uses in a complex periurban basin and integration of agricultural issues in such basins (called AguAloca process).

The development of the tools and methodology to support the dialogue process relied on the companion modeling approach. The team decided to use computorized models (using multi-agent systems software) in order to represent the complex pollution dynamics.

The underlying models for the tools were developed by two small teams of scientists following a 4 step method analyzing the resources and their dynamics, the actors and the interaction between actors and resources. These underlying models were then transformed into games material by modelers using the modeling basis developped in WP2 (social basis developped with JogoMan or spatial and hydrological basis developped with SpatMas).

Representations of stakeholders were also integrated in the underlying models of the games using two different methodologies. For the Teraguas games, a series of workshops with a focus group of local urban residents of the Guarapiranga catchment enabled the team to better understand their representation concerning urbanization and pollution processes. These workshops also permitted us to test different methods and tools permitting to map dynamics of resources and actors interaction. For the AguAloca games, the underlying model of the game was discussed twice with representatives of the catchment committees. Interviews with individuals permitted the team to assess some indicators of decision making process in detail.

2.3.3 Implementation, scaling up and dissemination (WP5)

a) The Teraguas process: Using role playing games for capacity building on negotiation over land use planning and urban infrastructure development in protected headwater catchments

The objective of this intervention was to contribute to the bringing together of stakeholders involved in local planning and development process, to improve their capacity to negotiate and to help them assess possible solutions that would enable the preservation of water quality in the Guarapiranga catchment.

Different tools and methodologies developed and tested in WP4 were used in a multi-step methodology called Teraguas. This resulted in a simplified Companion Modelling process set up to empower urban residents and representatives to participate in negotiation processes related to local planning in protected headwater areas. The different steps allowed to discuss: (1) the nature, dynamics and interaction of resources at settlement level; (2) the actors involved and their action on the resource; (3) concepts of negotiation introduced by rapid dramatization; (3) integration of the different previous elements in a simulation of negotiation in the Ter'Aguas game and (4) preparation and planning of negotiations over conflictive issues in reality.

The Teraguas process was replicated twice: first in the municipality of Embu-Guaçu to prepare some communities for their participation in the elaboration of the master plan of the municipality; and second in 3 communities of the Paralheiros sub-municipalities to prepare communities to negotiate with the regional drinking water supply company and with the municipality about a sanitation project. The game was also played 3 times indepentenly (2 with the focus group as validation sessions and once with the subcomittee of the Guarapiranga catchment).

Monitoring of the sessions showed that the approach contributed to changes of representations about other actors and system functionning; improved participants understanding about the dynamics of land and water management in periurban areas; enabled a better relationship between local actors and public sector agencies; and improved capacity of representatives in negotiating and interactions with other organizations.

Comparison of the games played with local actors and the sub catchment committee underlined the discrepancies between the preoccupations of both spheres and the difficulty for catchment committee to concretely take into account somes issues (such as negotiations between land regularization vs access to sanitation).

b) ***The AguAlocal process: Supporting sub-catchment dialogue about water allocation in quantity and quality and the relationships with agricultural activities***

The objective of this intervention was to help stakeholders to better take into account quality issues in the management of water at catchment level, and to contribute to a dialogue to promote a better integration of agricultural activities in catchment development and policy in the Cabeceiras-Tietê sub-catchment.

To facilitate the mobilization of the agricultural sector in this discussion, specific activities oriented toward smallholders were developed. A series of workshops were implemented with farmers of the Cabeiceras Tietê in order to discuss the relationship between water and agricultural development in the catchment, capacitate them about water issues and prepare them for interaction with the sub-Committee.

The game was tested twice with representatives of the catchment consultative committees and engineers form the regional drinking water supply company; and played twice with these engineers, representatives of municipalities, representatives of the catchment agency of Alto-Tietê and of the Alto-Tietê catchment committee. However, it was impossible during the project time to implement the game with representatives of the farmers and to fully develop the simulation models, mostly because of lack previous modeling work and availability of data.

Assessment of the process indicates that it enabled learning about the significance of integrated management of water, about water quality management in a complex system, discussion about rural aspects of water management at catchment level, and negotiation about allocation of financial resources. Proposals to improve the functionning of the subcommittees were submitted such as training courses on negotiation. It also proved useful as a way to prepare other activities such as negotiations about financial resources alocations (water rights fees are being discussed) and simulation workshops based on a calibrated model using real data.

c) Dissemination activities

In Brazil, the dissemination activities were only initiated: powerpoint training materials were designed out of the training workshops undertaken during the project and are to be posted on the internet. First draft of booklets and methodologcal guidelines are being elaborated. Games have also been tested on demand for the training of professionals in water resources and catchment management in specific training courses involving the regional drinking water company and the environment ministry.

2.4 Conclusions and perspectives

As a research initiative, the Negowat project contributed to: i) new insights in different methodological and theoritical aspects such as the use of simulation (specifically role playing games) in negotiation processes and in a companion modelling approach; ii) a better knowledge of the limits and interests of multi-stakholder platforms for natural resources management; iii) specific knowledge about land and water management in the periurban areas studied and integration of different mechanisms affecting the environmental functioning of periurban areas; and iv) elaboration of methodologies facilitating capacity building of local representatives for their participation in negotiation processes or interaction with others organizations.

As an intervention project, it contributed to capacitate and empower some local representatives and enabled us to raise awareness on different aspects related to land and water management in periurban areas at national/regional levels (such as support to water drinking committees, or the need for specific agricultural policy in Sao Paulo headwater catchment). It contributed to reduce tensions between locally competing groups of interest (for example urban residents and farmers in Bolivia or communities, water firm and municipality in Sao Paulo). It contributed to the definition of new water

regulation and institutional arrangements either directly or indirectly by capacity building and supporting some negotiation processes.

As a cooperation initiative, it contributed to the building of a research network as well as the development of new research partnerships in Brazil and Bolivia and between countries (including between Europe, Brazil and Bolivia). It more particularly contributed to the introduction of new ways of work, methodological perspectives or thematic areas in different partner institutions. At least 4 new research and development project proposals have been submitted, two of them being already funded. In Bolivia, it has contributed to the renovation of a masters training course, introducing new training modules.

It has not been possible to implement a collective analysis and comparison of the methodologies between the Brazilian and Bolivian teams, as was initially planned, mostly because of discrepancies between the project agenda in both countries. The development of thematic studies, which proved to be very time demanding, could also have been better articulated with the development of tools and methodologies. It has also been difficult to aggregate the team around multi-agent modelling as initially planned but interesting discussion were implemented about role playing games, multi-agent modeling or implementation of companion modeling approach with very heteregenous actors (Faysse, 2006; Butterworth and al, forthcoming).

Even if there are undoubtly impacts at regional level, direct social impacts are limited to the participants to the intervention processes. A detailed ex-post assessment of the impacts of the project is planned during 2007 (with French funding). In periurban areas that are so densily populated, significant impacts of such intervention supposes an important replication effort and the development of coordinated actions with the mobilization of the various relevant institutions. The main challenges remain the institutionalization and integration of these methodologies and results in institutions and/or governemental policies.

In both case countries, the impacts of the project were also limited by the typical institutional and organizational weaknesses faced in periurban areas. As transitional or migration zones, neither completely rural nor urban, and thus generally with no specific policies, these territories are characterized by unadequate and fragile organizational levels. Consequently, efficient intervention in conflict management concerning natural resources management in periurban areas may suppose previous intervention to support local organization and local collective activities.

Given the first research results, clear paths for new investigation concern: (i) the place and role of virtual simulation in collective decision processes : how should it be articulated to reality ? what are its contribution and its limits ? (ii) how to monitor and assess a research-intervention process in a multi-step approach mobilizing various types of stakeholders as researchers, institutions and local actors; and (iii) how to combine MSP approach with more strategic actions supporting specific group ?

2.5 Main publications

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II CONSOLIDATED SCIENTIFIC REPORT

Project NEGOWAT

Facilitating Negotiations Over Land And Water Conflicts In Latin American Peri-urban Upstream Catchment : Combining Agent-Based Modelling With Role Playing Game

1 Objectives

Water management is one of the key issues of a sustainable urbanization (Malsimovic and Tejada-Guibert 2001). In developing countries, urban expansion in a context of social inequalities dramatically affects water resources in terms of quality (with problems of physical, chemical, biological pollution, etc.) and quantity (depletion of water resources) (Niemczynowicz 1996). This raises the issue of supplying potable water to a growing number of consumers, in a context of limited financial resources to be distributed between investment efforts and the maintenance of existing network. This is the case of the cities of South America which already host 70 % of the population.

New water policies based on the paradigm of integrated water resource management, i.e., territorial - and often participative - management of water at catchment level, are being discussed and implemented all over the world. These policies emphasize the role of negotiations, either to solve conflicts or for long term strategic resources planning. Can these policies be applied and implemented in the rapidly changing, altered and densely inhabited periurban catchment? How to support negotiation processes in such context?

1.1 Water management in periurban area : a complex issue

In the interfaces that are periurban areas, domestic water uses compete with other demands such as irrigation or environmental and recreational use. This competition is all the more exacerbated, that it is often combined with a competition for access to land. The cities fringe supports the urban expansion processes, which lead to very diversified forms of land occupation. It also provides specific hydrological functions to a city— for example catchment area and absorbtion of rain water- functions which are altered by densification and urbanisation.

In many developing countries, this periurban area also concentrates most of the poverty and urban expansion and this area is often associated with the growth of shantytowns with inadequate sanitation arrangements, and enhanced pollution runoff, encroachment of urban expansion over agricultural areas and their infrastructure (Burke and Beltran s.d). These processes directly affect the water quality of drinking water reservoirs and aquifers (Baykal, Tanik et al. 2000). In many metropolitan centres, these tensions are already leading to water use restrictions or open conflicts, as in Sao Paulo (Brazil) (Braga 2000) or in Bolivia.

Land and water management is periurban context is a complex issue combining ecological. ecological, technical and social aspects. It combines questions related to the availability of water resources, organisation and management of water supply, water uses -closely related to land use and occupation, organisation and management of water drainage and the articulation between these different elements. Thus, water quality and availability depends on the evolution of land use and occupation, strategy to develop new urban infrastructures (especially water and sanitation), evolution of farming activities and institutional arrangements to manage land and water, how they are being articulated and the place of users and stakeholders in this management.

Two issues are particularly important in a periurban and urban context: (1) flood management (2) Providing adequate water supply and sanitation in the expanding fringe of the cities. Given the specific periurban context, adressing theses issues is not straightforward and various questions have to be addressed: How to provide safe water for a growing number of consumers, who often are not able to pay the costs related to the investment needed? How to deal with other competing demands for water in the same time? How to control the degradation of water quality? How to articulate land and water management at catchment level?

1.2 Toward new role for scientific contribution in conflict management

The competition over land and water, the rapid spatial and demographic dynamics, the related social transformations facilitate the development of complex conflicts. Among others, new project development related to land (urbanization project, transportation project, infrastructure project) and/or water (new water or sanitation infrastructure, new storage capacity or flood control project), institutional arrangement of these new projects, multiple uses of the resources and the land (competition between agricultural water uses and periurban for example), implementation of new policies and legislation (conflicting arrangement), uncertainties of evolution of resources ownership and jurisdiction in a context of urbanization, procedural uncertainty on the functioning of management institution (such as representatives or agenda) are examples of issues that can lead to conflict and tensions in the periurban areas.

For many people, scientific evidence is implicitely considered as the key to settle environmental disputes. It relies on the prominent belief that there can be a rational and objective management of natural resources and that science can provide unambiguous answers. The development of "participative" management processes is more and more calling into question this representation (Funtowicz 1990) even if different approaches proning the use of science intensive tools to support collective decision or negotiation are still implicitely related to such a vision. In these approaches modeling is viewed as a way to better understand the "internal" causes of conflicts, which are then often restricted to their technical aspects (Nandalal 2003) – and as a way to facilitate communication between actors which is perceived as deficient (Rajasekaram 2003). Many of these approaches claim that sciences and modelling should be kept outside the political process (Robinson 1992).

These approaches are more and more criticisized. The first kind of criticisms focuses on the type of information mobilized. A participative and democratic process for environmental management supposes the integration of different types of information that can be scientific and technic but also traditionnal, cultural and local. Moreover, the management of this information raises questions regarding their validity, accuracy, authenticity and reliability. Disagreements on the scientific evidences themselves, how to collect them, to interpret them or their implication open way to new types of uncertainties and debates within the negotiations processes (Ozawa 1985). Thus experts conclusions frequently conflict one with another because of the hypotheses, approaches, formulation of the question or even the question that are referred to. Capacities of parties to understand and mobilize the information provided are also a discussion point. The segund type of critics focuses on the political aspects of negotiation. Many findings tend to indicate that conflicts are heavily related to the historical and social context in which they evolve and are fondammentaly the result of power relation and interests dispute. Information is just a resource among other can be manipulated to impose the point of view of one group of interest or build the legitimacy of the parties involved (Boonstra 2005)

Other approaches propose to use modeling processes (defined as the building of representation using specific vizualization supports) and simulation tools or mobilization of information as an interaction platform that enables parties to elicit and/or to reveal each others perspectives, behaviors, risk sensibility, values, and interests. Modeling and simulation is not proposed to provide irrefutable scientific evidence but is considered a mediation support to improve communication, bring the individuals together, and integrate individual and group knowledge (Maurel 2004). It provides a means to externalize tacit knowledge (Arias 1999), but also to build trust and empathy while simulation allowing participants to experiment safely with (future) decisions and institutional designs, and reflects on the outcomes (Mayer 2004). Without dealing with power issue, this type of approach proposes thus another way to manage and use information that the two previous approaches. One type of simulation tool, role playing games, is particularly being studied in this approach on which relied the basis of the Negowat project.

1.3 Objectives of the Negowat project

The NEGOWAT project (Facilitating negotiations over water conflicts in peri-urban areas) project was a four year (2003-2006) research initiative involving partners from Europe and Latin America. It

focused on developing tools to better understand competition and conflicts over water in peri-urban zones of developing country cities, and to help to facilitate negotiations between different stakeholder groups. This included the testing and application of modeling tools such as role playing or scenario development to support participation and more effective negotiations in integrated water resources management. The use of these methods was, in each of two study cities in Latin America, linked to multi-stakeholder dialogue processes with the overall goal being to reduce the growing tensions among competing groups of interests, and to develop negotiated approaches to improved water management for multiple uses with better participation of civil society in decision-making processes. Specific objectives were:

- To investigate the hydrological and social functioning of peri-urban upstream catchments;
- To increase the capacity of Latin American partners to undertake participatory and multidisciplinary research;
- To develop, test and validate methodologies to facilitate discussion and negotiation over water access and land use problems among social organizations in peri-urban areas;
- To improve the participation and negotiation skills of those communities commonly marginalised in decision-making processes.

The project has been implemented in two regions of Latin America : the protected headwater catchment of the Metropolitan Region of Sao Paulo in Brazil, and the part of the Tiquipaya Municipality in the Cochabamba Metropolitan area in Bolivia that is facing a fast urbanization process. The background contexts of these two areas are summarized in 1.4.

In each area, specific conflicts that were representatives of problems of the periurban areas studied have been selected and specific methodogies using role playing games have been developped and tested. This report presents for each of these cases the methodology, the results and impacts as well the problems encountered.

1.4 Presentation of the two[1] areas studied

1.4.1 The protected headwater catchments of the Metropolitan Region of São Paulo (Brazil)

The upstream catchment of the Metropolitan Region of São Paulo (RMSP), more specifically the Cabeceiras-Tietê and Guarapiranga catchment are respectively responsible for 15 % and 30 % of the water supply of the 18 millions inhabitants of the agglomeration. The two catchments have superficies of 1690 km² and 905 km² respectively. Part of their territory is protected by a specific legislation (*Lei dos mananciais*) aiming to control the urbanization, but they are both affected by the development of precarious settlements, lacking of adequate urban infrastructure, inclusively sanitation network. This directly impacts the quality of their superficial water resources and the drinking water reservoirs. In the same time the demand of a growing population is increasing the competition with other uses in particular agriculture.

Since the 90's, the new water governance framework is strengthening the importance of discussion between the different stakeholders and levels of management with the implementation of discussion bodies, the catchment committee, and an executive body, the catchment water agency. The Alto-tietê catchment, which includes nearly 80 % of the RMSP, has been divided in 5 subcatchments with their own sub-committees. In the protected headwater catchment, articulation between water management and land management is looked for with the integration of different tools (catchment plan, municipality master plan etc). Water and sanitation services are mainly provided by a semi-public firm (SABESP) that manages a very complex and centralized system of potable water production (5 interconnected systems with 9 mains reservoirs, canals, pumping station, tunnel) and 5 effluents

[1] *Under INCO funding the project was developped in two cities of Latin American (São Paulo – Brazil and Cochabamba-Bolivia). Complementary DFID funding also allowed to develop the project in India (Chennai). The work developped there, coordinated by the NRI partner of the Negowat project is not included in this report.*

treatment stations. SABESP provides water and sanitation services for 80 % of the 39 municipalities of the RMSP. Domestic effluents from illegal occupation in the headwater catchment are directly polluting the main water reservoirs of SABESP in Guarapiranga and Cabeiceras and only expensive treatments permit to provide potable water. In spite of the different legislation to protect the headwater catchment and prevent pollution process, water quality is steadily decreasing in the main reservoirs. In Cabeceiras-Tietê, the pollution process are even more complex as the drinking water reservoir is the last of a serie of 5 reservoirs managed jointly. This complex system was first build to protect the city against flooding and allow dilution of effluents but has evolved into a strategic water supply system during the last 20 years because of the increase of water demand. Because of the populational increase of the RMSP, water demand in expected to overcome water offer by 2025 and this is putting an increasing pression on irrigated agriculture (mainly irrigated horticulture) of the catchment. There is thus increasing competition between the different uses of the Cabeceiras-Tietê catchment and their resolution must take into account not only the alocation of water but also the management of quality of water at catchment level.

This is the role of the catchment committee and land management and urbanization control is the responsibility of municipalities. Though water and land are theoritically managed in an integrated manner in an institutionalized multi-stakeholder platform (the catchment committee), but conflicts between the main agencies, a weak representation of local communities in the participative bodies, large social inequalities and asymmetry of information and decision making power limit the efficiency of water governance.

1.4.2 Tiquipaya in the periurban area of Cochabamba (Bolivia).

Tiquipaya is one of the neighbouring municipalities of Cochabamba. It is divided into a valley part, which represents less than 10% of the total area of the municipality but where urbanisation is concentrated (with 71% of the inhabitants of the Municipality), and a larger less-densely populated mountain area. This rapidly urbanizing periurban area was once one the most productive agriculture area of the Valley. Urbanization is driven by the migration of poor immigrants from rural areas and mining centres of the Altiplano and relatively well-off households from the city are also moving out to settle in peri-urban areas and building large mansions attracted by the low land prices and greener environment. Municipalities have little control over the urbanization process, but are faced with an explosion in demand for water and sanitation services, which is neither met by State nor Municipality so that alternative modes of service delivery have developed to fill the gap, such as community-managed water systems. Sanitation is only provided in the old city center of Tiquipaya.

The lagoons to store water in the upper part of the catchment are mainly under the control of irrigation farmer associations. There are five main irrigation associations: four of them are in charge of the operation and maintenance of dams in the upper part of the catchment and of the canals. Water is used for flood irrigation, to grow mainly maize, alfalfa, cash crops and flowers. The water rights follow the traditional practices, and are based on a pattern that was mainly structured during the XIXth century. The irrigation farmer associations defend strongly their traditional water management practices and have to date successfully defended their rights refusing to increase the small amounts of surface water that domestic and industrial water users withdraw. In Tiquipaya, competition between farmers and drinking water committees over water resources had generated tensions but has not led to open conflicts.

Bolivia is characterized by a very weak control of national and local government over management of land use, water resources and water services. Urbanization plans are designed but no implemented. The current law on water resources dates back to 1906, and in practice is almost not used anymore. On the other hand, local user-based associations are strong and have proved their have ample capacities to organize and sustain developments in their constituencies. However, these organisations also struggle with the rate of change in urbanising areas and the larger scale at which solutions now need to be found to natural resources competition. Though these organizations have successfully provided access to drinking and irrigation water in many areas, they are unable to deal with some issues such as the future of agricultural activity within the Municipality and pollution. Moreover, they are not able to

deal with the more and more urgent need to review the distribution and management of water resources, including the increasing discrepancy between right holders and demands for surface water, and the complete absence of management of groundwater, in terms of quantity and quality.

2 Activities

In each country, the activities were undertaken during three differents phases. The first phase was aiming to better understand the dynamics, stakes, issues and problems in the area studied (mainly WP1 and WP3). The 2nd phase was devoted to the building of methodologies of intervention and tools, its test and validation (WP2 and WP4). The third phase was focused on implementation, monitoring and dissemination (scaling-up activities) (WP4 and WP5).

All these activities were implemented parrallely in both countries, but the work and its timing have been very different in Brazil and Bolivia with different chosen issues and methodologies (Table 1). The activities will thus be presented in each country separately.

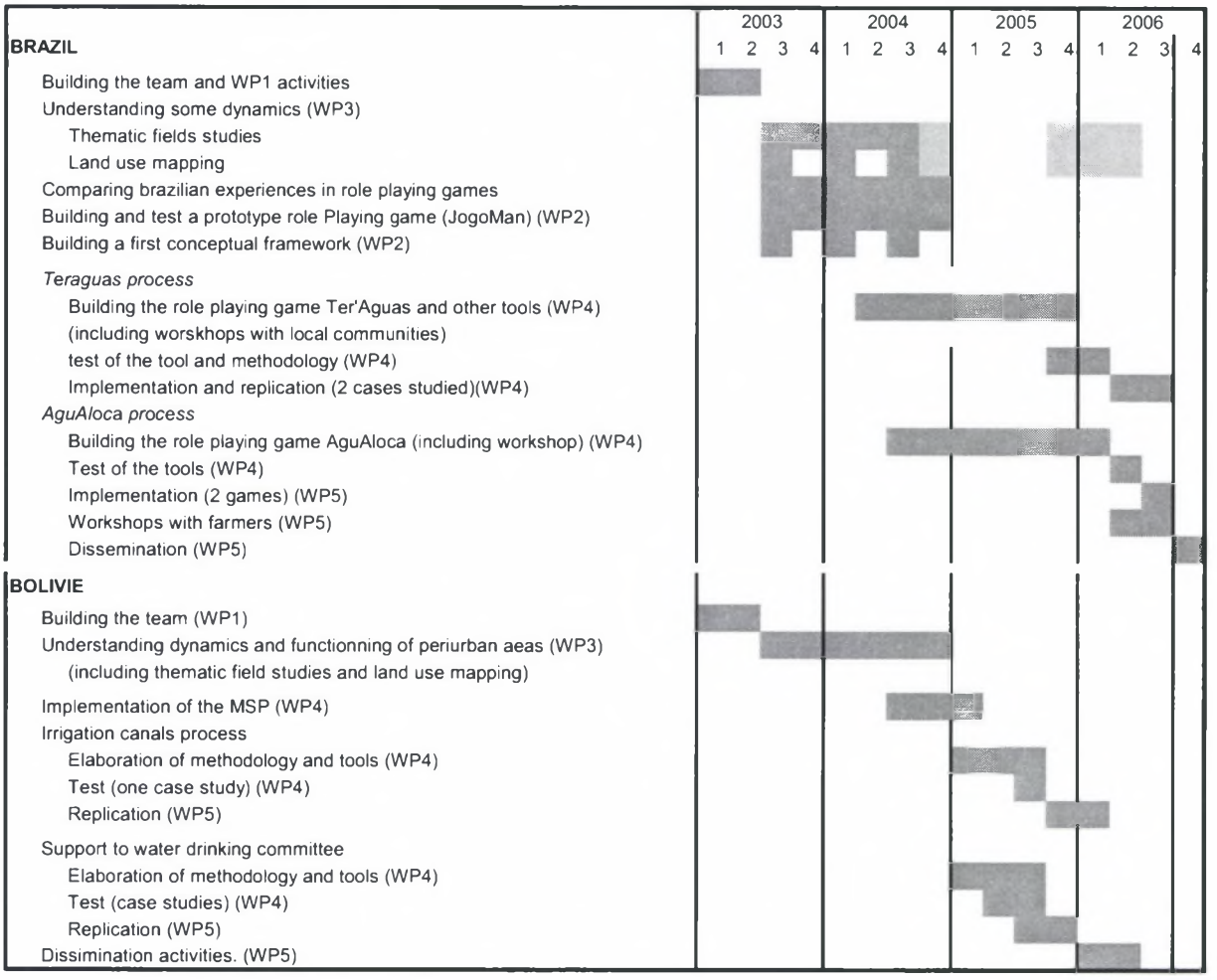
The program and workplan proposed (as stated in the Technical Annex of the project) had to be adapted to each situation, their evolution and evolution of the cooperation organisation whithin the project team during the 4 years. Not all tasks previsted were possible to be implemented or fully developped. Each team decided to put some emphasis of some tasks that were crucial for the success of the intervention processes given local situation and to treat more lightly other activity. Globally in each countries, the main activities planned in each workpackage were carried out and main objective package achieved, but methodologies, specific activities were adapted.

Some common activities were implemented between 2003 to 2005 such as training in multi-agent modelling (WP1) and role-playing games (WP4), and regular meetings (2 each year) to discuss the advancement, methodological orientation and understanding of the functionning of land and water management in periurban areas (WP3). They were important moment of interaction between both teams and helped them make sense of their work and results by comparing methods and situation. However, these common activities are not precisely described in this report but summarized in the management part. A report for each common activities was also provided during the project.

Table 1 : Presentation of the main similarities and differences of the intervention processes of the project in Brazil and Bolivia

	Brazil	Bolivia
Institutional situation	Institutionalization of land and water management (catchment committee, local water laws etc)	No institutionalized space to discuss land and water at regional or municipal level
Issues dealt with (conflictive issues)	- tensions linked to urbanization and its drivers, infrastructure development and water quality at municipal level or catchment levels - management of water at catchment in quantity and quality and competition with irrigation.	- development of a water and sanitation project (Mesa técnica) - water supply in periurban area (support to potable water committee) - impact of urbanization in irrigation canals
Methodological orientation (activities development)	Emphasis on (1) collective building of the tools (2) indirect integration of stakeholders representation by specific work sessions with focus groups (3) mobilization of actors by parrallel specific activities	Emphasis on (1) elaboration of a coordinated and sequential set of activities from diagnosis, identification of solution and agreement building (2) organization and implementation of the facilitation of the whole process from its beginning to its end
Main theoretical framework	Companion Modeling Approach	Discussion of the Habermasian perspective
Target actors	Comunities representatives and members of catchment sub comittees, public sectors (municipalities, Sabesp)	Communities representatives and grassroots stakeholders (in one case with particular orientation with gender participation)
Objectives of intervention	Preparing negotiation, aproximation of actors, capacity building for negotiation of local actors	Facitation of negotiation process up to reaching of agreements
Scale of work (area / actors)	Local (a set of settlements in a municipality in Ter'Aguas) to regional (sub-catchment or sub catchment committee)	Micro-local (self organized potable water committees, local area within Tiquipaya municipality) to municipal level
Type of discussion tools developped (main tools)	Computorized role playing game developped using the Cormas soft(Bousquet, 1998)	Multi Stakeholder platform Non computorized role playing games (SosteniCAP and *Larq'asninchej*) A data sheet simulation tool (water tariffs in water committee)

Figure 1 : Sequence of activities in each country .



2.1 Main methodological orientation and activities in Bolivia

4 institutions of the project participated in the activity in Bolivia (UMSS, CERES, CIRAD, NRI). The work was coordinated by Dr Faysse from CIRAD, under the supervision of a steering committee of senior scientists of CERES and UMSS. Work was undertaken by a team of 6 to 8 full time junior scientists. The team had its own office in Tiquipaya, in order to be closer to stakeholders they had to work with. Consequently, they were no clear separation of activities between partners, even if some scientists got more specifically involved in one or another process. The different processes were supported by NRI through regular visit and short stays.

2.1.1 Thematic field studies and preparation of process intervention (WP1, WP3)

Thematic field studies (WorkPackage 3) were implemented in the following areas : land use change mapping (UMSS), land market analysis (CERES), analysis of the performance of drinking water committees (UMSS), analysis of the multiple uses of water at household level (UMSS and NRI), analysis of waste water reuse (UMSS), stakeholder analysis (UMSS and CERES). They provided a general baseline of land and water issues in Tiquipaya but were not well connected otherwise to the latter work implemented. This is partly related to the fact that the initial idea of supporting a multistakeholder platform about the development of Tiquipaya Municipality with reference to land and water management proved impossible to implement for various reasons (see UMSS's report). A multi-agent prototype and game more related to urbanisation process was elaborated and tested during this phase but was not used afterwards.

Competition and conflictive issues about land and water were then identified and characterized. This led to the selection of 3 processes that the Negowat project was able to support.

i) a technical roundtable about a planned water and sanitation project;
ii) improving drinking water committee management;
iii) addressing the impacts of urbanization over irrigation canals.

2.1.2 Implementation of the negotiation processes in Bolivia (WP4)

Because there were no existing institutionalized space to address land and water issues in Tiquipaya, the Bolivian team chose to design from scratch the three processes and assume a role of facilitators in these negotiations. The methodologies chosen focused on the organization of a coherent sequence of activities enabling to implement this negotiation process and to reaching of agreements. The main methodological orientations of each of them are presented in Table 2.

The interventions were based mostly on an Habermasian perspective as opposed to a more political and conflict sensitive approach based on power relationships focus (Faysse, 2006).

The team chose to focus on the analysis and evaluation of three tools: Multi-Stakeholders Plateform, Role Playing Games, and spreadsheets for scenarios analysis of water tariffs. They are presented in Box 2. Multi-agent modeling was tested during the first part of the project and assessed as not adapted to the cases studied (cf UMSS report for more details). Specific methodologies were proposed to assess role-playing games and MSPs and allowed the elaboration of 2 specific monitoring report (Cossio et al., 2006; Faysse et al., 2006).

Table 2: Methodological orientation of the 3 different processes supported by the Negowat project in Bolivia.

	Mesa tecnica : a technical roundtable to discuss a water and sanitation project	**Capacity building of community-managed water supply systems**	**Impact on urbanisatin in irrigation canals**
Objectives	*"Raise awareness, analyse and provide a discussion space for the MACOTI project in order to reach a negotiated agreement and a common vision of the project between participants and propose changes to improve it"*	*"Improve the management capacity of the management team and grassroot users by creating a space of discussion and participatory approach to locally specific solution"*	*"to motivate and facilitate a negotiation process at local level between farmers and urban dwellers to organize a common management of urbanization impact on irrigation canals"*
target	All local organizations (drinking committees, OTBs, farmer organizations) and institutional stakeholders (Municipality, Vice Ministery of Basic Service, FNDR, Constructing and Supervising company)	Management team of the committee and grassroot users Specific attention given to young people and women	Local farmers and local urban dwellers (grassroot inhabiltants)
Legitimacy of Negowat intervention	The organization of a technical roundtable was proposed by the Ministery of Basic Service. The proposal from the Negowat team to facilitate this roundtable was accepted by the Vice-Ministery, Municipality and the main local organizations.	• Conflictive issue of the MACOTI project • Lack of any discussion and support to periurban community managed water supply system in periurban or urban area	Inondations due to canals during a previous rainy period Process developped with local OTB, based on an initial common diagnostic of irrigation canals in the two areas
Methodology	A methodology to design and evaluate a MSP elaborated by the team (Faysse and al, 2005)	Cf Figure 2 Include a RPG to mobilize grassroot stakeholders and raise awareness and exell spreadsheet for analysis of tariffs scenarios	Cf Figure 3 Include RPG to help the local inhabitants to understand the issue associated with irrigation canals
Partners involvement	UMSS, CERES, CIRAD	UMSS, CERES, CIRAD, NRI	UMSS, CERES,CIRAD
Implementation	5 sessions of 2 days to tackle 3 points : technical, financial and institutional aspects of the project	4 pilot communities (2 in Tiquipaya – elaboration and test of the methodology) and 2 in Southern Zone of Cochabamba City	2 pilot areas
Methodological difficulties	• Insufficient analysis of power balance issues, especially between important national decision makers (such as national credit bank FNDR) and local organizations. Lack of expertise to fully analyse the project contents • Different interepretations about the roundtable objectives	• Follow-up problem in the communities suported and scaling up to other communities • Depends of active participation of several legitimate representatives (intermediaries between facilitation team and community) • Methodology not relevant to create a water drinking committee	Municipality involvment was not initially previsted, but proved necessary and its involvment was insufficient to insure implementation of the agreement made

Figure 2 : The methodology to support drinking water committee management

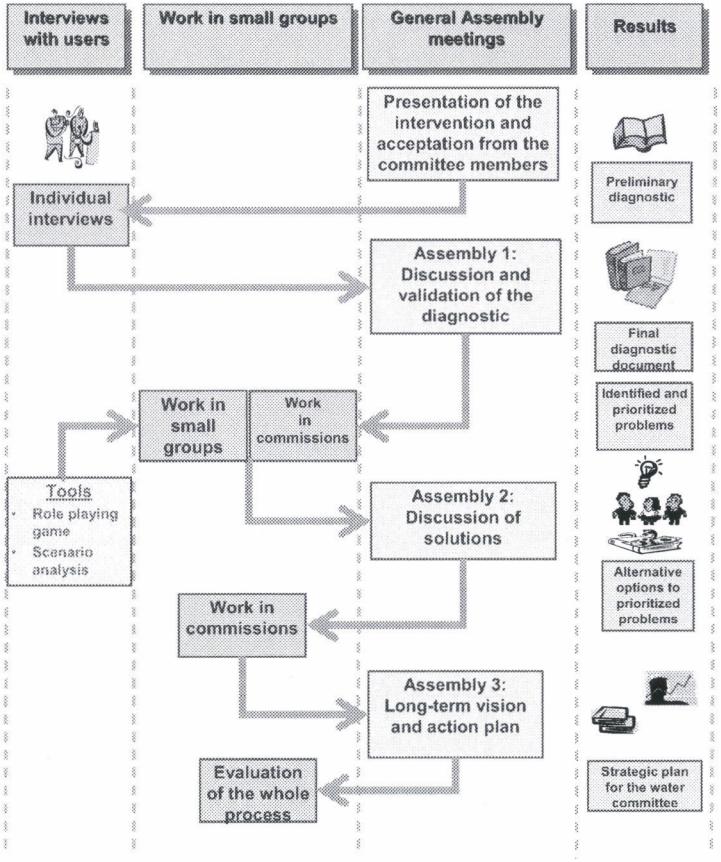
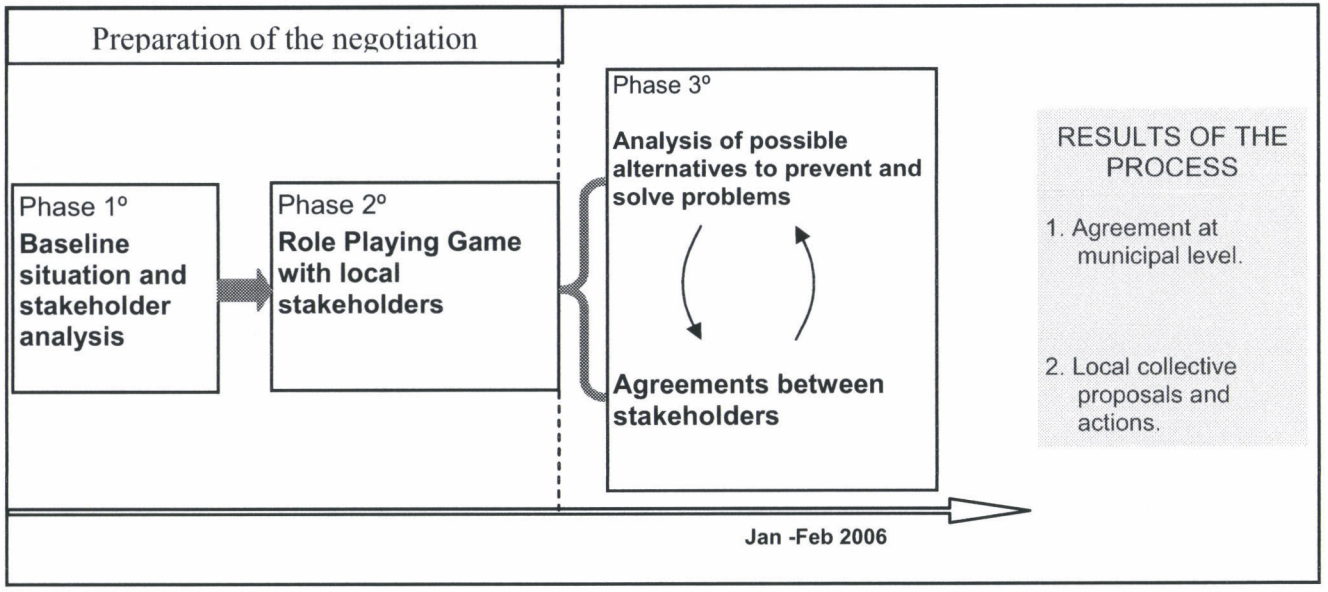


Figure 3 : General structure of the facilitation process about urbanization impacts on irrigation canals



2.1.3 Dissemination of results (WP5)

A very important effort has been made on the dissemination of the results through the development of different publications, activities and academic training based on the project experience. A specific course in UMSS on land and water conflict analysis and facilitation was implemented in 3 modules: (i) Use of tools to undertake a diagnostic of land and water issues in a peri-urban area (March, 8-11th, 2006); (ii) design, use and evaluation of multi stakeholder platforms March, 23-25th, 2006 ; (iii) Training on design and use of Role Playing games (April, 6-8th) 2006. The materials used for this training session, elaborated under the coordination of NRI, are available of the Negowat website.

Results were also presented at regional and national levels to decision makers:

- October, 28th, 2005 : "impacts of urbanization in the valley of Cochabamba". The attendance was of 80 members, from irrigation associations of the Cochabamba Valley and Municipalities
- Presentation of the Negowat results in La Paz (April, 21st, 2006) co-organized with European Union Office in Bolivia and French Embassy. Around 60 people attending, including the Bolivian Minister of Irrigation.
- Presentation of the Negowat project in Cochabamba in San Simon University (June, 1st, 2006). The workshop was opened by the University dean. Around 80 persons attending.
- Presentation of research results to drinking water committees (June, 4th, 2006) around 30 leaders of community-based drinking water committees of Tiquipaya and Colcapirhua. Dissemination of the various publications done by the project on the topic.
- International Workshop organized by the Vice-Ministry of Water Services (13 and 14 of July, 2006) Presentation of Negowat experience in supporting drinking water committees and of the newly edited book on experiences of support in Bolivia and Colombia

2.2 Main activities and methodological orientation in Brazil

2.2.1 Thematic field studies and model elaboration (WP1, WP3)

Thematic field studies (WP3) were implemented in the following areas: mapping land use changes (APTA), analysis of land market dynamics (UNICAMP), analysis of water quality dynamics in superficial water (APTA, AIEGEA), analysis of the dynamics rural landowners (including farming, fishing and tourism activities, and characterization of water uses (APTA), stakeholder analysis in periurban settlement and analysis of their representation about pollution and urbanisation (POLIS Institute), urban water and sanitation acess and their health impact in periurban settlements (USP-FSP), analysis of catchment committee functionning and representation (USP-PROCAMP). The data and information gathered in these works were used to build a first conceptual model and the sublying models of the tools build (WP2).

During this preparation phase, the team also compared various Brazilian experiences using role playing games for environmental education (PROCAM-USP). A theoritical prototype called jogoMan was elaborated with the objective to train the Negowat team in (i) development of computerized role playing games using the software Cormas (Adamatti 2004; Adamatti 2005) (PROCAM, POLI-UP and CIRAD) (ii) implementation, and monitoring of this kind of role playing games (Camargo 2006) (PROCAM). This prototype is also currently being used to design a web-based role playing game that can be used for training in negotiations for water management at catchment level. (PhD thesis of D. Admatti under progress, POLI-USP). (WP2).

Box 1 : spreadsheet and 'What-if' scenarios analysis (Bolivia)

A group made up of both grassroots members and management team members is first elected during a general assembly meeting. With this group, a first activity is to detail all the costs incurred and the income received by the committee. The calculations are made on a whiteboard. Group members follow these calculations with a pocket calculator. In particular, replacement costs are estimated. Once the financial balance is made, a simple spreadsheet is used to test the impacts of different factors:

- what happens if you take into account costs that were previously ignored in calculating the tariff, such as the cost of replacing equipment;
- what might be the willingness and capacity of users to pay a certain tariff?

Group members propose tariff structures that are tested with the spreadsheet. The group eventually selects one or various tariff structures, which are later submitted to all committee members during a

Box 2 : . The Larq'asninchej role-playing game (Bolivia)

Larq'asninchej ('our canals' in quechua) represents a peri-urban community. The roles played in the game are irrigation farmers, urban dwellers and the local OTB representative. At the beginning of every turn (which represents one year), the farmers decide which fields they want to cultivate and possibly irrigate, meanwhile urban dwellers decide where to build houses. Both groups may decide to set up walls to protect their house or crops from thieves. For both groups, it is cheapest to build walls that infringe on the nearby canals. Farmers situated downstream of blocked canal sections face difficulties to obtain irrigation water. At the end of each turn, the OTB representative leads a meeting in which the "local community" analyse the problems arising from walls built too close to canals and possible solutions. If no agreement is reached locally, the Municipality, represented in the game by a set of cards, eventually takes a decision.

By making the players put themselves in each other's shoes, the game aimed at improving inhabitants' understanding of other points of views held by different residents. Therefore, in the game, irrigation farmers were invited to play the role of a new urban dweller and vice versa. Moreover, the game aimed at raising awareness among local inhabitants, so that they learned about the issue at the scale of the community rather than just at neighbourhood level.

The game enabled the participants to discuss possible alternatives to canal infringements. Rather than actual testing of possible alternatives, it enabled local inhabitants to jointly find solutions and implement it, and to show that co-operation between the two stakeholder groups was possible.

The general baseline survey provided by the thematic studies and contacts with the catchment committee and municipalities representatives led to select two specific issues:

- Supporting discussion and dialogue dealing with land use and occupation at local level and their impact on water resources quality, with specific reference of the implementation of a new regulation for land management in the Guarapiranga catchment.
- Supporting discussion and dialogue dealing with water allocation and quality management at catchment level and its implications for agriculture, in the Cabeceiras-Tietê catchment (.

2.2.2 Tools and methodologies elaboration (WP4)

In both cases, the objective was to elaborate a methodology, including discussion tools and role playing games that would allow to approximate the different actors whether within a formalized discussion platform (the Cabeiceras Tietê catchment committee) or at local level (in Guarapiranga catchment).

The main methodological orientations of each process are presented in Table 1. Elaboration of the game was considered as a way to set up a dialogue platform to integrate multidisciplinary knwoledge and stakeholder representations. Internal modelling workshop (with a small group of Negowat scientists) led to the development of the underlying models of the games, which were later completed by input from workshops with local stakeholders or direct discussions. The underlying models were then developped in games (including game supports and rules) and other tools by modelers and computers scientists and tested with stakeholder focus group.

The work was developped under the theoritical framework of Companion Modelling approach (ComMod) presented in Annex (2).

A specific monitoring methodology was elaborated by Procam to assess the contribution of game in capacity building and as a discussion platform (Jacobi and Granja, 2006).

2.2.3 Dissemination of results in Brazil (WP5)

The work developped in WP4 was organized in a multi-step methodology called Teraguas, which is based on a simplified Companion Modelling process to empower urban residents representatives to participate to negotiation processes related to local planning in protected headwater areas. The different steps of the methodology are presented in Box 3. Various tools and activities used in this methodology were elaborated and tested during the WP4.

The Teraguas process was replicated twice: (1) one in the municipality of Embu-Guaçu to prepare some communities for their participation in the elaboration of the master plan of the municipality (2) in 3 communities of the Paralheiros sub-municipalities to prepare communities to negotiation with Sabesp and municipality about a sanitation project. Their implementation is detailed in Institute Polis report.

It has not been possible to complete the Agualoca process whithin the time frame of the project. More specifically, we have not been able to implement a game session gathering in the same time representatives of smallholders and of the subcatchment comittees neither to implement a course about negotiation.

Dissemination has not been fully completed either but will be completed as part of the Technology Implementation Plan by ways of participation to specific course about water management (2 courses in november en december 2006 implemented), elaboration of booklets for technicians and NGO (underelaboration), a large audience workshop in 2007

Box 3: The Teraguas process

A series of 7 activities are held during 4 to 5 workshops. Activities include:
(1) mapping the relationships between resources (land, water, housing, urban infrastructure) in each settlement and comparison between setlements in order to identify similarities and differences.
(2) Reconstitution of the development of settlements and historic of the present situation in order to introduce the dynamics of resources relationships.
(3) Simplified reconstitution of the mechanisms of dynamics (for example land market or land use) (this activity has only been implemented once)
(4) Mapping the actors, their responsabilities and their activities (legal or illegal) on the resources.
(5) Rapid drammatizatio on a close situation to the issue, adapting the game situation (roles description) from a preexisting game "Desafios das Aguas" in order to introduce multi-parties negotiation.
(6) Ter'Aguas role playing games and its debriefing. It helps to connect all previous elements, give a dynamic view of the situation at regional level, experiment new attitudes and solutions.
(v) Action planning or negotiation planning related to the issues selected. This helps the stakeholders to prepare a specific action or negotiation and helping them to identify further information needs, mobilization needs, actors to be involved, etc

Table 3 : Main methodological orientations of the Negowat intervention processes in Brazil

<table>
<tr><th></th><th>Using role playing games for capacity building on negotiation over land and water processes: the Teraguas process</th><th>Supporting sub-catchment dialogue about water alocation in quantity and quality and the relationships with agricultural activities: the AguAloca Process</th></tr>
<tr><td>Objectives</td><td>"To contribute to the approximation of stakeholders interested in local planning and development process, to improve their capacity to negotiate and to help them assess possible solutions that would enable the preservation of water quality in the context of the Guarapiranga catchment"</td><td>"to help stakeholders to better take into account in the management of water at catchment level of quality issues, and to contribute to a dialogue to promote a better integration of agricultural activities in the catchment development and policy".</td></tr>
<tr><td>target</td><td>Local communities representatives, person in charge of planning in municipalities and person in charge of water resource protection and interaction with users of SABESP</td><td>Cabeiceras-Tietê Sub-catchment committee representatives and representatives of smallholders</td></tr>
<tr><td>Legitimacy of Negowat intervention</td><td>Partially given by being a research project
Build throughout the process by (i) worskhop sessions with local actors (ii) participation sub-committee working sessions (iii) thematic field studies and indepth knwoledge about local dynamics</td><td>Build throughtout the process by (i) presentation of previous thematic studies results (ii) interaction with small focus group (iii) specific workshop sessions for farmers about agricultural issues</td></tr>
<tr><td>Methodology</td><td>Methodology of elaboration of the games and tools in Figure 4
Presentation of Teraguas methodology in box 3 and the game in box 4</td><td>Methodology of elaboration the games : Presented in Figure 5
Presentation of AguAloca game and agricultural workhops sequence : box X</td></tr>
<tr><td>Partners involvement</td><td>Elaboration of underlying model of the tools : APTA, PROCAM, UNICAMP, CIRAD
Elaboration of the discussion tools with local communities : POLIS Institute
Elaboration of the games : CIRAD, POLIS and POLI-USP
Implementation of the intervention process : POLIS
Monitoring of the game : PROCAM</td><td>Elaboration of sublying model : APTA, PROCAM, AIIGEA, CIRAD
Elaboration of the tools : POLI-USP, CIRAD
Worskhops with agricultural actors : APTA
Negotiation course : PROCAM (not implemented)
Implementation of the game : POLIS and CIRAD with PROCAM participation
Monitoring of the game : PROCAM-USP</td></tr>
<tr><td>Implementation</td><td>
<table>
<tr><th></th><th>Test (game alone)</th><th>Complete process</th></tr>
<tr><td>Focus Group in Paralheilos</td><td>2</td><td></td></tr>
<tr><td>Embu-Guaçu (Master Plan)</td><td></td><td>1</td></tr>
<tr><td>Jardim Oriental (sanitation conflict)</td><td></td><td>1</td></tr>
<tr><td>Guarapiranga sub-catchment committee</td><td>1</td><td></td></tr>
</table>
</td><td>
<table>
<tr><th></th><th>Sub-Catchment committee focus group</th><th>SABESP Engineers</th><th>Alto-Tietê catchment Agency and sub committee</th><th>Farmers</th></tr>
<tr><td>Test of game</td><td>1</td><td>1</td><td></td><td></td></tr>
<tr><td>AguAloca game</td><td></td><td>1</td><td>1</td><td></td></tr>
<tr><td>Agriculture workshop sequence</td><td></td><td></td><td></td><td>4</td></tr>
</table>
</td></tr>
<tr><td>Methodological difficulties</td><td>Difficulty to mobilize some sectors (rural landowners) for a complete discussion
Black box contents of the game for some partners
Articulation with infrastructure development project would enhance impacts</td><td>The process was not completed : a game joining farmers representative and participants of the subcatchment committee is still to be implemented.
The course on negotiation technics initially previsted has not been implemented either
Black box content of AguAloca games for some partners</td></tr>
</table>

Figure 4 : Methodological paths for the elaboration of the Ter'Aguas game

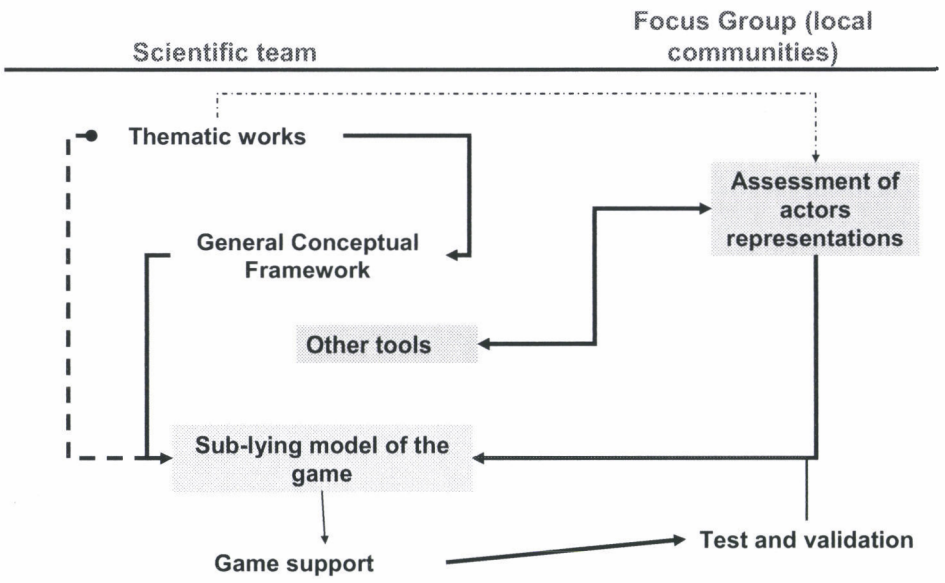
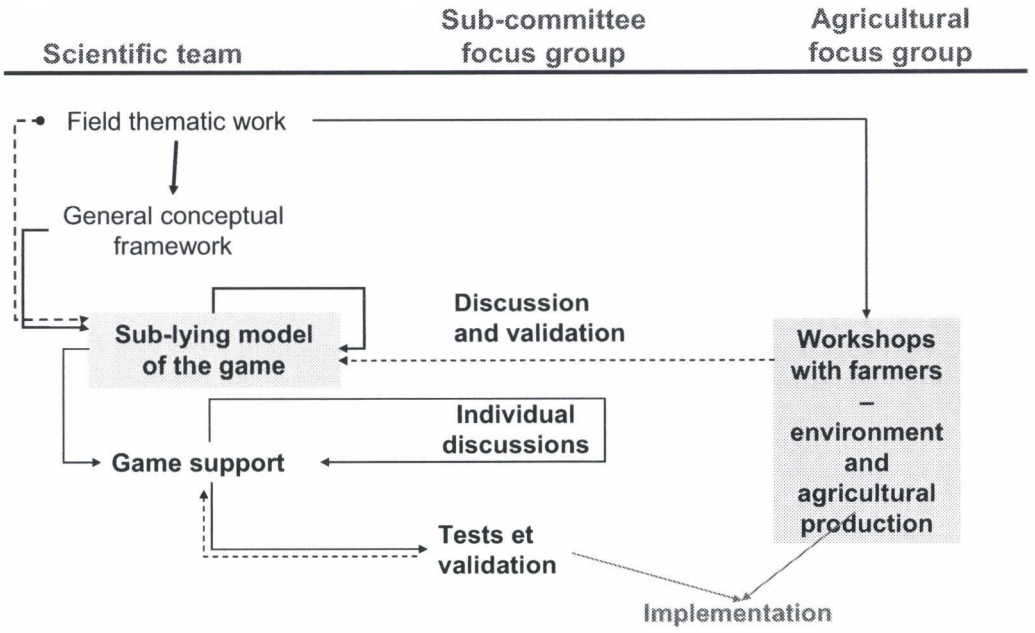


Figure 5 : Methodological paths for the elaboration of the AguAloca game



Box 4 : Presentation of the Ter'Aguas game

Ter'Aguas is a computerized role playing game developed with the multi-agent software Cormas (http://cormas.cirad.fr) and is used to simulate negotiations related to land use planning in a periurban municipality. It is based upon the Specific law of Guarapiranga

Six types of actors are represented: a municipality mayor in charge of the development of urban infrastructure (roads, school, health centre etc), a water firm in charge of the development of water and sanitation infrastructure, four district representatives defending the interests of local dwellers (four different types of district in term of access, type of settlement, homogeneity, proximity to rivers are represented), two small farmers in the surroundings of the district, two big landowners with speculative and electoral strategies, and one weekend house owner also defending environmental issues in the catchment.

The players take decisions concerning : investment strategies (in urban infrastructure or water and sanitation), subvention /tariffs or land tax amounts, selling or purchasing plots, development of property and settlement, land use activity, regularization or licensing land uses and activities, and allocating land to migrating families in the area. The computer simulation is used to rapidly assess the impact of land-use changes on reservoir water quality (using an adaptated version of the Mqual model), on the cash assets of players, social indicators (unemployment) in the municipality and eventually invasion of plots by migrating families that have not yet been settled. After a round of decision making, all players gather to try to find a more collective planning strategy and try to implement it the following round. The interactions can focus on (i) strategies for implementation of urbanization and investment planning in urban infrastructure (sanitation and water access by collective networks or individual wells, roads etc) (ii) planning of land use and occupation in a context of a zoning legislation focusing on one urban indicator (minimal plot surface) and (iii) land market dynamics with the possibility of each land owner selling or buying plots with virtual migrating families.

Box 5 : Presentation of the *AguAloca Game*

a computerised role-playing game developed with the multi-agent software Cormas (http://cormas.cirad.fr) that aims to simulate negotiations related to water allocation and its impact on water resource quality at a catchment evel.

The environmental setting is based upon the Alto Tietê Cabeceiras Sub-Catchment. This peri-urban catchment includes multiple and competitive use of water influenced by the neighbourhood of the metropolitan region. The catchment, with basically two municipalities (one typically peri-urban and the other still very rural), a strong irrigated agriculture sector, and industrial activity, with a complex hydraulic management system (3 dams, 2 transfer canals) which aims to protect the metropolitan region from flooding and to supply domestic water to the Metropolitan region.

Five actors are represented within the game, which requires six players. The two Mayors of the municipalities have to guarantee access to water services for their inhabitants. One operates the water services system itself while the other made a concession with the company in charge of the Metropolitan Region water supply. The water company has to supply water to the whole Metropolitan Region.The irrigating farmers' delegate has to defend irrigator's interests while the industry's delegate has to defend their interests and operates two paper manufacturing plants. The Catchment Water Department has to operate the complex hydraulic system respecting the user's water rights.

The players make decisions every six months either just before the rainy or dry season. The decisions are concerned with the system that they are operating taking into account: (i) production objectives, (ii) pumping processes, and (iii) effluent treatment processes. Processed by the model, these decisions are translated into water demand (quality and quantity), water effluent (quality and quantity) and water satisfaction i.e. whether demand is met (quality and quantity).

3 Results achieved

The results achieved by the Negowat project may be divided into 4 types: (1) methodologies and outputs (ii) "theoritical" results (iii) social impacts and (iv) training and cooperation.

3.1 Methodologies and outputs

3.1.1 Methodologies

The project has developped **2 methodologies with broad application areas** (or potentially important social impacts if applied on a large scale) for empowerment and capacity building in negotiation related to land and water management in periurban areas

- A methodology for capacity building in management of periurban community managed water supply system. The methodology includes the mobilization and awareness raising of grassroot users (with a specific attention to women and young people) as well as capacity building of the management team and representatives. The application areas are the 500 committees that are supplying water for 500000 inhabitants in the metropolitan areas of Cochabamba (Quiroz et al., 2006).
- A methodology for empowerment of local representatives regarding local planning and related negotiation in Sao Paulo periurban catchment area (Brazil). The periurban catchment areas of Guapiranga and similars areas hosts between 300.000 and 800.000 inhabitants and the related pollution affects the quality of water of supply systems providing between 5 and 10 million people.(Barban and al, 2006)

These methodologies and related tools have been tested and validated in a couple of different situations in each case. They have proved sufficiently flexible to be adapted to the different types of issues that can be found in such large application domain (main management problems for water committees, main issues related to land planning). They are directly and immediably usable by NGO or local developers, provided specific training.

They have proved particularly interesting to (i) capacitate local representatives to negotiate and interact with external organizations and/or institutions (ii) change attitudes and representations about the situation (iii) improve global understanding of the system studied, its dynamics and relationships between components (iii) improve collective and individual learning. We think that the Teraguas methodology would probably be particularly interesting in the preparation phase of infrastructure projects (for example sanitation development, master plan development, reubanization projects etc). Some partners already intend to use them completely or partially (case of Teraguas for NGO POLIS). There are still doubts about the follow-ups of the work developpped concerning support to water drinking committees but there has been an important effort to disseminate this methodology toward local NGOs.

Three methodologies developped by the project have more narrow application areas, but did have important contribution to theoritical discussions:

- Building of agreement to mitigate the impact of urbanization on irrigation canals (Bolivia)
- Facilitation of an adhoc Multi Stakeholder Platform about Macoti water and sanitation project and its assessment
- Supporting dialogue concerning water quantity and quality and agricultural process (oriented very specifically to Cabeceiras-Tietê sub-catchment committee).

Lessons, information and analysis from their development and implementation have significantly contributed to more theoritical discussion such as urbanization externalities in rural areas (and possible

mitigation), negotiation and conflict management, limits and potentialities of MSPs or integrated water management at watershed level.

3.1.2 Tools: games, spreadsheets and others discussion tools

As part of these methodologies, the project have developped various tools and softs that are presented in the following table.

Table 4 : Tools develop by the Negowat project and part of the methodologies developped.

name	Type	Country	Comments
SosteniCAP	Non-computorized RPG[5]	Bolivia	
Larqu'asninchej	Non-computorized RPG	Bolivia	
Tool to simulate tariff scenarios in community-based drinking committee	Excell datasheet	Bolivia	Prototype
Financial management software for community-based drinking committee	Access database	Bolivia	
Ter'Aguas	Computorized RPG	Brazil	Possible use in academic and professional training courses about integrated water management
AguAloca	Computorized RPG	Brazil	Possible use in academic and professional training courses about integrated water management
JogoBairro	Interaction tool	Brazil	Mapping of resources (water, land, housing, infrastructure) interaction and problems in periurban brazilian settlement
JogoMan	Theoritical RPG	Brazil	Prototype, used in a phD dealing for the design of an e-learning RPG on negotiation for natural resources management
Drammatization tool	Simplified RPG (only roles - no spatial support)	Brazil	Adapted from the environmental education game "Desafios das Aguas"
Guidelines for negotiation planning	Guidelines	Brazil	Adapted from a tool developped in Bolivia (from CESU-UMSS)

These tools (and their elaboration process) are presented in different Negowat reports (Barban and al, 2006, Clavel and al, 2006, Quiroz and al, 2006, Faysse et al., 2006)

The computorized role playing games developped rely on existing previous models and datas dealing with biophysical dynamics (quality processes), and developped by other projects.

In Brazil, some partners have being trained to use the computorized games developped. User's manual and basis for reproduction of material supports are also avalaible in the Negowat Brasil CD .

[5] Role-Playing Game

3.1.3 Dissemination and publications

A training set for a professional public has been elaborated, in the form of a serie of powerpoint slides that gathers the main methodological and theoritical results of the project. This set will be posted on the website Negowat.

The Bolivian team have also done a large effort to elaborate and provide publications products for a large range of users (cf Box 6). In Brazil, 3 prototypes of booklets are currently being elaborated (elaboration funded by the French Foreign Affairs) (Box 7).

Box 6 : Targeted publications for various publics (Bolivia)

Publications for a broader public
Three cartoon based books to raise awareness about the problems related to land and water issues in Tiquipaya. They address: the urbanization process; the drinking water committees in Tiquipaya; and the MACOTI project and related problems.

Publications for drinking water committee management team
Three cartoon based books to help strengthen the internal management of committees, which address respectively: the legal issues and especially how to obtain a legal status; how to design a tariff structure; and how to manage the accounts of the committee.

Publications for NGOs and professional institutions
A guide to design role-playing games (Peñarrieta and Faysse, 2006).
A book recollecting experiences of support the management of drinking water committees in Bolivia and Colombia (Quiroz et al. 2006).

Publications in scientific and professional journals
An assessment of existing drinking water committees in peri-urban areas of Latin America (Courivaux et al., 2006).
An assessment of the potential and limits of multi-stakeholder platforms (Faysse et al., 2006b; Faysse, 2006)

Box 7 : Booklet for large public being elaborated in Brazil

A booklet to design role-playing games (adapted and completed from the Bolivian role-playing game).

A booklet about land and water management of periurban catchment and regularamentory issues.

A Booklet presenting the principale of the basic principles of the teraguas methodology for NGO,

A book summarizing the different intervention processes in the 3 cities in Brazil, Bolivia and India, their methodologies, achievements and lessons learned is currently finalized (Butterworth and al, in Press). It will be posted in the website Negowat and IRC sites and translated in Spanish.

As presented, various workshops have been implemented in 2006 in Bolivia at regional and national levels to disseminate the project results to decision makers. A workshop is being planned in Brazil in 2007 with this objective. Various scientific publications are being prepared in Brazil for dissemination in academic circle of the results of the project.

3.2 Theoritical results

The experiences developped in Brazil and Bolivia are contributing to general discussions whithin different research networks and through different means (publications, on-line discussion,

participation to conferences and workshops). More specifically, the project is contributing to advances in 3 areas (1) analysis of the potentials and limits of multi-stakeholders platform for natural resources management (2) role playing games and simulation tools for natural resources management (3) Companion Modeling and participative modelling. The following paragraphs summarize the main elements of these contributions.

3.2.1 Multi-stakeholder platforms potentials and limits

A detailed evaluation of the potentials and limits of multi-stakeholders platforms has been undertaken, with specific reference to the technical roundtable facilitated by the Negowat team in Bolivia.

Multi-stakeholder platforms (MSPs) have been widely promoted as a promising means of resolving environemental conflicts, first in developed countries and, more recently, as a global good practice. However, many MSPs have been implemented in an unfavourable context — primarily of social inequities and large poweer asymetries betweens stakeholders — and have not met initial high expectations. Social and economic inequalities are far greater in many developing countries that occidental countries, and this is sometimes disregarded when international cooperation agencies advise MSP-type decision-making. The establishment of MSPs should not be driven and analyzed mainly as an ideal of perfect communication and social learning, but should be seen rather as a possibly useful process that will, nevertheless, always remain imperfect. Where the context was unfavourable, external intervention proved necessary to face the challenges of design and implementation.

In situations of large power assymetries other approaches have been designed, often refering to the the empowerment of the weaker groups in the negotiation. But in a facilitation process, actions such as supporting weaker stakeholder groups, or intervening in the relationship between a constituency and its representative, might be interpreted by MSP participants as conflicting with a facilitating role. For example, in Bolivia, the Negowat team could have refused to facilitate the MSP on the MACOTI project and may have supported some groups in their refusal of the project. But, with such a conflict-based approach, the very interesting and constructive discussions between supporters and opponents of the project on the institutional component would not have taken place. This shows the needs to further study how to mix an MSP with some strategic actions based on power asymmetry analyses. Detailed analysis is presented in the UMSS report and in a specific article (Faysse, 2006).

These findings, out of the Bolivian case studies, are supported by results from the intervention processes in São Paulo. There, the water management governance organization like many integrated water management policy relies on the same theoritical basis that supports the developmement of MSPs. Investigations underline the difficulties to integrate the point of views and interests of local stakeholders (local communities, smallholders), theoritically represented in the catchment committees. The Teraguas methodology and intervention process which is more specifically oriented toward local community representatives is one type of empowerement or strategic approach that can be implemented. With the sub-committee of Cabeiceras-Tietê, mobilizing of small-holders about water management was only possible trough the development of specifically farming-oriented workshops. It is also likely that their participation in the Teraguas process that was initially looked for but that could not be secured would have necessitated specific activities and capacity building.

Strategic approaches tend to consider any agreement as a necesseraly instable arrangement, insist on their historical determination and the differences of interests between parties. Combining strategic approaches with MSP approach could include collective understanding both of the different interests and point of views of parties and historical development of the conflict. The Companion Modeling approach can be valuable for the first point while other theoritical framework such as the theory of Convention (Boltanski Luc 1991) or the sociology of translation (Callon 1986) can be interesting to analysis the historical development of conflicts (Beuret 2006).

3.2.2 Role playing game: design, contents, implementation , role for natural resources management with actors

Detailed analysis and assesment of role playing games for natural resource management, and its roles as negotiation support tools has been undertaken. The results are underlying the following aspects:

Tools named "role playing games – RPG - for natural resources management" gather very different types of games, with different objectives, contents, design modes and integration modes in intervention or capacity building processes. We more specifically identified 3 types of games (i) "governance" games, used for training about planning and implementing negotiation process in the field of public policy (ii) environmental education games, that have the objectives of training local stakeholders to the best way to manage the environment (iii) the so called companion modeling games, that focus on the interaction between actors and the resources, and the potential of the game as a simulation model. (Collectif ComMod 2006). The differences between these games are presented in two publications (Ducrot and al, 2006; Camargo and al, in press).

The design and implementation of RPG is a rather heavy process, whether computatorized or not. Development of computorized tools in Brazil was particularly long, but this was partially related to the team difficulty to mobilize adequate full time computing skills and to the participative methodology selected. Computorized games are not necessarily more complex tool or more difficult to play (as the complexity of the game to be played depends on its proximity to real actions) but may require specific facilitation modes. One of the key factors of a game is the adequate distance between reality and theoritical/virtual situation. Thus the design of underlying model of the game is an important step of the design of the game.

RPG have proved usefull especially to (i) create a favorable basis of interaction between actors, generating empatia and aproximating actors (ii) reveal and and facilitate understanding about the different interests, constraints, values systems and sensibility to risk of the different parties (iii) facilitate the understanding of complex dynamics .

Thus, RPG can be viewed as a scene where the complexity of the social and biophysical interactions can be partially expressed and revealed, inclusively hierachical relationships and systems of values. Game sessions can enable to collectively identify the nature and type of disagreement between parties, which is a basis for the development of possible trade-off. But as a played scene, they reveal it only partially, and thus have little interest to provide concrete and immediate applicable solutions. Collective finding of operational solution supposes necessarely other activities adapted to the situation studied.

They also can be a good introduction to more complex simulation modeling or scenarios exercices : Many simulation models or geographic data-bases are justified by a desire to develop of negotiation support tools; Such tools rarely achieve their objective and are seldom effective in supporting multi-party discussion - either for lack of trust in the models or data and a lack of understanding of the contents, because the scenarios do not really support collective work on scenarios, or because the approach is not well geared to mobilizing non-specialists. The Negowat work succeeded in introducing simulation to all parties, no matter if they were well-informed and capacitated or not.

The methodology of collective elaboration of the game used in Brazil did promote collective learning within the research group. Individual knwoledge was integrated in a visual and logical way using a a common language (modeling languahe) and structuring components of the model was collectively. The efforts made to provide a minimum quantification of the process have led to key interaction moments, where each participant verified and confronted his own understanding of the system and his theoritical premises and implicit hypoteses. But this integrative work is expensive in term of time and transaction costs and it was not chosen not to elaborate collectively the rules and specification of the games, even if methodologies exist to do so. A consequence is that for many researchers, the computer parts of the game remains a black box. Nor has the project tested the direct participation of actors in the elaboration of the games (underlying models and/or games rules). Their knowledge has been indirectly incorporated in the model as their knowledge has been perceived by scientists during specific workshops. During the project, it has not been possible to confront in the same meeting the

representation of local actors and institutional actors or researchers. One can wonder whether this would have been possible in face of the difference of information and training.

3.2.3 Contribution the development of the Companion Modeling approach

The question of the design and use of role playing game within a negotiation process has led to an active discussion within the Companion Modelling group. The methodology developped in Brazil was explicitely based on this approach. But the project tested innovative features or elements, contributing to the improvement of this approach. Among the innovative elements we can state:

- The introduction of rapid drammatization activity in the sequence of work, in order to introduce the concept of negotiation to local actors that are used to other modes of interaction with local authorities: they compete between them to present their demand and wait for their potential implementation in a rather passive way. It also purposely allows them to understand what a virtual scene would be, and to discuss the contribution of position shift from reality to virtuality to solve real problems. It contributes to the discussion about the role and place of simulation of a virtual situation (and its relative place to reality) in understanding of a complex reality or problem solving.
- The Companion Modelling approach is a problem-oriented approach, developped and adapted for a unique situation. It relies on the idea that discussion tools have to be built collectively and are disposable in the sense that they only are adapted to one situation and one moment. It is thus very costly and thus raises the question of its sustainability in areas such as periurban areas, densily populated and where the same question can express itself quite differently following the local situation. The Teraguas methodology has been formalized to be replicated in different situation of the periurban catchment, but in a flexible and adapted way depending of the question. The first steps are indeed allowing an adapted modelling of the question studied, while the game session, a key moment of the work sequence, is sufficiently flexible and including dealing with most of the conflictive situations related to land and water planning at local level in the protected catchment. The methodology is thus replicable as a whole in the different situations.
- AguAloca dealt with land and water management of periurban catchment at catchment scale, focusing on water dynamics (even if it include simplified representation of land uses change) while Teraguas dealt from the same issue at local scale focusing on land use and occupation changes and including simplified water dynamics representation. The same question was thus developped in a combined way with 2 articulated processes (and their related tools), with the other. While each process is independent, implementation has indicated that coupling both approaches can have added value to provide a complete understanding of the complex dynamics governing the socio-environmental dynamics both at catchment and local scale. Desagregation was chosen in order to simplify the representation of biophysical and social dynamics and make them acessible to actors: a same tools dealing in the same time with complex water quality water dynamics and land-use change could have to complex to achieve its objective of making clearer the underlying dynamics. It contributes to make explicit the objectives differences between scale of management and can provide a discussion platform about how to articulate the management of the diferrent scale. Further work is however necessary to assess the contribution of the articulation as we did not have time whithin the time project to articulate both process with suc-committee.

The project has also contributed to the on-going discussions of the group about the monitoring and assessment of role-playing game sessions: it has tested and implemented two monitoring methodologies, and it is one of the few existing research projects when this evaluation and monitoring has been systematically applied.

The 4 processes of the Negowat project where role playing games have been used, are integrated in the research plan of a French funded project that aims to analyse the impacts of participative modeling and

intervention project based on the Companion Modelling approach by comparing some 30 cases studies around the world.

3.3 Social impacts of the intervention processes

The detailed social impacts of each intervention process at local level are presented in the following tables (Table 5 – Brazil, Table 6 – Bolivia).

In both cases, the intervention contributed to the evolution of representation and attitude of participants as well as capacity building of local representatives about negotiation and interaction with others actors. In some cases, it contributed to a renewed interested at regional or even national level about the issue studied: For example, the Negowat work in Bolivia contributed to raise awareness about the importance of self-organized drinking water committee at national level, about multi-functionality of irrigation canals at municipality level or the necessity to start adressing the relationship between agricultural water and domestic water (a discussion that was taboo at the beginning of the project). In Brazil, the specialists of the Negowat team were asked to contribute to the elaboration of agricultural part of the specific Law of Guarapiranga (along with the sub-committee) along with the sub-committee members: at the beginning of the project, catchment protection was dealt with mostly through urbanization control and management, that is a urban question. The Negowat team was one of the few research team, if not the only one, to develop comprehensive framework integrating the rural dynamics in this periurban areas and its expertise appears thus to be valuable to better integrate rural issues in legislative framework.

The limits or the way this impact could have been amplified are detailed in partners' report (UMSS for Bolivia and POLIS institute/CIRAD for Brazil). In Bolivia, one of the problems was that no institutions were able to ensure the follow-up of the agreements reached. This problem relates to the issue of the institutionalization of activities implemented and developped from a bottom-up perspective in the timing a short-term project. In Brazil, there has not been enough time in the project to fully complete one process (Agualoca) and fulfill all the expectations and demands raised by the other one (Teraguas) (including training course and elaboration of guidelines). We did not have time either to better integrate the results in institution policy planning at regional level.

Generally speaking, the work contributed to the implementation of integrated water management from a bottom-up perspective in Bolivia and from an institutionalized perspective in Brazil. In Bolivia, it thus contributed to raise awareness about different issues and capacitate and mobilize local representatives on the issues dealt, a first step to put these issues in an institutionalized agenda. In Brazil, it contributed to the integration of local communities and stakeholders point of views and interests in some of the on-going discussions of the catchment committee, a major challenge of integrated water management at catchment level..

Table 5 : Results achieved in the different Negowat intervention processes in Brazil

	Using role playing games for capacity building on negotiation over land and water processes: the Teraguas process	Supporting sub-catchment dialogue about water alocation in quantity and quality and the relationships with agricultural activities: the AguAloca Process	Farmers workshops
Output	• The methodology Teraguas to capacitate actors on related negotiation and prepare interactions between different actors • A RPG that can be used as a training tool (Ter'Aguas game) • Various interacting tools	• A game that can be used as training tools as well as interaction platform for actors	• A methodology to mobilize local farmers to initiate an environmental friendly production label • A serie of discussion papers to craft an agricultural policy in headwater catchment
Specific output	• Proposal of sharing costs for development and maintenance of individual sceptik tanks		• A first basis for a proposal of environmental friendly practices for agricultural production in the Cabeiceras-Tietê catchment
Social impacts : Local	• Approximation of local actors : SABESP, communities and municipalities • participants changed their representation about others actors • Improved knwoledge and understanding of participants on the dynamics of land and water management in periurban areas • Improved capacity of representatives that participated (+-20 people) in negotiation and interaction with external organizations • Interest raised about the methodology with demand to formalize the approach into guidelines to be used in other areas – health in particular	• Better understanding of the importance of managing quality as well as quantity => demand for more technical and specific information from Sabesp engeneers to be included in daily management of reservoirs systems • For players : better understanding of the meaning and consequences of integrated water management • For Players : better understanding of each other interests and positions	• Better knowledge of farmers about water management, water scenarios and opportunities. • Interests raised about development of an organization of agricultural production in the catchment with an environmental label • Better information of representatives of sub-committees about agricultural activities in the catchment
Social impacts : regional	• Demand to participate in the training of catchment committees members or SABESP engeneers (to be implemented)		• Participation to the elaboration of the Specific law of Guarapiranga (rural aspects)
Limits	• Impact would have been enhanced if the Negowat team has been able to follow up some negotiation (for example in Paralheilos) until the finalization of agreement but not possible in the timing of the project	• It has not been possible to implement the game with technical chamber of planning of the sub-committee and representatives of farmers as planned.	

Table 6 : Results achieved in the different Negowat intervention processes in Bolivia

	Mesa tecnica : a technical roundtable to discuss a water and sanitation project	Capacity building of community-managed water supply systems	Impact on urbanisation on irrigation canals
Outputs	• A methodology to design, implement and evaluate Multi Stakeholder Platforms	• A methodology for supporting periurban community managed water supply systems • a book gathering experiences of support to drinking water committees in Bolivia and Colombia • Cartoon books for water committees representatives • 3 tools (RPG SosteniCap, a simulation datasheet, monitoring financial tool)	• A methodology to address the issue of multiple uses of canals in periurban areas • A RPG adapted to raise awareness on the issue • A regional workshop gathering different actors of the Cochabamba Valley
Specific output	• Several recommandations of improvement of the MACOTI project • Two proposals for the institutional settings of the project	• Diagnostic documents for 2 committees • Improved organizational model for 2 committed and definition / implementation of byLaws • Legal by-laws for 2 committees	• Agreement about maintenance of canals signed
Local impacts	• Change of attitude : from general judgement toward detailed and positive discussions • Better understanding of the components of the project	• negotiation of new power tariffs and reduction of operational cost (1 committee) • Water costs reduced for 2 committees by negotiation with private tankers and Cochabamba electricity company. • Change of vision about importance of the management component • Improved capacity of representatives to negotiate and interact with external organizations.	• Better dialogue between local urban residents and farmers in 2 local areas and change of vision about canals • awareness raised of the importance of canals at municipality level • Improved management of irrigation and drainage canals
Social impact at regional or national level		• Awareness raised about existence and functionning of community water drinking committees and periurban areas	• Interests raised at regional level (Cochabamba levels) about the necessity to develop mechanism to mitigate the impact on urbanization on hydrailic infrastructure and irrigation management
Limits	• Recommendations have not been implemented		• Maintenance work agreed has not been implemented (lack of follow-up)

3.4 Training and cooperation

3.4.1 Improved knowledge about land and water management in the peri-urban catchments studied.

Field studies and learning from the interventions have contributed to develop new knowledge either local or specific to the area studied and of more general interest.

- Example of local information, contributing improved knwoledge about the periurban area studied : historic reconstitution of land use evolution in Guarapiranga / Cabeiceras Tietê (Brazil) and in Tiquipaya (Bolivia); analysis of the contribution of the Jundiai reservoir to fosforus pollution charge of downstream reservoirs (Brazil); Impact of cold front in toxic algae bloom Sao Paulo reservoirs; Heteroneity, quantitative importance and difficulties of small farming systems of the RMSP (Brazil); Census of local settlements organizations in Paralheiros;
- General understanding of periurban functionning: For example, mechanisms of land speculation in Sao Paulo; representations of local actors about urbanization and pollution in headwater catchment, nature and importance of the differences of representations between local actors and institutional ones in Brazil.

More generally, the project permitted the integration of different informations and knowledge in an integrated framework or representation that contributed to a better understanding of the specificities of periurban areas, of the relationships between land and water management, and of the social and technical aspects of water management in periurban. This was a particularly important challenge in Brazil where the complexity of the situation makes it difficult to understand the interrelashionships between the different economic, social and technical factors and can be an obstacle to the elaboration of sustainable solutions.

3.4.2 Multidisciplinary integration

One of the objectives of the project was to promote multidisciplinary research and integration. This is recognised as of one the main achievements of the project by partners, especially in Brazil, which was achieved through the collaboration for the elaboration of the tools with an adapted methodology. It more specifically allowed integrating social sciences (economy, sociology), agronomy and hydrology/limnology. In Bolivia, this integration was more developped during the elaboration of a 3 weeks training course about conflict analysis and management during WP5. even if some thematic areas were not really covered (the Bolivian team focused more on the social and ecomical aspects of management that on the biophysical part).

However, in Brazil, the implementation of various parallel activities in the same time made difficult for some partners to make sens of the developmenet path of the project and of the coherence and interaction of the different activities. Consequently some have had difficulties during the first phases of the project to understand their contribution in the project as a whole. This can partially explain why two partners quitted the process prematurely (IIEGEA and CERES) even if the major driver for their departure was financial problems.

3.4.3 Development of expertise in different research area and development of new aera of work

The project has allowed partners to build new expertise and skills in different areas of work. In some cases, it has led to the development of new research-development orientations. The following items are more specifically cited in partners' reports: building and use of role-playing game for capacity building and empowerement related to natural resources management, periurban agriculture for APTA, water and sanitation acess in periurban settlements and communities, social learning and companion modeling in Procam, conflict and negotiation (inclusively methodological aspects), potable drinking committee management in UMSS, pollution management in multi-reservoirs system for CIRAD, as well multidisciplinary integration and intervention research (UMSS, POLIS, USP).

Individual learning of the scientists depends on their previous research and pedagogical practices and experiences. The Negowat team in Brazil brought together people from different backgrounds: academic researchers, expertise and support to public decision makers and specialists in action research and intervention together with local actors or local development. Unsurprisingly, each participant therefore assessed the potential and limitations of the methodology in light of their background: some researchers tend to value the computer-basedd tools or exchanging technical information more, while others focused on the elaboration process or the full sequence of interaction with the actors. In Bolivia, the project trained 7 junior scientists in questions like research-conflict management, negotiation and research intervention.

The Negowat project also capacitated partners to participate in international cooperation research project (especially in Brazil where the involved partners had little experience of such projects).

3.4.4 Academic consequences-redefinition of course contents

The results and methodological learning has already permitted to partially redesign the academic training modules in the UMSS post-graduate programme "Integrated Water Resources Management".

3.4.5 New project and development of partnerships.

The developpement of new expertise, skills and area of research has directly led to the development of various new research and cooperation projects:

- An Alfa project on "Water Governance in urban and periurban catchment" coordinated by PROCAM and involving CIRAD, NRI, and UMSS : the GovAgua project
- The URSI project involving CIRAD, UMSS and the Cemagref French Institute, about a cross-country (France and Bolivia) study of evolution of irrigation canals in peri-urban areas: 1) problems linked to urbanisation; 2) local agreements that foster transition to multiple uses of the canals; 3) bottle necks to design and implementation of such agreements.
- Participation of UMSS-Centro Agua to the Concertacion project, funded by Dutch cooperation, involving work on negotiation Project on negotiation
- Development of a project proposal about agricultural water pollution coordinated by APTA
- Elaboration of a project proposal to IRDC about negotiations in periurban areas involving Polis Institute.

4 Problems encountered

Four type of problems were encountered in the project

1) The difficulty to implement a colective analysis and comparison of the work and results between Brazil and Bolivia.
2) A slow and somewhat disconnected implementation of the thematic studies (WP3) with the other workpackages especially with the development of the tools and methodology and their implementation.
3) Difficulties in computer and multi-agent modelling
4) No time to fully complete and implement one process and all dissemination in Brazil

4.1 Insufficient integration of Brazil and Bolivia work

It has not been possible to develop a real collective analysis and integrated work between Brazil and Bolivia in spite of various attempts supported by the coordination (regular meetings, promotion of the writing collective papers etc) and momentanous enthusiasm. It is partially explained by the important differences of situation (Institutionalized management of water in Brazil versus very ainstitutions in Bolivia, focus on quality in Brazil versus on inundation or potable water in Bolivia, very different scale of work - regional to municipality level in Brazil, micro local to municipality level in Bolivia), to the difference in team composition (in Brazil main participation of senior scientists with the support of students, in Bolivia full time contractual juniors), of the processes, of the issues studied, of the methodologies that did not permit comparison on the way. Because the timing of implementation was also very different (intervention processes started in 2004 in Bolivia and was terminated when it was only starting in Brazil beginning 2006), comparison of methodologies or contribution of simulation tools to negotiation process was also impossible during the project time frame.

Even if the periodic meeting did not result as expected in joint outputs, partners acknowledged the contribution of these moments in their work. They were key moments to discuss the theoretical and methodological framework of each team as well as the institutional, political and environmental dynamics of the peri-urban catchments in each country. In spite of the differences between situations, or maybe because of these differences, these interactions were thus important for each team to better identify the specificities of the dynamics studied and of their conceptual basis each scientist was refering to, even in the same thematic field.

It is expected nevertheless that comparative analysis between both situations will be undertaken in the frame of the GovAgua project that will used part of the experience and results developped during the Negowat project.

4.2 Delays of implementation of the thematic studies and disconnection to the intervention process

It has been difficult to fully integrate and relate the thematic studies to the intervention processes.

The objectives of thematic studies were initially to (i) provide information whenever knowledge gaps existed in order to complete intervention processes (ii) contribute to the elaboration of a network involving researchers and local actors, facilitating the development of the intervention processes (iii) in certain case, to build empirical knowledge (as opposed to theoritical views of the situation of the catchment that researchers were defending at the beginning of the project).

Many of these studies have however been developped independently. It can been partially explained by diferent elements (i) Delays in identifying the conflicts that would be dealt with (ii) difficulties for

the coordination to explain to the partners involved in what was a very innovative approach how the field studies was articulated to the intervention process.. The problem was accentuated with financial and administrative problems of some partners (APTA and CERES for example) that led to a stop of all activities, time availability of some partners, insufficient concrete knwoledge at the beginning of the project that made difficult the elaboration of a first representation that would have permitted to point out gap of information

The gap between field studies and actual intervention in negotiation processes has had various consequences : (i) many participants had difficulties to understand the role of the tools and modeling as an integrative framework at least at first and the added value of multi-vision integration in the intervention processes (ii) In Brazil, some thematic reports were provided at the end of the project when the information was of no use for the intervention process, or tools/methodologie development or even integration of knwoledge. The delays were for some items partially compensated by direct participation of the scientific to the tool elaboration meetings. (iii) In Bolivia, the team pointed out during the intervention processes a lack of information that had to be compensated on the spot.

It also resulted in important centrifugal forces especially in Brazil that gathered a large team of senior scientists. Each of them were involved in different field studies, in which they were fully mobilized during quite a long time (first phase of the project) and leading to undertandable wishes to focus the intervention phase on some of their own field issues or for their "client-actors".

On the other hand, fields studies proved very important (1) for the research team to have a detailed knwoledge of the areas studied and the dynamics adressed as some researchers had essentially a theoritical vision of the situation at the beginning of the project (2) to build a legitimacy of intervention, as a research team, jointly to the local actors and local institutions. This was particularly important in Brazil, as few research projects had been developped in the area studied and organizations and institutions were eager for datas and information.

4.3 Dificulties in computer and multi-agent modelling

It has been difficult to aggregate the team around multi-agent modelling as initially planned for the following reasons.

1) In Bolivia, the biophysical dynamics were not a key question of the issues studied, or could be adressed simply (risks of inondation for the canals maintenance) at the scale studied. Thus modelling of biophysical processes did not appear necessary, and non-computorized role playing games proved sufficient to provide a good discussion virtual platform. Simulation of long term dynamic focused on economic issues (such as water tariffs) that could be adressed with spreadsheet simulation tools.
2) The Bolivian was mainly composed of social scientists and expressed certain distrust toward modeling at the beginning of the project, especially toward computer modelling.
3) There were difficulties all along the project to fully mobilize computers specialist competences. The project had only one full time multi-agent modelling at the beginning of the project in Bolivia, who was very isolated (inclusively for being the only Bolivian specialist in this area in the country). In Brazil, it has not been possible to secure a full-time post doc specialist in this field because multi-agent or modeller posdoc scientist have much better work opportunities in the private sector. Consequently, the project worked with part time modelers and graduate students but this arrangement was not fully satisfactory: Modeling work advanced slowly depending of the availability of the modeler specialist.

Training on multi-agent modelling was provided to senior scientists of the project at the beginning of the project. Retrospectively, it would have been more efficient to begin with training about role-playing games and select some partners for a multi-agent training. One of the difficulties is to select researchers or student with the adequate background to make the most of the training provided, that is engeneers with a strong emphasis in social sciences. Most of students interested in the project

activities came from social sciences fields and their academic training do not provide them with the basic computers and mathematical skills necessary to be able to tackle, even as a users, multi-agent models elaborated. On the other hand, people from computers sciences or hard sciences basis often do not have the adequate experience and sensibility to coordinate the development of an intervention methodology with tools development.

However it must be pointed out that in Brazil, the results achieved has raised a lot of interest about computorized role playing and multi-agent modelling. As senior scientists are more aware of the skills and interests for a successfull development of such games, they are currently selecting students or young scientists that can be efficiently trained in the use of tools of the project and development of multi-agent modelling for natural resources management.

4.4 Delays in Brazil made it impossible to complete WP5

In Brazil, it has not been possible to fully complete WP5. More specifically, the team was unable to implement a game session gathering representatives of the sub-comittees and local farmers as initially planned as well as provide the sub-committee with a course about negotiation. The team did not have either to complete the dissemination of the work with local workshop, and dissemination booklets. The administrative and financial difficulties of some Brazilian partners, the delays in the completion of thematic field studies and in the development of underlying models, difficulties to secure modelling and computor expertise resulted in delays in the development of tools and consequently in the intervention process, more specifically for the AguAloca one.

The AguAloca game has been succefully tested and validaded but not internalized in the sub-committee. It has however and as expected raised interests for simulation tools, calibrated and validated on the reals dynamics of the Cabeceiras –Tietê catchment. The team had started to elaborate such a model (The SpatMas model), which is based on the same conceptual basis than AguAloca games. The proposal was to use player strategies developped during the AguAloca game to develop the social basis of the SpatMas model and then to let the sub-committee elaborates a couple of management scenarios, implemented in the model and the results discussed by sub-committees members. The coordinator had understimated the time to develop such a model in context of lack or difficult acess to data, lack of previous existing models calibrated in the catchment studied. Insufficient involvment of hydrologists before the hiring of young hydrologist by CIRAD and the late development of the AguAloca game also explains that this part could be not be completed during the project time. It could however provide the basis for an future interesting phD work.

5 Technology implementation plan

Indicate all potential *Foreground Rights* and *exploitation* intentions (including a timetable) taking account of Community policies, including those for transfer of technology to SMEs, and promoting the use of generic technology (see Annex II of the contract: General Conditions - Article 16 & 17).

5.1 Bolivia

Methodology to implement and evaluate multi-stakeholders platform

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Course	A course has been organized in the San Simon University to teach the methodology and the experience obtained by the researchers on the issue. The course is formally recognized by the University, and may be repeated in the forthcoming years.	1 year
Research projects	Centro AGUA is partner of various projects on negotiation and will use the knowledge obtained on the issue during the Negowat project. For instance, Centro AGUA has been called to organize in 2006 and 2007 a multi stakeholder platform in Punata to tackle problems of groundwater over exploitation.	1 year

Methodology to support peri-urban drinking water committees

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Set up of a Resource Centre	Centro AGUA is part of a Bolivian network that aims at supporting the set up of Resource Centres on Water and Sanitation. This network gathers a large diversity of involved stakeholders: NGOs, University, private sector. Such initiative is supported by the IRC Dutch NGO. Knowledge obtained during the Negowat project, as well as the various publications (booklets for drinking water committees, book gathering experiences of supporting drinking water committee management in Bolivia and Colombia) will be used and disseminated through this network.	2 years

Methodology to design, implement, monitor and evaluate Role Playing Games as tools to support negotiation processes

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Course	A course has been organized in the San Simon University to teach the methodology and the experience obtained by the researchers on the issue. The course is formally recognized by the University, and may be repeated in the forthcoming years.	1 year

5.2 Brazil

5.2.1 APTA

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Assistanship to ISA (Instituto Socio Ambiental), an NGO projects	In 2006, ISA, an environmental NGO promoted a workshop in order to mobilize and empower civil society of the Guarapiranga sub-catchment in order to promote a participative appraisal and a policy proposal. The Negowat participants in APTA coordinated two sub group during this workshops (socio-economic activities and water transposition). As a result of this work, it was proposed to create an organization of urban agriculture in the State Departement of Agriculture in order to develop and implement a specificagricultural urban policy. The participants of the workshop have organized a project to implement the decisions from the Seminar. .APTA has assumed a consultancy role in this project regarding agriculture.	Project approval

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Formulation of a research-development project on Urban Agriculture by the State Department of Agriculture.	Social pressure for the elaboration of the project, inclusively meeting to the head of the state department. Submission of the proposal to the Catchmwnt Agency	July 2007 monthes
Elaboration of a Specifi legislation for the rural area in the Alto-Tietê catchment	Participation to the discussions related to the elaboration of the specific legislation concerning rural areas of the Alto-Tietcatchment (meetings and discussion organised by the catchment committee and catchment Agency)	December 2007
Elaboration of new institutions to guarantee the environmental quality of agricultural production..	Research and development Proposal for the national water agency of a new policy instrument to transform agriculture in an environmental service Project to be developed by the organized APTA team with the identified partnerships and external funding.	December 2008

Negotiation project to empower the technical branch to develop a common property management strategy for the watershed's rural area	Project to be crafted with the technical branches (organizations) and the watershed agency to assess the possibility of implementation of a common property management for the rural areas of the watershed according to the specific legislation for the rural area and with FEHIDRO's resources. (specific funding for watershed management	December 2007

5.2.2 Polis Institute

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Creation a new area of activity in the Instituto Polis – the Água como direito (Water as a right)	I. This area will develop research, formation and assessorships activities to the priority public of the Instituto Polis (the civil society organizations and governments), establishing connections with National and International Forums for the defense of water and basic sanitation, public rights and social control. II. Partnerships with other Enviromental NGOs, as: a) ISA – Sócioambiental instituto in the development and publication of the "Guarapiranga Seminary 2006 – proposal of the priority actions to guarantee water of good quality for public supply" b) ISA and SOS Guarapiranga – joint project in election process – for IDRC (Canada) funding III. Possibilities of future projects with NGOs, municipalities, Water company, Environment Department, University, and with the partners of the Negowat project. (ideas in discussion)	Since 2005 2007-2009

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Methodology Teraguas for capacity building and aproximation of local actors in land and water management. And Role Play Game Ter'Águas (Polis/CIRAD/PROCAM) Qualification / capacity building Programs to the local actors and comittees representatives	These processes and tools collaborate in the programs of qualification/capacity building offered by the Instituto Pólis in the areas of Right to the City, Strengthening of the Local Civil Society, Citizenship School, Urban Reform Forum. The methodology is already being reproduced and used with other groups of the civil society in areas as the Grajaú, formation of educators, educators' nets.	Since 2005

Kwoledge about the social actors and their organization/action and conflicts at the catchment areas (Guarapiranga and Tietê-Cabeceiras sub-catchments)	The research had been and still they will be basis for publications and conferences.. It integrates this new environmental area of Instituto Polis with the areas of Urbanism and Right to the City, making possible the creation of integrated projects.	

5.2.3 USP

Methodology and results assessing the relationship between health and sanitation in Tietê Cabeceiras and Guarapiranga catchments': methodology and results (FSP/USP)

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Dissemination of results To various public (local communities, international and national scientific communities)	Implementation of worshops with the communities involved in the research to disseminate and discuss the results Elaboration of an article with results of research in indexed periodic of international impact. Presentation of the results of this research in an Environment Engineering National Congress	1 year

Role Playing Game JogoMan (POLI/USP)

Role Playing Game Jogoman (POLI, PROCAM, CIRAD)	Development of a Phd thesis whose aim is to make it possible to run a role playing game asynchronously (through the Web) and incorporating artificial intelligent agents when not all the human actors are available to participate in a game	12 months

Dynamic of organisation of watershed committee, methodology to monitor and assess role playing game, capacity building in participative modelling and social learning (Procam/USP)

Dissemination of results and methodologies to different public types (social organization, national and international scientific communities)	Organisation of a Seminar in partnership with GovAgua project-Alfa Programme o Negotiation of Water Conflicts in Periurban Regions (in preparation) Presentation of results in different academic spaces as well as in communities, social organisations Publication n refereed journals in Brazil and also abroad Publication in national and international congresses	2007 – second semester 2007

Teraguas game (Procam/USP and FSP/USP)

Use the products of NEGOWAT in academy	Use the instruments developed in NEGOWAT Project, like Ter´águas, in class with Graduate, Pos-Graduate and Specialization students of FSP University and environmental education with specialization in conflict negotiation.	2007

5.3 Cirad

Implementation of Companion modelling approach in a periurban situation

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Participation to the organization of a workshop/seminar with partners disseminate results	Organization with Negowat partners of a seminar to disseminate the results of the project and the methodologies elaborated to be implemented 2nd semester 2007, in Sao Paulo.	2007 – second semester
Dissemination of results in international scientific communities and with local actors	Support to the elaboration of 3 prototype of booklets for a public of NGO technicians (with Polis Institute). Elaboration of scientific papers to discuss the results about the methodologies.	1 semester 2007
Participation to Research activities concerning assessment of the use of participative simulation and	The impacts 4 cases studies (2 in Bolivia and 2 in Brasil) will be assessed and compared to others participative modelling and simulation cases, using a common methodology.	2007

Methodology Teraguas e AguAloca

Activity	Brief description of the activity, including main milestones and deliverables	Timescale (months)
Integration of the tools and methodologies in training and formation project	The methodologies and tools elaborated will be included in training course on multi-agent modelling which will be implemented in Brasilia in March 2007 as part of the Alfa project SMART. Results, tools and theoretical elements will be included in the training modules developed in the GovAgua project	March 2007
Adaptation and integration of the tools for other situations of water management	Project proposal to be submitted for example to the next 7PCRDT	2007
Support to the articulation of the tools to development project	CIRAD will support the elaboration of research and development project based on the use of the tools and methodologies developed during the Negowat project .	2007

6 Publications and papers

6.1 Publications in refereed journals

1. DUCROT R., C. LE PAGE, P. BOMMEL, M. KUPER, 2003. Articulating land and water dynamics with urbanization: an attempt to model natural resources management at the urban edge. Computers, Environment and Urban systems, 28 (2004) 85–106
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6.3.1 Books

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6.3.2 Book contribution

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6.4.1 Negowat document

a) Negowat reports

a.1) Bolivia :

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13. Cuadernillos de capacitacion para pequenos sistemas de água potable. Cuadernillo n°3. Manejo administrativo y financeiro. Centro Água, Projeto Negowat. 28 p

6.5.4 Internet

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6.5.5 Indirect contributions from Negowat

These publications were mentionned by AIIEGA. Although not directly related to the Negowat activities, they were partially linked to activities developped whithin the Negowat project by this partners.

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TUNDISI,J.G.; DUPAS, F.A.; ROHM, S.A.; POLI, M.N.; MATSUMURA-TUNDISI, T.; PARESCHI, D.C.; SOUZA, A.T.S. & SHIBATA, O.A. - Uso atual e uso potencial do solo no município de São Carlos-SP - base do planejamento urbano e rural. Anais da I Mostra de Ciência e Tecnologia em Políticas Públicas Municipais - Unidade Temática de Ciência, Tecnologia e Capacitação da Rede de Mercocidades (26 a 29 agosto/2004) - São Carlos - SP. Suprema Gráfica e Editora. 46-53 pp.

ABE, D.S.; ADAMS, D.D.; GALLI, C.V.S.; SIKAR, E. AND TUNDISI J.G. 2005 – Sediment greenhouse gases (methane and carbon dioxide) in the Lobo-Broa Reservoir, São Paulo State, Brazil: Concentration and diffuse emission fluxes for carbon budget considerations. Lakes & Reservoirs Research and Management, 10: 201-209 pp. Blackwell Publishing Ásia Pty Lt.

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TUNDISI, J.G.; MATSUMURA-TUNDISI, T.; ABE, D.S; TUNDISI, J.E.M. 2005. Ecological impacts of hydroelectric reservoirs and perspectives for their integrated management. Greenhouse Gas Emission from Hydropower Reservoirs and Water Quality (Editors – Luiz Pinguelli Rosa; Marco Aurélio dos Santos; José Galizia Tundisi) – COPPE-UFRJ. 67 - 81 pp

ABE,D.S.; TUNDISI, J.G.; MATSUMURA-TUNDISI, T.; TUNDISI, J.E.M.; GALLI-SIDAGIS, C. – Impacts during the filling phase in reservoirs: case studies in Brazil. In: Global warming and hydroelectric reservoirs (COPPE/UFRJ). 109-116 pp.

ABE, D.S.; GALLI-SIDAGIS C.; ADAMS, D.D.; CIMBLERIS, A.C.P.; BARROS, P.R.H.B.; TUNDISI, J.G.; MATSUMURA-TUNDISI, T.; TUNDISI, J.E.M. 2005. – Carbon gas emission from the sediments of reservoirs of different ages in central Brazil. In: Global warming and hydroelectric reservoirs (COPPE/UFRJ). 101-108 pp

THOMAZ A.A. ROCHA-E-SILVA; RANTIM, F.T.; MATSUMURA-TUNDISI, J.E.; MATSUMURA-TUNDISI, T.; TUNDISI, J.G. and DEGTEREV, I.A. 2003 – dynamics of cytochrome p450 inducers in polluted sites of São Paulo city reservoir. Environmental ecotoxicology elsevier sciences (usa). Vol. 59/1 - 109-115 pp.

7 Conclusion

As a research initiative, the Negowat project has contributed to new insights in different methodological and theoritical aspects such as the use of simulation (specifically role playing games) in negotiation process and in companion modelling approach; the limits and interests of multi-stakholders platforms for natural resources management; some specific knowledge about land and water management in the periurban areas studied, integration of different mechanisms affecting the environnemental functionning of periurban areas, elaboration of methodologies facilitating capacity building of local representatives for their participation in negotiation process or interaction with others organizations.

As an intervention project, it has clearly contributed to capacitate and empower some local representatives and enabled to raise awareness on different aspects related to land and water management in periurban areas at national/regional levels (such as support to water drinking committees, or the need for specific agricultural policy in Sao Paulo headwater catchment). It has contributed to reduce some tensions between locally competing groups of interest (for example urban residents and farmers in Bolivia or communities, water firm and municipality in Sao Paulo). It has contributed to the definition of new water regulation and institutional arrangements either directly (Specific Law of Guarapiranga, Macoti project) or indirectly by capacity building and supporting some negotiation processes.

As a cooperation initiative, it has contributed to the building of a research network as well as the development of new research partnerships in Brazil/Bolivia and between countries (including between Europe and Brazil/Bolivia). It has more particularly contributed to the introduction of new ways of work, methodological perspectives or thematic areas in different partner institutions. At least 4 new research and development projects has been submitted, two of them being already funded. In Bolivia, it has contributed to the renovation of a master training course, introducing new training modules.

A specific effort was made to dissiminate the results and makes them acessible to decision makers and NGOs (that could be in charge of replicating them) in Bolivia. In Brazil, this effort was not possible whithin the time of the project but is part of the Technology Implementation Plan proposed by partners. The main challenge remains the institutionalization and integration of these methodologies and results in institutions and/or governemental policies. Even if there are undoubtly impacts at regional level, direct social impacts are limited to the participants to the intervention processes. As a research project, our efforts were focused on the development and test of the methodologies and not on their replication in a significant numbers of situations. The duration of the project (and more specifically of the intervention part of the project 2 years in Bolivia and 1,5 years in Brazil) did not allow to completely disseminate and scale up the methodologies elaborated. In periurban areas that are so densily populated significant impacts of such intervention supposes an important replication effort and the development of coordinated actions with the mobilization of the various relevant institutions. Integration of NGOs in the project consortium was thought has a first step to facilitate the perenisation of the activities. But, This appears insufficient not only because financial and human resources limits of NGOs might restrict their actions but more because the issues tackled by the project were by definition pluridisciplinary and involving various group of interests and institutions (and regulations). Investigations about sucessul innovation insist on the previous development and consolidation of a previous network of actors to allow its perrenisation (Callon, 1986). The building of such a research and development network takes time and previous legitimacy of the research team. The consortium succeeded to aquire this legitimacy but the consolidation of this research and development network was not given perhaps sufficient attention.

In both case countries, the impacts of the project were also limited by the typical institutional and organizational weakness of periurban areas. As transitional or migration zones, neither completely, rural or urban and thus integrated in specific policies, these territories are characterized by unadequate organization levels. Consequently, efficient intervention in conflict management concerning natural

resources management in periurban areas may suppose previous intervention to support local organization and local collective activities.

Findings also underline the necessity to involve stakeholders early in the research design. It supposes not only an early development of stakeholders or conflict analysis but a previous legitimacy of the research team which is not always easily given at the beginning of a research project. Building a research and development network, gathering research team, local actors, key institutions should be looked for at the beginning of the project, but one should not minimize the necessary time to achieve it.

During the project, tensions appeared between the development and intervention objectives of the project and the research ones that can not be easily solved. In order to get some immediate impacts, the team might be driven to rapidely initiate some activities, without enough time of preparation, analysis and discussion while research driven processes might appear disconnected to real "demand". Coordination of both objectives is especially difficult to achieve whithin a multidisciplanary and multi-cultural teams, when centrifugal "forces" can appears. To minimize the difficulties, it could have been usefull at the beginning of the project to propose the same type of activity to each participants to the project (for example a rapid conflict analysis in each one field of research), enabling participants to initiate contacts with local actors and in the same time start initiate an internal discussion about the different ways to analyse a situation and underlying hypothesis of the theoritical framework defended in each thematical area. .

The project raised other questions such as : how to be able to mobilize adequate modelling expertise when necessary when the research agenda is not driven by the modeling process (the research question here are less the development of tools that their use as a discussion, even if this use led to important research question concerning their development and contents) and when no consulting expertise is easily avalable (multi-agent expertise for example exists in Brazil but not in the area of natural resources management and can be limited by financial resources in a context of high competition for such skill).

An ex-post assessment of the impacts of the project is planned in 2007 (French funding). Given the first research results, clear path for new investigation concerns: (i) the place and role of virtual simulation in collective decision processes : how should it be articulated to reality ? what are its contribution and its limits ? (ii) how to monitor and assess a research-intervention process in a multi-step approach mobilizing various types of stakeholders as reseearches, institutions and local actors (iii) how to combine MSP approach with more strategic actions supporting specific group ?

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III MANAGEMENT REPORT

Project NEGOWAT

Facilitating Negotiations Over Land And Water Conflicts In Latin American Peri-urban Upstream Catchment : Combining Agent-Based Modelling With Role Playing Game

1 Organisation of the collaboration

The activities were undertaken through the development of two separate teams one in Bolivia and one in Brazil.

- In Bolivia, the team was composed of small team of junior scientists (7 people), recruited for the project time and coordinated by Dr Faysse from CIRAD posted in Bolivia. This coordination was supervised by a steering committee composed by the senior scientists of UMSS-Centro-AGUA and CERES and with the external support of Dr Butterworth (NRI). The integration of the work was facilitated by the implementation of a Negowat office in Tiquipaya where all the Negowat team was posted during the last 2 years of the project. Senior scientists were more particularly involved in the dissemination activities (workshops, training courses etc).
- In Brazil, the work gathered 5 institutions. The team was composed by the senior scientists of these institutions (a core group of 3 in USP, 2 for Apta, 1 in Unicamp, 1 in Institute Polis, 1 in IIEGEA). The activities was supported by the mobilization of various students and contractual scientists – on partial or full time basis - (1 in institute Polis, 1 CIRAD/USP, 1 POLI-USP) in each institutions partial. In APTA various senior scientists were also involved at different time of the project to complete specific activities of WP3 and WP4 (worskhops with farmers). IIEGEA participation only lasted up to 2005, as well as Unicamp though Unicamp scientists (that were engaged in other activities outside of Brazil) maintained a distant participation in the project when possible (through the elaboration of papers and dissemination materials). The team was concretely coordinated by R Ducrot, with a coordination group involving Dr Jacobi (PROCAM-USP), Dr Carvalho (APTA) and Dr Barban (POLIS). Integration was achieved through the development of common specific activities.

Whithin each team, a good level of collaboration was achieved inspite of the rapid rotation of personnal in some institutions and the existence of normal tensions in a team gathering scientists from very different research background. For example, in Brazil the development of the Teraguas process was made possible thanks to the important involvment of scientists from CIRAD, APTA, POLIS, PROCAM, FSP for the modelling of the tools, UNICAMP and IIEGEA for some knwoledge and CIRAD, POLIS, FSP, APTA and PROCAM for the implementation of the methodology with actors. The coordination of scientists from so many diferent institutions, each one with their own research and development experiences and objectives, was comprehensively not a smooth path. Integration of work improved during the two last years of the project after the end of field thematic studies. As the work focused in the development of tools/methodologies and the elaboration and implementation of intervention processes, participants started to better understand their their individual and respective contribution to the collective process.

The major problem was an insufficient integration between the Brazilian and Bolivian team. As already discussed, we did not manage a good level of collaboration between teams in spite of regulars meeting (2 meeting a year) during the 3 first years. This meetings proved however key moment to make sense of the work done in each country.

Other difficulties were:

- Distance: AIIEGA is located in São Carlos (400 km from São Paulo) and the Negowat participants of this institution were not able to follow the activities on a regular basis. This contributed to their isolation and departure (along with financial difficulties).
- Rotation of personnal. In Brazil, a lot of work was done by students. It would probably have been easier to secure a couple of technicians of graduate level for the implementation and development of games (a very specialized task) than to train various students. On the other hand, mobilizing students permitted to train more people.

The premature departure of some partners (CERES in Bolivia, AIIEGA in Brazil and UNICAMP for field activities) has led to the reaffectation of work responsabilities and corresponding budgets to partners which is detailed in 2005 Negowat report.

2 Meetings

Two main types of meeting were implemented during the project:

- "Conceptual Framework Meetings", which aim to facilitate exchanges and comparison between the Bolivian and Brazilian teams about methodologies, conceptual frameworks, tools, intervention approach, and results. Integration of approach and conceptual framework was initially looked for but proved impossible to achieve. But, partners discussed the theoretical, methodological framework of their activities as well as the institutional, political and environmental dynamics of the periurban catchments in each country. In spite of the differences between situations, or maybe because of these differences, these interactions were perceived as important key moment to clarify and make sense of the dynamics studied, understand the specificities of each situation or its general features. But in spite of numerous initiatives and temporary enthousiasm from both sides during common workshops, no collective paper could be written.
- Training sessions about tools development or methodologies. Two training session was implemented: one introducing multi-agent modelling and the other on the development of role playing games for natural resources management. The second training was particularly important

The following table is summarizing the main meetings dates and contents. Because of the state of advancement between Brazil and Bolivia, no meeting was implemented in 2006. One of the difficulty was that given the different speed of advancement, it has not been possible to develop an integrated discussion and complete comparison of the methodologies developped in Brazil and Bolivia during the project time. This will be partially done whithin the frame of the GovAgua project but it would have been interesting to collectively discuss into details potentialities and limits of the methodologies and tools developped.

3 Exchanges

Two CIRAD researchers were posted full time in partner's institution: one as visiting scientist in USP/IEA Brazil (2003 to 2006), the other in Bolivia UMSS (from February 2004 to June 2006). A yound hydrologist from CIRAD was also posted in USP/PROCAM from May 2005 to December 2005 (as a trainee) and April 2006 to September 2006.

Table 7 : Summary of the Negowat meetings

		Date and place	participants	results
Scientific meetings	Kick-Off Meeting	3rd-5th of February 2003, USP Sao Paulo, Brasil	All Brazilian Team, 6 Bolivian scientists	Familiarization with project objectives, structure and organization
	First Conceptual Framework meeting	28th – 30th of May 2003, POLIS Institute, Sao Paulo	All Brazilian team, 6 Bolivian scientists (Ceres UMSS)	Elaboration of a first conceptual diagram - Extension of the range of tools that could be used – Definition of on some common methodology basis for thematic field work.
	Second conceptual framework meeting	24th to 29th November 2003, UMSS, Bolivia	All Bolivian team, 6 Brazilian scientists	Discussion of the conceptual framework – first comparison of the results and representation between Brasil and Bolivia - Elaboration of strategies of exchanges between Brasil and Bolivia and planning of joint publication
	Third Conceptual Framework meeting	16th to 20th of August 2004 Sao Paulo, Brazil,	All Brazilian team, 6 Bolivian scientists	Discussion of the first field work results, discussion on joint papers, elaboration of a proposal to elaborate training materials, elaboration of the basis of the monitoring methodology of the intervention processes
	Workshop "MSP Tiquipaya"	6Th-8th December 2004, UMSS, Bolivia	All Bolivian scientists, 3 scientists from the Brazilian team	Discussion of the methodology developed in Bolivia for elaboration and monitoring of a multi-stakeholders platform
	Negowat Meeting	December 12-14th 2005, USP, Sao Paulo	All Brazilian scientists , 5 Bolivian Scientist	The first day presented the state of advancement of the results of the project while the second and third days were dedicated to joint work on two issues: role playing games and training materials.
		18th-20th October 2006 Delft, Netherland	4 scientists	Elaboration of the introduction and conclusion of the final book Negowat
Training sessions	Multi-agent modelling	20th –31st of january 2003 USP, Sao Paulo	18 scientits (Bolivian 6, 12 Brazilian)	Introduction to multi-agent modeling and role playing game for natural resources management - Presentation of the Cormas soft and Unified Modeling Language - Elaboration of toy tools
	Advanced course in multi agent modelling	22nd – 3rd of May 2003 Montpellier, France	3 modellers (B Paz, D. Adamatti, R. Ducrot)	Development of 2 prototype tools : Yacoupaj and JogoMan.
	RPG Training course	23 - 28 of May 2005 Bolivia	6 Brazilian team , 5 of the Bolivian team and 6 persons of UMSS and Ceres .	The session was coordinated by Dr Michel Etienne from INRA-CIRAD (France). The trainers were Dr Pierre Bommel, Dr R Ducrot , Dr N Faysse from CIRAD and Dr B Paz from UMSS-Centro Agua. The course was a first step to present Bolivian and Brazilian advances and methodological references in game development and intervention processes. It was an important step for the development of WP4.

Apart from the participation to the meetings already mentionned, there has been numerous short visits to Brazil and Bolivia among which more specifically

- Dr B. Paz (UMSS Bolívia) to Montpellier France (CIRAD) for a MAS training session (21/04- 3/05) in 2003, and 20 June – 20 July 2004, for modeling development, and 10 days in january 2005 B Paz (10 days 1 week 2005) for training on role playing game and modeling development. Dr Paz also spent a month in USP Sao Paulo (19 avril – 21 may) 2004 for modelling development
- D. Adamatti (USP-Brazil) to Montpellier France (CIRAD) (phD – MAS training ((21/04-3/05) in 2003
- Various visits of Dr M. Kuper (Cirad France) to Sao Paulo and Cochabamba (1 week in feb 2003, and 1 week in may 2003, and 1 week in February 2004 as well as to Cochabamba, Bolivia (1/06-6/06) 2004
- Various visits of Dr J Butterworth,(NRI England) to Cochabamba Bolivia : 3 weeks may and june 2003, 1 month in November 2003, 3 weeks February-March 2004 - 3 weeks June 2004 - 3 weeks december 2005, J Butterworth (10 days – April 2005) and 5 days in 2 periods in Sao Paulo, and 2 weeks in March and May 2006, with short stay in Sao Paulo
- Various visits of Dr Pierre Bommel to Sao Paulo (3 weeks in 2003, 1 week in March 2004, 10 days in October 2004, a couple of days in 2005.
- As well as regular visits of Dr R Ducrot to Cochamba (2 to 3 times a years for coordination purpose).

4 Problems

As already stated, we faced the following problems:

- Early departure from the project of two partners (AIIEGA and CERES) at the end 2005. This was mainly due to administrative and financial problems whithin institutions.
- Instability of personnal in the NGO CERES due to internal problems during the duration of the problem.

This has led to some reorganisation of partners responsabilities. In Bolivia, they were no clear difference of the work developped between UMSS and CERES and all activities were developped by the Negowat team. In Brazil, part of the responsabilities and budget of AIIGEA were transferred to CIRAD and USP (contractation of a young hydrologist).

The major problems however were the administrative and financial difficulties all over the project that required a lot of energy and time to the coordinator to be overcome, in particular:

- The difficulty to understand the functionning of the 40 % initial reimbursable advance. This was especially serious for Brazilian partners that had little previous experiences with international cooperation and were used to very different Brazilian administrative rules from Fapesp. The resulting misunderstanding has led to serious cash problems for 3 partners. Activities were stopped in APTA for 10 months because of these difficulties and very much slowed down in USP and AIIEGA. The consequences was a year delay in the development of the activities that was only partially recovered by the 12 months extension of the project, because it was necessary to end in the same time WP3 activities while WP4 and WP5 activities were already fully engaged.
- Brazilian partners had difficulties to provide the cost statement and administrative reports in time, and some of them (AIIEGA, USP, APTA) have provided them with more than 6 months

delays during the 4 years of the project. That created paiement delays for all the consortium that made all the more difficult the cash problems of partners.

- Non-european partners presented difficulties to advance funds. These problems were accentuated by the paiement delay due to the late finalization of the cost statement. This was partially overcome thanks to the involvment of the European institutions, especially CIRAD that advanced important sums to its main partners (UMSS, USP and POLIS institute).

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I INDIVIDUAL PARTNER REPORT

Project NEGOWAT

Facilitating Negotiations Over Land And Water Conflicts In Latin American Peri-urban Upstream Catchment : Combining Agent-Based Modelling With Role Playing Game

NB :

Two partners did not provide an individual final report as they did not implement any activities in 2006: AIIEGA and CERES. CERES activities are in fact included in the Bolivian Final report as their activities from 2003 to 2005 were closely integrated in the Negowat Bolivian team, (with scientists from UMSS Centro-Agua, Ceres and CIRAD). AIIGEA add provided in 2005 a compilation of their publications that were related to the Negowat activities (the list is provided in AIIEGEA 2005 report).

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Contract number: ICA4-CT-2002-10061

Facilitating Negotiations Over Land And Water Conflicts In Latin- American Peri-Urban Upstream Catchment: Combining Agent-Based Modelling With Role Playing Game

NEGOWAT Project
Final Report
Partner n° 1 : CIRAD

R Ducrot, N Faysse

October 2006

1 CIRAD FINAL SCIENTIFIC REPORT (2006)

1.1 Objectives

Cirad has initiated and coordinated the Negowat project. Its objective was to develop a discussion about water management at the urban fridge in cooperation with Latin American partners and tests the companion modelling approach for water management in Latin America.

- Full time participation of three searchers Dr Ducrot (2003-2006) in Brazil, Dr Faysse, posted in Bolivia (mid 2004 to mid 2006) and Lucie clavel Ms student (9 months 2005) then contractual (6 months 2006).
- Part time participation of Dr Pierre Bommel, computer specialist (during all the project) and ponctual support of Dr Lepage, Dr Kuper, Ms Antona, Ms Cerdan, Mr Sabourin, Mr M Etienne

1.2 Activities

Cirad-Tera's activity in the Negowat project included the following activities:

Coordination and supervision of the scientific activities in Bolivia and in Brazil (WP6 and all WP)

Training in companion modelling approach including in the elaboration of role playing game and multi-agent modelling (WP2, WP4)

Participation in the hydrological studies. (WP3, WP4)

Coordination of the modelling process (WP2) for the elaboration of the tools, that will be used as support of negotiation and discussion process in WP4

Conceptualization with partners of the implementation of the WP4, of its monitoring process (WP4) and replication (WP5).

1.2.1 Coordination of the project and the scientific activities in both countries (WP6)

Cirad was in charge of the general scientific coordination of the project. This included reporting, articulation between workPackgage and coordination of the articulation between the Brazilian and Bolivian teams.

In Brazil and Bolivia, the Cirad was in charge of the coordination and general orientation of the activities developed by the Negowat team. Dr Faysse joined the Negowat team in Bolivia only early 2004, i.e., one year after the project had started. He later took responsibility of coordinating all Negowat activities, under the supervision of a steering committee involving senior researchers from Centro AGUA y CERES. In particular, Dr. Faysse coordinated the team that was based in Tiquipaya city center and which was entirely devoted to implementation of the Negowat work program. Besides Dr. Faysse, this team included from 5 to 8 young researchers from Centro AGUA (and at the beginning also from CERES).

In Brazil, the activities was coordinated by R Ducrot with the close support of Dr Jacobi (PROCAM – USP), Dr Carvalho (APTA) and Dr Barban (POLIS institute).

1.2.2 Training and coordination in companion modelling and elaboration of role playing game combined with multi-agent modelling (WP1, WP3)

Two training courses were organized to capacitate partners on multi-agent modelling (2 weeks in 2003) (training of 18 partners) and on the elaboration and use of role playing game for natural resources management (1 week in May 2005) – (training of 18 persons). The courses mobilized various specialists of Cirad.

1.2.3 Participation in thematic studies WP3

a) Hydrological activities

Cirad was involved in the development of the hydrological activities : In Bolivia, it lays the basis of the development of hydrological studies (methodology and monitoring process). Because of the reorientation of the work developed in Bolivia during the project, the data initially obtained has not been mobilized and used in the negotiation processes.

In Brazil, Cirad has been directly involved in the following activities (1) synthesis of avalaible hydrological datas in the catchment, (2) analysis of available simulation models (functioning, scale, datas need, calibration). The involvlment of CIRAD was particularly important in 2005 and 2006 with the recruiting of a yound hydrologist, Lucie Clavel, to compensate for IIEGEA defection. Lucie Clavel has been responsible in particular to organize the existing datas on hydrology, water allocation and water quality in a coherent framework, to simplify and degrade the existing simulation models in functions that could be easily used in the simulation tools elaborated, to articulate the hydrological functions with other elements of the tools (management function, actors' decision making) as well as analysing management strategies of the main actors involved in water management at catchment level.

The work developed in presented in the AguAloca report.

b) Support to rural thematic studies (Brazil)

Yara's Carvalho visited Cirad for 3 months at the beginning of the project in order to study different theoretical frameworks related to multifunctionality of agriculture, especially in periurban area. Her visit permitted to organise the support of different French scientists from CIRAD in multifunctionality, quality building and rural organization to the work of Dra Carvalho. During the project duration, short visits of these specialists were organized in Sao Paulo.

1.2.4 Modelling and Tools development (WP2)

Dr Ducrot coordinated the modelling and development of the tools in the Brazilian team with the following methodology :

- elaboration of a global representation of land and water management in the upstream catchment of the RMSP via a series of internal workshops. These workshop, coupled by discussions moment allowed by the Brazil-Bolivian workshops allowed to proposed a global vision formalized in the WP3 report.
- Collective elaboration of the conceptual models of the game with two small group of scientists of different discipline, by applying the discussion framework proposed by the Companion Modelling Group (www.commod.org) "resources, actors, interactions". This included the development under the supervision of the Institute Polis of stakeholders workshop to help identify stakeholders representations on the process studied.
- Coordination of the elaboration of the supports of the 3 games produced : JogoMan, Ter'Aguas and AguAloca, including the tests of the supports and their validation (WP4)
- Elaboration of the conceptual framework of a simulation models, by combining the framework developed in the stage (1) and the framework developed in stage (2). A specific attention was given to the articulation of spatial and hydrological process.

Cirad also coordinated the development of the game support through 3 mains activities.

- Dr Ducrot and Mr Bommel contributed to the development of the JogoMan game : participation to the formalization of the game basis (UML basis), reformulation of the computerized base of the game (2nd version elaborated with an important involvement of Mr Bommel),
- Dr Ducrot was more specifically in charge of the development of the Ter'Aguas game supports : transformation of the conceptual model into a formalized game basis (UML basis), coding and elaboration of theTeraguas soft; elaboration of the game supports (maps, players interface), elaboration of the log and replay functions of the game.

- Lucie Clavel was responsible by the elaboration of the AguAloca game support and model basis of the game in close articulation with the USP/POLI computing team. The AguAloca soft itself was developed by the USP/POLI computing team and the game support (game board, interface) was conceptualizedby Lucie Clavel.

In Bolivia, Dr Faysse participated to the elaboration of the tools as part of the Bolivian team.

1.2.5 Development of the methodologies of intervention in support of negotiation (WP4)

a) Brazil

In Brazil, the methodology of interaction with stakeholders were developed in close partnership with Institute Polis for the Teraguas process and Procam and Apta for the AguAloca process.

a.1) Teraguas process

The objectives of the Teraguas process is to approximate the different stakeholders interested in local planning and development process in a protected periurban catchment area, capacitate local stakeholders parties in negotiations processes related to this issue and helps them to assess some possible alternatives local and shared solutions to contribute to quality preservation in the mananciais, especially in the context offered by the new legislation that is being implemented.

The elaboration of the intervention methodology was elaborated jointly by Cirad and Polis Institute, by using some of the results of stakeholders workshops developed in the WP2. We adapted some of the tools tested in an organized sequences of activities with the objective of (i) approximating the diferent parties and helping them to realise the existence of common objectives (a sustainable living in the headwater catchment area) (ii) discussing interactions and negotiation modes, by differentiating competing demanding, negotiations, negative/positive attitudes for negotiation in order to allow at medium term an evolution of their interaction modes that has proved little efficient (iii) introducing some opportunities offered by the new legislation that requires participation and collaborative work (iv) indicating some ways of possible interactions at short term.

The following tools were more specifically used : rapid dramatization, formalization of historical development of the district, mapping of land and water management problems of the settlement, identification and discussion of the main actors involved in the management of these issues; Ter'Aguas game; presentation of the specific law of Guarapiranga; planning of negotiation activities planning.

The methodology was implemented in 2 cases : in the northern part of the Embu-Guaçu municipality for the preparation of master plan and with 3 settlements in the Paralheilos sub-municipality that was conflicting with the public sectors about the development of individual sanitation.

a.2) AguAloca process

Elaborated in concertation with Procam and Apta. Ciras was more specifically involved, through the work of Lucie Clavel of the implementation of the game (tests with focus group and Sabesp engeeneers) and one test with the Alto-Tietê Agency and Committee. One game with the technical chamber of planning of the SubComittee planned at the end of september was cancelled by the sub-committee and we did not have time to organize another game session before the official ending date of the project.

The games sessions underlined the quality of the games support (as a simplified yet close representation of integrated water management at catchment level), the capacity of the game to discuss water quality issues along with water quantity allocation, to introduce the meaning of integrated management at catchment level.

b) Bolivia

As already stated, Dr Faysse was part of the Bolivian Negowat team. All the achieved work was team work, so it is difficult to single out CIRAD specific contribution (for a presentation of all implemented

activities, see Centro AGUA report) apart from the evaluation of implementation of multistakeholders platform..

The only exception may be an evaluation of problems related to implementation of Multi Stakeholder Platforms in developing countries, where usual enabling conditions for the success of these platforms are not met. This evaluation was based on the Negowat Bolivia experience and led to a specific article (Faysse, 2006).

1.3 Main results and outcomes:

1.3.1 Scientific results (for Cirad)

a) WP2 : Modelling and tool development

The project directly contributed to an improvement of knowledge concerning the following aspects:

- Role, place and management of computer-based and non-computer games as discussion platforms with stakeholders.
- Role and interaction modes of computer scientist with a multidisciplinary team for the developement of such tools (part of pHd Thesis in development of P. Bommel).
- Contribution to technical discussions concerning the development of some specific computer functions in the Cormas soft facilitating the development of computer game (more specifically : management of communication interfaces between computers and players, organization of the game "memory" – function log, organization of a possibility to replay a specific game session stored – function "replay") .
- Contribution to the discussion of the use of Unified Modelling Language as discussion tools to formalize multidisciplinary knowledge: It appears a methodology difficult to implement if the participating team does not a previous good knowledge of the situation studied. It is also easier not to focus on the UML formalization at first and to orient the discussion much more on the contents than on the form. It is inappropriate to work directly with stakeholders.

b) WP3 : Thematic studies and functionning of periurban catchment

A multidisciplinary framework of analysis linking water, land, settlements and actors has been elaborated and can be used as a starting point to develop further project and tools related to periurban areas. The main determinants of the dynamics studied in each countries have been identified.

The work also permitted to discuss the specificities of periurban aeras in term of development and successful implementation of intervention research project related to negotiations : speed of changes, differences of power between stakeholders, necessity to combine communication approach with more strategic approach etc.

One important innovative contribution was the integration of quality issues in role playing games representating water allocation. Various game have been developped and are being used around the world to discuss water allocation (for example in South Africa) but the AguAloca is the only one that integrates quality issue with water allocation.

c) WP4 : elaboration of tools and intervention methodologies (for Cirad).

The project has contributed to elaborate and discuss the following methodologies:

1. Adaptation for replication of a companion approach to deal with conflict related to land and water conflicts at local territorial levels in periurban areas in Brazil.
2. Clarification of the different types of role playing games in environmental management process, their specificities, objective, use, development and management in an intervention research project.
3. Development of models :

- specific computerized tools (game tools) has been elaborated ; the Ter'Aguas game and the AguAloca games (with their respective user's manual) that can be used within training course or adapted companion modelling approach.
- non computerized tools have been elaborated and tested: the SosteniCAP and Larq'asninchej games. Use of both games within a negotiation process has been thoroughly evaluated.

1. Elaboration of a methodology that allow to adapt the companion modelling approach in a rapid throuh interesting way of interaction. Adaptation of the companion modelling approach
2. Development of a methodology for supporting community-based drinking water committees
3. Contribution to the theoretical and conceptual discussion about interest, limits and conditions of implementation of multi-stakeholders platform, conflict analysis and negotiated process. Contribution to how monitor and evaluate such multi-stakeholder platforms
4. Integration of power in companion modelling approach
5. Contribution to the internal discussion of Cirad on methodologies to monitor companion modelling and participative modelling project.
6. Development of a methodology to evaluate the use of role-playing game within negotiation processes.

d) WP5 : scaling up and replication.

1) Discussion of place and use of role playing game as a training tools
2) Elaboration of a replication methodology for companion modelling approach (scaling up) about the process studied. .
3) Guidelines for elaboration of role playing games and adapted companion modelling approach (in elaboration)

1.3.2 Development results (for Cirad)

1) In Bolivia, the work enabled the support to 4 community-based drinking water committees in peri-urban areas of Cochabamba. More importantly, this intervention as well as the edited book on experiences of support to drinking water committees helped making these committees more visible to the eyes of Bolivian government.
2) In Bolivia, the work on urbanization of irrigation canals enabled to move from a single use vision of these canals to a multiple use ones, thus helping to start discussions on innovative ways to cope with the urbanization process. Agreements were designed and signed to formalize new acknowledged functions of canals as providers of both irrigation and drainage services.
3) In Brazil, the development impact have still to be assessed (as part of specific French funded project). First assessment of the Teraguas process indicates that the intervention helped participants to make sense and discuss the respective impact of their decision makings on the resources and other actors, helps them to better understand role, responsibilities, interests and positions of other players as well as have discuss other mode of interaction than traditional ones. To what extend these changes of representation will be incorporated in development process remind an important question. .
4) Participation to various training courses : for posgraduation training (2 courses), for water basin managers, for Sabesp technicians.,

1.3.3 Products - concrete outputs (for Cirad)

1) computerized role playing games (models): AguAloca and Ter'Aguas as a participative modelling product with their use manual.
2) A methodology of companion modelling replicated and adapted
3) In Bolivia, the findings were incorporated in a special course within the University at Centro AGUA. The course was organized around three modules: i) the diagnostic of a peri-urban area; ii) methodologies and tools to support negotiation processes; iii) role-playing games. Second, a range of publications were produced for different public targets. It took place during the first trimester of 2006 and 24 professionals and students attended the course.
4) From the experience obtained, guidelines to design and use role playing games were written in Spanished, with a target audience of NGOs: Peñarrietta, Faysse. (2006). Pautas generales para la elaboración, uso y empleo de juegos de roles en procesos de apoyo a una acción colectiva. Etreus Ed., Cochabamba, Bolivia.,
5) The Negowat team took the initiative to edit a book that recollected experiences of support in drinking water committees' management for 10 institutions from Bolivia and Colombia: Quiroz, Faysse, Ampuero (Eds.) Apoyo a la Gestion de Comités de Agua Potable. Experiencias de fortalecimiento a comités de Agua Potable comunitarios en Bolivia y Colombia. Etreus ED, Cochabamba, Bolivia.
6) Diferent guidelines and booklets are being elaborated and will be finalized in Brazil : participative modelling and games, land and water conflicts in headwater catchments and companion modeling approach with example of the Teraguas methodology.

1.3.4 Other outcomes (for Cirad)

- Construction of research partnerships in Brazil and Bolivia related to water management; participation of Cirad and its close French partners Engref in the new Alfa project GovAgua coordinated by Procam.
- Building personal capacity on issue related to pollution management in complex basin
- Integration of the Brazilian and Bolivian case studies in the ADD project, dealing with the evaluation of intervention research project involving modelling for natural resources management.

1.4 Difficulties and problems

As coordinator of the Negowat project as a whole, we have been facing the following problems

Slow and somewhat disconnected implementation of the thematic studies.

Thematic studies were initially proposed to complete information necessary for the development of the intervention processes and elaboration of the tools. They have practically being developped by partners with very diferent objectives, and somewhat disconnected to the intervention processes.

In Bolivia, there were in particular a disconnection between the initial diagnostic and related thematic studies and the issues dealt within the negotiation processes. In Brazil, the disconnection was partially related to a coordination difficulty in a team composed of various diferents institutions, senior scientists and spatially dispersed. Each scientists tended or would have like to orient the intervention process in their own field of activities and with their traditionnal clients. Recentering the work on 2 processes only was a difficult task to achieve and was still incomplete (for the AguAloca process). This dispersion and coordination difficulty also resulted in the late elaboration of WP3 reports : some reports and information were provided at the end of the project when there were of no use for the

intervention, modelling or tools development. This was all the more a problem when the specialist did not participated to the collective elaboration of the tools which means that the specific information or knwoledge was not really taken into account.

The SpatMas has not been completed (basin scale multi-agent models to simulate land and water process at catchment scale) .

A biophysical and spatial conceptual model has been elaborated and used as a conceptual basis of the AguAloca game but it has not been possible to implement the SpatMas during the project time. The initial proposal was also to use players strategies and actions in the AguAloca game to development the social (agent) base of the SpatMas model, then to participatively elaborated management scenarios with stakeholders and water committee during participative workshops, implement them in the SpatMas model and discuss the simulation results.

Various reasons contribute to explain this incomplete development.

- Lack of high level competence in multi-agent modelling : it was initially previsted to recruit a full time pos-doc in multi-agent modelling but we have not been able to identify an adequate candidate for the posdoc salary offered (in the context of very competitive market for such skills). Consequently a Phd student was initially recruited but it proved inadequate for the level of modelling and time needed. Then a part time modeller was recruited but as a part time contribution was not enough to accompany the modelling need. The Bolivian computer specialist was also involved, but the changes of computers specialist made even more slower the development of the model itself.
- Insufficient involvment of hydrologists of IIEGEA in model development to gather and adapt the existing datas and models. The adaptation of hydrological models to the SpatMas model was thus slow until the recruitment of Lucie Clavel of Brasil to compensate for AIIGEA insufficient involvement.
- Datas related to water quantity difficult to access (spread in various institutions) and datas and previous models related to water quality in the catchment studied were sparse.
- Late implementation of the AguAloca games in the game project : the game sessions could only be implemented in september 2006 (while it was initially planned in June 2006, whith July, August and september to be devoted to the finalisation of the SpatMas game).

1) The AguAloca process not completely implemented

Delays in the development in the subjacent modelling and insufficient modelling expertise (cf point 2) resulted in delay in the development of the game itself. The game has been tested and validated by a small group of actors of the sub-comite of Cabeiceras-Tietê and of the Alto-Tietê Comitê but it has not been possible to implement the game with all participant of the sub-Comitee and with representatives of the agricultural sectors. It was also previsted to propose a course on negotiation to the sub-committee that we did not have time to implement.

2) Difficulty of coordination between Brazil and Bolivia especially on the following aspects.

- Methodology of monitoring and evaluation of the games : two different framework has been produced and no comparison could be implemented.
- Comparative framework : comparison has been very difficult. On the other hand, the differences of situations, methodologies, theoritical background between Brazil and Bolivia proved very enlightening for the researchers.
- In spite of numerous initiatives and temporary enthousiasm from both sides during common workshops, no collective paper could be written.

- The different project time frame between Brazil and Bolivia, as well as team composition and functionning that resulted in two very diferent dynamics of work partially explains this difficulty.

1.5 "Technology" implementation plan

BRAZIL

- Funds will be looked for to translate the Negowat book published in English in Spanish and/or Portugues.
- A seminar, in collaboration with USP, Apta and Procam will be implemented in 2007 to disseminate the Negowat results and discuss the methodologies proposed in Brazil and Bolivia. Fundings for this event will be looked for locally and internationally.
- booklets for large public are being elaborated with Polis Institute : about role playing games, Teraguas methodology and land and water management in Sao Paulo Mananciais. The elaboration of the prototype are funded and we are looking for more funding for larger diffusion.
- The methodology and results developped in the project will be presented to the National Agency of Water of Brazil in Brasilia in December.
- Further training on the use of the AguAloca and Teraguas games will be provided to partners.
- Cirad will support the development by its Negowat partners of training session based on the methodology and tools developped during the Negowat project.
- Further development of the AguALoca (introduction of a financial funds) and adaptation to other Brazilian situation.

BOLIVIE

- The work on drinking water committees was a pioneering one within the G-EAU research unit to which CIRAD researchers are attached, and it came at the right time since this unit is considering more research in the future on drinking water issues in developing countries.
- An other research work was on-going on the issues of urbanization of irrigation canals and shift from single use to multiple use of canals in France. This research work was undertaken within the same G-EAU research unit. In such a context, a 6 month research project was set up and implemented in 2006, to go on studying the issue both in France and Bolivia. The project was financed on the G-Eau research unit own funds. A common methodology was used on both countries. This work enabled to follow up the work undertaken within the Negowat project in Bolivia. It also enabled to broaden the study, since an evaluation of all Bolivian irrigation schemes facing urbanization problems was made. Second, the study analyzed the bottlenecks to reach agreements, and finally workshops were set up with local stakeholders to help breaking the identified bottlenecks (Ladki et al., 2006).

BOTH

- Methodologies and theoritcial results will be incorporated in the training courses developped by the GovAgua project
- Role Playing Games are used by many other researchers within CIRAD and the G-EAU research unit, and experience gathered within the Negowat project will support the currently very active discussion regarding the potential use and limits of this tool to support negotiation processes.
- The ex-post impacts of 4 interventions will be assessed in 2007, following the methodology developped by the ADD COMMOD project and compared with 25 other intervention research project based on the same principles (negotiation in natural resources management)

1.6 Publication and papers

1.6.1 Publication in refereed journal

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DUCROT R., BUENO A.K., REYDON B.P 2005. Institutional arrangements to articulate land and water management in peri-urban catchment : example of the metropolitan region of São Paulo, brazil. International Journal of Water. Vol. 3, No. 2, 2005, 186-203

M BOUZID, R. DUCROT, Y. M. CHAGAS de CARVALHO, R. IMBERNON. Dinâmicas agrícolas peri-urbanas e gestão integrada da água : Caso de uma bacia produtora de água na Região Metropolitana de São Paulo. CADERNOS DE CIÊNCIA & TECNOLOGIA, v22, n°2, mão/ago 2005. 349-364

BOUZID M., DUCROT R., CARVALHO Y., IMBERNON R. Prise en compte des dynamiques agricoles périurbaine dans la gestion intégrée de l'eau. Cas d'un bassin versant producteur d'eau dans la région métropolitaine de São Paulo (Brésil). Cahiers agricultures, Cahiers Agricultures vol. 14, n° 1, janvier-fevrier2005, 131-137.

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DUCROT R., C. LE PAGE, P. BOMMEL, M. KUPER, 2003. Articulating land and water dynamics with urbanization: an attempt to model natural resources management at the urban edge. Computers, Environment and Urban Systems, 28 (2004) 85–106

1.6.2 Seminar and conferences

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GRANJA, S.I. B e DUCROT, R. CAMARGO, M. E. 2006 - Role playing games: ferramenta para construção de consensos gradativos, artigo para o III Encontro da ANPPAS - Associação Nacional de Pós-Graduação e Pesquisa em Ambiente e Sociedade, de 23 a 26 de maio , Brasília-DF. http://www.anppas.org.br/index

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potable water supply? Communication in the workshop « water resources management for local development: Government, institutions and policies, November 8-11 2004, Loksop Dam South Africa. 21 p.

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DUCROT R., M.L.REFINETTI-MARTINS, P JACOBI, B. REYDON. 2002. *Water management at the urban fringe in metropolitan catchment : example of the Sao Paulo upstream catchment (Brasil).* Vth International Eco-city Conference, Shenzen, China, August 19-23, 2002. http://www.ias.unu.edu/proceedings/icibs/ecocity03/papers/ducrot/index.htlm.

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Quiroz, Faysse, Ampuero (Eds.) Apoyo a la Gestion de Comités de Agua Potable. Experiencias de fortalecimiento a comités de Agua Potable comunitarios en Bolivia y Colombia. Etreus ED, Cochabamba, Bolivia.

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1.6.4 Reports and student thesis

a) Negowat document

FAYSSE, N; COSSÍO, V.; PAZ, B.; QUIROZ, F.; AMPUERO, R. (2005). A Methodology for intervention in the design and evaluation of a short-term Multi-Stakeholder Platform. Centro AGUA Negowat report, UMSS. Bolivia. www.negowat.org.

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DUCROT R., 2006. Ter'Aguas. Manual do usuário. Projeto Negowat. 36 p.
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R Ducrot (ed). Negowat Project: Second annual Report (year 2004). ICA4-CT-2002-10061. Rapport CIRAD n° 62/04. 122 p.

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R Ducrot. 2005 ed. WP3 report. Brazil 242 pages ; Bolivia. 142 pages. CD

R Ducrot (ed). Negowat Project: First annual Report (year 2003). ICA4-CT-2002-10061. Rapport CIRAD n° 57/03. 105 p.

R Ducrot (ed). Negowat Project: First annual Report (year 2003). Annexes. ICA4-CT-2002-10061. Rapport CIRAD n° 57/03. 105 p.

R. Ducrot (ed). project Negowat : 6 monthly activity report, covering period form 01 january 2004 to 30 june 2004. INCO-DEV, ICA4-CT-2002-10161. 41 p.

R Ducrot 2003. Third conceptual Framework meeting. Negowat project. São Paulo, 16th-20st of May, 2004. Negowat project, INCO-DEV ICA4-2002-10061-Cirad Tera N°42/04 september 2004, 13 pages +annexes.

Project Negowat : 6 monthly activity report, covering period form 01 january 2003 to 30 june 2006. INCO-DEV, ICA4-CT-2002-10161. 9 pages + annes.

R Ducrot 2003. First conceptual Framework meeting. Negowat project. São Paulo, 28th 31st of May, 2003. Negowat project, Cirad Tera 19/03. June 2003, 28 pages +n annexes.

R Ducrot 2003. Kick –Off meeting report. Project Negowat. São Paulo 3rd – 5th of february 2003. 12 p.

1.6.5 Communication in other media (internet, video, magazines, newspaper etc)

CD : Material do Curso Taller : Enfoques e instrumentos de negociacion para la gestion integral de recursos hidricos. 25 -29 Abril 2005. Cochabamba. Bolivia. UMSS Centro-Agua, LA-WETnet, PROMIC, WALIR, NEGOWAT, CAPNET, GWP SAMTAC.

CD : Material do Curso "enfoque de juedo de roles en la modelacion de acompanamiento. 23-27 de mayo 2005, Cochabamba Bolivia. Proyecto Negowat. CIRAD, INRA, Centro Agua-UMSS,

Nicolás FAYSSE, Vladimir COSSÍO, Bernardo PAZ, Franz QUIROZ, Raúl AMPUERO. 2005. Use of a methodology to support the design of a short-term Multi-Stakeholder platform: the case of a water and Sanitation project in Tiquipaya (Bolivia). NEGOWAT, Cochabamba - Bolivia (pdf file 207 Kb). Spanish version (pdf file 144 Kb). Accessible in the website :

Nicolás FAYSSE, Vladimir COSSÍO, Bernardo PAZ, Franz QUIROZ, Raúl AMPUERO. 2005. A Methodology for intervention in the design and evaluation of a short-term Multi-Stakeholder Platform. NEGOWAT, Cochabamba - Bolivia (pdf file 112 Kb). Spanish version (pdf file 144 Kb). Acessible in the website.

CD : Material do Curso "enfoque de juedo de roles en la modelacion de acompanamiento. 23-27 de mayo 2005, Cochabamba Bolivia. Proyecto Negowat. CIRAD, INRA, Centro Agua-UMSS,

COURIVAUD, A., FAYSSE, N., BUSTAMANTE, R. 2006. El papel de los Comités Comunitarios de Agua Potable en las zonas peri-urbanas: Enseñanzas para Cochabamba, Bolivia. Revista n. 21 Water and Sanitation Programme, Lima, Peru.

COURIVAUX, FAYSSE (2005). Organisations communautaires et entreprises de dsistributions en Amérique Latine. Typologie d'une coexistence aux modalités variées. Lettre du PsEau n. 49.

1.7 Conclusion

As any complex intervention project, the initial planning of activities had to be modified to adapt to the evolution of the local socio-economic political-situation and actors preoccupations. The team composition has evolve during the project time and there have been inherent tensions within the team but normal in such complex project and globally the cooperation within teams has been satisfactory. Thus, the project has permitted to develop interesting research activities in a stimulating cooperation context, providing concrete and methodological results in a real situation of partnership.

For Cirad, the project provided various valuable contributions

- The development of methodologies, their implementation and test have contributed to various internal discussions of the Cirad research teams about the use of simulation tools for water resources management and conflict management, the role and place of MSPs for natural resources management, methodologies to support local stakeholder participation in integrated water management.
- It has permitted to initiate the development of new thematic perspectives within the *Gestion de l'Eau, Acteurs Usage (Water management, Actors, Uses)* research unit. more specifically about integration of quality issues with quantity, water management in peri-urban areas, potable water and sanitation management, management of multi-uses water at territorial levels.
- It has permitted to initiate interesting collaboration about water management and Companion Modelling approach with South American partners and European partners. New research activities (within GovAgua Alfa project, ADD Commod but also new project being developed) are currently being developed in Andean countries and Brasil which are directly related to the Negowat project

The development of methodological and theoretical aspects has led to practical interventions, contributing to these discussions. Various elements indicate that there is a dissemination of the methodologies at regional or national levels, even if dissemination to decision makers and institutionalization can still be improved. The experience acquired during the Negowat project includes scientific aspects but also management aspects (coordination of regional complex project, management of European research project, team coordination).

1.8 Management aspects

Cirad was in charge of the general coordination of the project, as well as the scientific coordination in Brasil (in close relationship with 4 seniors scientists of 4 different Brazilian institutions) and in Bolivia (in coordination with 3 senior scientists of the Bolivian institutions). The project has also permitted to create strong collaboration links with 4 institutions of the project Apta, USP, Polis and Centro –Agua-UMSS;

Two Cirad scientists were posted full time as visiting scientists. Dr Ducrot at IEA/USP (Brazil, 4 years) and Dr Faysse at UMSS-Centro-Agua (2,5 years). L Clavel was also posted in USP for 6 months (after a trainee period of 6 months)

The exchanges also included various short term visits of scientists to France for training purpose, even if the time have decided to develop more training activities in Latin American continent than in Europe as initially planned in order to allow more partners to beneficiate from these training, and various short term visits of French scientists to Bolivia and Brazil.

As coordinator, the main difficulties met was : (i) partners were not familiar with E.C management rules. This was a particularly difficult problem for Brazilian partners that have mostly experiences of funding by Brazilian institutions that use very different financial rules. This has led to difficulties to understand the financial rules of INCO project (reimbursable advances, 20 % of overhead on expenses and not money received) that lead to various difficulties in the management of the funds and elaboration of the Cost statements. (ii) Difficulties to advances funds (iii) difficulties especially for some Brazilian partners to respect the deadlines to provide cost statements.

To compensate this problem, Cirad (and NRI) has advanced to various partners (UMSS, USP, POLIS, Ceres) funds to avoid cessation of activities.

The methodology proposed (especially the collective modelling and use of simulation tools in MSPs process) was innovative for most of partners but many partners were mostly interested by the thematic studies. Uncertainties about the contribution and development of collective modelling and simulation, and individual interest in some thematic fields, and sometimes some scepticism about use of simulation and modelling in MSP process was responsible for centrifugal forces within the teams that was not always easy to coordinate. Nevertheless, this was solved during the last 10 months of work as partners could make sense of how their contribution was integrated in the whole process.

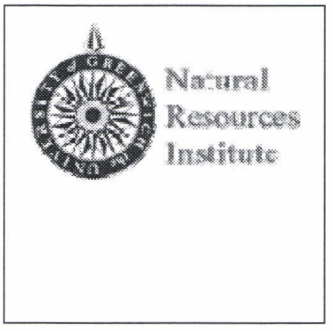
In Brazil, this centrifugal initial tendency and the important financial and administrative difficulties of 2 main partners (Apta, USP) has led to important delays in the implementation of work. Work was stopped for 9 months in Apta and very much slowed down in USP. This was only partially compensated by the extension of project duration has the full development of the work was also linked to availability of actors and decision makers. Consequently it was not possible to (1) fully terminate the dissemination of the results (publication and local seminars) (2) to fully complete and validate one of the process (AguAloca).

INCO - DEV : International Cooperation with Developing Countries (1998 - 2002)

Contract number: ICA4-CT-2002-10061

Facilitating Negotiations Over Land And Water Conflicts In Latin- American Peri-Urban Upstream Catchment: Combining Agent-Based Modelling With Role Playing Game

NEGOWAT Project
Final Report
Partner n° : 2 NATURAL RESOURCES INSTITUTE



John Butterworth

December 2006

2 NATURAL RESOURCES INSTITUTE: FINAL SCIENTIFIC REPORT (2006)

2.1 Objectives

NRI played a supporting role in most of the project activities, focusing on supporting the Bolivian project team in various activities especially Centro-Agua. NRI also coordinated the production of training materials on the methodologies developed during the project. In addition, NRI were involved in extending the project activities to Chennai, India through additional funding from the UK Department for International Development.

2.2 Activities

Work package 1: Preparing modelling work

The first work package was to prepare the development of the conceptual framework and modelling phase by providing training for thematic scientists in agent-based modelling in order to foster knowledge, stimulate integration from different disciplines and introduce them to integrated modelling. Stakeholders point of view on land and water management issues and conflicts in their catchment was also assessed as well as the available information, tools and data in each discipline to be mobilised. John Butterworth from NRI visited Sao Paolo, Brasil from 26/1/03 to 7/2/03 to participate in multi-agent system modelling training and the kick-off meeting.

Work package 2: Model design and development

The second phase was the methodological development of the conceptual framework to be used for the agent based models. It was intended to provide a critical understanding of the hydrological and social functioning of the periurban upstream catchments. Based on these core models, further agent based models were to be developed. This work package required regular interaction between agent-based model specialist and thematic scientists, and the definition of common environmental indicators. This phase contributed to identify the "knowledge gap" related to interactions between natural resources dynamics and uses, and thus further focus the specific field work to be carried out in each thematic area in the third work package. John Butterworth visited Centro-Agua and other Bolivia partners from 12/5/03 to 13/6/03 to provide some inputs to this task (in Bolivia) and to assist Centro-Agua in preparation for the first progress meeting in Brasil in May 2003 (CFM1).

Work package 3: Conducting thematic field research

The third work package aimed to carry out the required "thematic" work in order to fill the "knowledge gap" identified in the previous phase. In each thematic area identified (hydrology, periurban agriculture, urbanisation and human settlements, environmental/land use of land and water, land market and rights), a first literature review identified the focus of the thematic activities. However, all thematic scientists worked in close interaction with the modelling team requiring at times additional data or expertise (specific information looked for and methodology) during the building of the conceptual framework. WP2 and WP3 were conducted simultaneously in order to allow a transfer of information and knowledge between disciplines, and thus facilitate the integration and linking of different scientific disciplines. John Butterworth made visits to Bolivia to support Centro-Agua and the Bolivian research team in these tasks: from 20/8/03 to 20/9/03 and from 15/11/03 to 6/12/03 including participation in the second joint progress meeting (CFM2), 26/2/04 to 14/3/04 and 5/6/04 to 6/7/04.

Work package 4: Developing and testing an approach to facilitate negotiations combining the models developed and role game playing

The fourth work package focused on facilitating negotiations over peri-urban land and water conflicts. NRI's role involved supporting the Bolivian partners, especially Centro AGUA, and CIRAD in facilitating the 'Mesa Tecnica' process in Tiquipaya focused on the proposed Macoti water and sanitation scheme. This involved support in methodological development and documentation, as well as the planning of an evaluation workshop in December 2004. John Butterworth visited Bolivia from 18/08/04 to 5/9/04 (also Brasil for part of progress workshop from 19-21/8/4) and 4/12/04 to 22/12/04

Work package 5: Validating the methodology proposed and preparing training materials

This work package involves the validation of methodologies (testing the methodologies in other catchments) and the development of training materials. NRI coordinated the development of training materials. Preliminary discussions with all project partners were held on the design of training materials based upon Negowat methodologies and findings at the August 2004 progress meeting in Brasil and in Cochabamba in December 2004. A preliminary plan was developed for a CD-based guide to negotiating peri-urban land and water conflicts. Detailed outlines were later developed for the training materials with involvement of all partners in Bolivia and Brasil.

A detailed plan for completion of the training materials was developed during and following visits by John Butterworth to Bolivia and Brasil in April including workshops with the team focused on training materials on 11 April (Cochabamba, Bolivia) and 15 April (Brasil) 2005 Activities were coordinated by institutes Centro-Agua and CERES in Bolivia and POLIS in Brasil. Modules from India (linked to related DFID supported research) were subsequently be added.

Initial training modules were tested as part of the LA-WETNET (the Latin American partner of the CAP-NET network for capacity building in integrated water resources management) training course/ workshop in conflict resolution held in Cochabamba in May 2005. John Butterworth visited Bolivia in August 2005 focusing on supporting the Bolivian team in further development of training materials, and he visited Brasil in December 2005 for a joint meeting of Bolivia and Brasil research teams where a further one-day workshop was held on the training materials as part of the team meeting. To complete these activities and support testing as part of a series of three training courses offered by Centro-Agua John Butterworth visited Cochabamba from 3 to 11/3/06 and 29/5/06 to 6/6/06 to Cochabamba and Sao Paolo.

2.3 Main results and outcomes:

In 2003, NRI were successful in obtaining UK Department for International Development (DFID) funding for the matching 50% of NRI costs and additional money was also provided to extend the work to India, working in Chennai with the Madras Institute of Development Studies. This work began in late 2003 and is reported elsewhere (see www.irc.nl/negowat).

Since NRI only had a supporting methodological development and backstopping role, results relating to workpackages 1-3 are reported elsewhere in Centro-Agua's report.

Work package 4: Developing and testing an approach to facilitate negotiations combining the models developed and role game playing

The main results of the Mesa Tecnica process are also reported in Centro AGUAs section of this report. Centro-AGUA, CERES and other partners were able to facilitate this officially sanctioned consultation process established by government with a view to resolving problems in the Macoti project design, which will hopefully lead to a revised, and more widely accepted, project. Participation within the *Mesa Tecnica* process was guided by a checklist based methodology that will be further refined as a 'conflict negotiation' methodology, together with the water and sanitation case study, user guidelines and supporting more academically orientated papers. A successful evaluation workshop was held in December 2004 which included comparison with processes in Bolivia, Brasil and also India (in work separately funded by the UK Department for International Development).

Work package 5: Validating the methodology proposed and preparing training materials

The agreed detailed plan for the training materials was to produce, test, finalise and disseminate training materials that can be used by the research partners and other organisations to strengthen capacities in the main focus of the project: methodologies for negotiating peri-urban land and water conflicts. These training materials are targeted at middle-level professionals and students (e.g. NGOs, regional and local government staff, University staff and researchers) involved in the management of land and water resources. Training is focused on transferring and developing knowledge in appropriate methodologies for use in different situations on potential and actual conflict. The training materials are made up of a series of modules (see list below for proposed list of modules). Each module includes a powerpoint presentation, and one or more supporting documents/ papers providing further information. All these materials are available on the project website.

Additionally, a project final scientific report/ book has been produced including results from Cochabamba, Sao Paulo and Chennai in India. The final manuscript is complete and available and will be published in early 2007.

2.4 Difficulties and problems

Several lessons can be highlighted in addition to those reported elsewhere:

1. Considerable time was devoted to baseline data collection (WP3), and while this provides a rich knowledge base, it was not driven by the needs of negotiated processes and the questions posed by stakeholders (it was rather researcher-driven).
2. Initial attempts to developing modelling frameworks and tools were also researcher-driven, and not clearly linked to negotiation processes on the ground.
3. Multi-agent system modelling requires a high level of expert knowledge which may not be replicable in some situations and more simpler and demand-driven approaches were later adopted alongside.
4. Attempts to develop ideas and establish support for a researcher-initiated multi-stakeholder platform were not successful, and were abandoned in favour of participating within existing negotiation processes (the Mesa Tecnica) that are driven by other stakeholders, with official mandates, and where there is clear willingness of key groups of stakeholders to participate.
5. It was difficult to mobilise the inputs of all the partners in a timely fashion for the training materials and some modules are still only partially completed and need some improvement. Other researchers have been reluctant to rapidly develop 'draft' training modules based on existing knowledge (for subsequent later improvement) preferring to wait for the last moment until other research activities have been completed before disseminating ideas.

2.5 "Technology" implementation plan

Results will be used in ongoing work and new projects such as training to be delivered by the EC supported GovAgua project.

2.6 Publication and papers

2.6.1 Seminar and conferences

a) Without proceedings

BUSTAMANTE R., BUTTERWORTH J., FLIERMAN M., HERBAS D., HOLLANDER M., van der Meer S., Ravenstijn P., Reynaga M. & Zurita G. 2003. *Livelihoods in conflict: disputes over water for household-level productive uses in Tarata, Bolivia*, International conference on multiple uses of water for life and sustainable development, September 29 – 30, 2003, Cartagena de Indias, Colombia.

2.6.2 Books contribution

BUTTERWORTH J, DUCROT R, FAYSSE N, and JANAKARAJAN, 2007. Peri-urban water conflicts: experiences in supporting dialogues and negotiations. Forthcoming. Published by IRC International Water and Sanitation Centre.

2.6.3 Reports and student thesis

a) Negowat workpackage report

NRI, MIDS, IRC. 2004 *Facilitating negotiations over water conflicts in peri-urban catchments (Negowat)*. Inception report to the UK Department for International Development.

2.6.4 Communication in other media (internet, video, magazines, newspaper etc)

BUSTAMANTE, R., BUTTERWORTH, J., DEL CALLEJO, I., DURAN, A., HERBAS, D., HILLION, B., REYNAGA, M. AND ZURITA, G. 2004. *Multiple sources for multiple uses: Household case studies of water use around Cochabamba, Bolivia.* [online] Available at http://www.irc.nl/content/view/full/8031 (accessed 22 March 2004).

BUSTAMANTE, R., BUTTERWORTH, J., FLIERMAN, M., HERBAS, D., DEN HOLLANDER, M., VAN DER MEER, S., RAVENSTIJN, P., REYNAGA, M. AND ZURITA, G. 2004. *Livelihoods in conflict: disputes over water for household-level productive uses in Tarata, Bolivia.* [online] Available at http://www.irc.nl/content/view/full/8031 (accessed 22 March 2004).

DURAN, A., HERBAS, D., REYNAGA, M. & BUTTERWORTH, J. 2004. *Planning for multiple uses: Household case studies of water use and livelihood activities in peri-urban Cochabamba, Bolivia.* [online] Available at www.negowat.org (and part of WP3 report)

BUSTAMANTE, R., BUTTERWORTH, J.A., & FAYSSE, N. *Is there a future for locally-managed domestic water supply systems in peri-urban Cochabamba? Analysis of performance and some possible scenarios.* [online] Available at www.negowat.org (and part of WP3 report)

2.7 Conclusion

The project has led to the development of strong new partnerships both within the consortium and with some external agencies such as the IRC International water and Sanitation Centre who were leading related work in India supported by DFID. In particular NRI appreciated developing good links and successful collaboration with Centro-Agua in Bolivia and this led to several other spin-off activities and projects in different areas. The GovAgua network formed from this group will take forward the training activities of the consortium.

The benefits in Bolivia are clearly described in the Centro-Agua report. Here the project was able to successfully complete tasks and achieve a high level of impact in terms of support to local negotiation processes, capacity building impact and local language publications that will continue to be accessible and widely used.

2.8 Management aspects

The collaboration was good throughout and well managed, although some partners did perhaps not contribute as much as others and little effective action was taken to address these problems. It is hard to rock the boat or eject a partner. In particular Centro-Agua took the burden of delivering most work in Bolivia, where the presence of a full-time staff member from CIRAD greatly increased the coordination and impact. The AC financing model probably had rather nejected impacts on the sustainability of Centro-Agua themselves however. It encouraged the setting up of an (excellent) but more junior project team of temporary staff which to some extent sidelined the permanent staff of the organization.

INCO - DEV : International Cooperation with Developing Countries (1998 - 2002)

Contract number: ICA4-CT-2002-10061

Facilitating Negotiations Over Land And Water Conflicts In Latin- American Peri-Urban Upstream Catchment: Combining Agent-Based Modelling With Role Playing Game

NEGOWAT Project
FINAL REPORT
Partner n° USP

Partners at USP

Graduate Program of Environmental Sciences-PROCAM
School of Engineering- POLI
School of Public Health-FSP

COORDINATOR : PEDRO ROBERTO JACOBI- PROCAM-USP

October 2006

3 USP FINAL SCIENTIFIC REPORT (2006)

The **USP Research Team** is composed by three groups: PROCAM (Graduate Program of Environmental Sciences) coordinated by Prof. Dr. Pedro R. Jacobi; Escola Politécnica -POLI (School of Engineering) coordinated by Prof. Dr. Jaime Sichman and School of Public Health (FSP) coordinated by Prof. Dr. Wanda Gunther. It has been involved in all stages of the project, as the different groups correspond to specific activities all along the project. The six stages in which the USP research teams participated were to: 1) prepare the development of the conceptual framework, 2) methodological development of the conceptual framework, 3) produce documents and collect data on "knowledge gap" related to interactions between natural resources dynamics and uses, 4) implementation of discussion sessions and the methodological development combining agent based modeling tools with role game playing, 5) test discussion methodology and 6) assess the feasibility and the validity of the proposed methodology validate the method and prepare diffusion, and coordinate and animate the scientific activities. At PROCAM several advisees at Masters and PhD level where involved: Fernando Monteiro, Maria Castellano and Reynaldo Romagnoli (2003-2004) in WP1, Maria Eugenia Camargo (2004-2006) in WP3, WP4 and WP5; Sandra Ines Granja and Marialina Lima(2005-2006) in WP4, WP5 and WP6. At POLI Diana Adamatti and Cesar Rabak in all stages. At School of Public Health, Mariana G. Arteiro is involved since 2004 in WP$, WP5 and WP6.

3.1 Objectives

In the context of the Negowat Project specific objectives were: to develop a methodology to facilitate the avoidance and resolution of conflicts over access to land and water resources in upstream metropolitan catchment areas with all relevant stakeholders. The scientific objectives are the following : 1) to develop a conceptual framework of the land and water management issues in periurban upstream catchment areas linking the dynamics of land and water resources, land and water use patterns, and roles of the various stakeholders; 2) to investigate the societal, economic, technical and institutional factors affecting the hydrological and social functioning of peri-urban upstream catchments; 3) to develop a methodology for the direct use by stakeholders of agent based models in order to conduct negotiation sessions on land and water resources management, by combining agent based modeling tools with role game playing; 4) to monitor and evaluate the validity of the approach and method in order to help stakeholders to explore and discuss scenarios and build agreements. The different knowledge levels are integrated in a model representing the hydrological and social functioning of the catchment as well as the different land and water uses, by means of an agent-based representation.

The **PROCAM/USP group** was involved particularly in three moments, 1) thematic field research on functioning of water basin committees and dynamics of social organization and building of social capital ; 2) training material development and discussion of methodology and 3) development of monitoring tools and monitoring of the application of role playing games and its respective simulations to explore different types of participation and involvement of actors/players in the peri-urban basins.

The **POLI/USP group** through the Laboratório de Técnicas Inteligentes – LTI was the responsible for the development of computerized models built upon the CORMAS platform (http://cormas.cirad.fr) developed in the VisualWorks (http://www.cincom.com) environment (Smalltalk computer language).

The **School of Public Health group** acted in NEGOWAT Project in two aspects: 1)study the relations between sanitation access and public health conditions; and 2) discussion of methodology and activities as facilitators in the application of role playing games and its respective simulations.

3.2 Activities

A. The **PROCAM/USP group** had an involvement in different activities. The first one was concentrated in following and strengthening links of the activities developed by the two sub-committees linked to the water catchments chosen by the project- Tietê/Cabeceiras and Cotia/Guarapiranga. The activities implied in participating in meetings with different governmental actors, community, social movements and NGOs that have an involvement in the sub-committees to obtain information on the dynamics of the functioning and to identify the main issues that are at stake. This activity was mainly oriented to improve the knowledge gap on social participation in watershed management in the two basins.

The second activity was to develop a bibliographic work on role playing game and comparing some of the Brazilian experiences, collecting four Brazilian experiences in the research field. The analysis is based on a comparison of four games that were developed and used to capacitate local stakeholders or lower scale agency technicians.

The third activity is the engagement in the formulation of Jogoman and the training material development and the testing sessions at local universities and its evaluation.

A fourth activity was the bibliographic work on conflict negotiation and consensus building methodologies, in depth study of conceptual framework on "Social Learning for Integrated and Participatory Water Management".

The fifth activity was the study of the social practices of the agriculture segment in Tiete- Cabeceiras basin, emphasizing the perspectives of the members of the water committee related to water management in the region, as the main conflicts and trends

The sixth activity was the development of evaluation and monitoring tools that allowed to analyze if the process of development of the games – Agualoca and Teraguas- allowed an effective understanding of the problem at stake by the different stakeholders. The tools intended to evaluate if the games facilitated the players to have a better understanding of reaches and limits that a simulation may bring. Three different instruments of monitoring were produced to evaluate the participation of stakeholders in critical peri-urban basins, the existence/inexistence of conflicts and the ways to agreed solutions, and if the participation of heterogeneous groups in the decision making process worked in the games. The instruments that were developed intended to evaluate the participation, the dynamics of cooperation/negotiation/agreement, the impact of the game/understanding of rules and its feasibility to be used as an instrument of social learning in water basin institutional setting and organizations of civil society.

B. The **POLI/USP** group had relevant role in WP 1 and 2 - Training on agent - based modeling, Build Conceptual Framework/Core Model, the development of three Catchment Models, the development of simulation tool: Jogoman Prototype (already described in other reports) and concluded its participation in activities - JogoMAN, SPATMAS and Agualoca in the work package WP3 the Laboratory activities were the following:

Partial participation in the "ComMod[1]" for modelling at Problem Domain level;

Object Oriented Analysis for the modelling of the software artefacts to be developed. The use of Unified Modeling Language® a standard adopted by the Object Management Group;

Development of the computerized models in Smalltalk language using the CORMAS platform.

The GUI – Graphic User Interface engineering during the project evolved as the team gained more experience in the environment and migrated to a more disciplined approach using the MVC – Model View Controller proposed by the Smalltalk technology. As a by-product, it was possible to simplify a

[1] Companion Modelling Approach

lot of the interfaces using the Principle of Uniform Access proposed by Bertrand Meyer and it is encouraged in Smalltalk programming.

During the development of the projects, LTI introduced in the process the use of several Software Engineering concepts:

a.1) Round Trip Engineering

This process allows the use of the modelling done in UML to be directly used to generate part of the code in Smalltalk (mainly the classes and attributes) and from the code already in the system to generate and annotate, if necessary, the UML diagrams.

The advantages of this approach are twofold: increase in productivity due the avoidance of double work in two different tools, and automatic synchronization of both views of the project (once a change is done in Smalltalk code the UML is update and vice versa).

The specific technology employed was the Parcel (a plug-in for the VisualWorks Smalltalk environment) *ADvance2* developed and made available by IC&C GmbH Software Foundations.

a.2) Concurrent Engineering

Using the VisualWorks facilities to merge code from more than a source (called "change sets" in the tool) the LTI team was able to divide the work in parallel tasks accelerating the development, especially in the case of Agualoca, where the GUI (Graphic User Interface) was done in parallel with the hydrologic model.

C. The **School of Public Health group** developed along the period of the project a diagnosis of the conditions of sanitation of water supply and removal and treatment of sanitary sewage in cities within the catchment of Tietê-Cabeceiras, considering the access to municipal services and the concession of sanitation operators.

The FSP group concluded analysis of on urban expansion and access to water services and sewage in two sub- basins: Tietê Cabeceiras and Guarapiranga/EmbuGuaçu. In Cabeceiras , the research was based in documental and bibliographical analysis of the available data obtained from the municipalities and from the state company of basic sanitation. The main issue of these municipalities is about the collection and treatment of sewage, because of them do not even reach 30%, and others do not treat the collected sewage, throwing to the rivers the totality of the sewage and this contributes to the pollution of Tiete River. The precarious conditions of basic sanitation has an impact in the health conditions of the population of the areas under study, observing an inverse relation between coverage of attention of basic sanitation systems and infant mortality due to infectious and parasitic illnesses. After the exploratory study, the research verified the relations between the assessments of water and sanitation services and infant mortality in cities of Tietê Cabeceiras. To identify the conditions of public health some indicators have been selected that can be correlated with the sanitary conditions of a place, being these: infant mortality rate and infant mortality by infectious and parasitic illnesses. In Guarapiranga, the research was done in two areas - in north portion of Embu-Guaçu City: Jardim Progresso and Sapateiro. These areas are served by a government program of Health Ministry, The Family Health Program (PSF), and this situation permitting the data obtain. This program brings information by sub-regions of two study areas about sanitation and diarrhoea occurring in young child, because there are agents who visit the families of the covering areas. The information about sanitation and health was obtained in field research in Health Units of PSF, and reports and filing cards of patients were consulted, within the registers in cadastres them made by agents, and the family's cadastres.

The FSP team acted the Teraguas dynamics contributing to facility these activities with students, communities and Sub-Committees members; and made interviews with Sub-Committees members before the activities took placed, and the outcomes are published in a specific report.

3.3 Main results and outcomes:

A. PROCAM

The activities of the research group in WP1 in the thematic bibliographic survey resulted in a text on the Dynamics of Water Management in the Metropolitan Region of São Paulo and on the Social Capital Formation and the Articulation of Social Networks. The contents of these texts were used later as part of articles and in the production of three Master Dissertations of students of Prof. Pedro R. Jacobi. The group also had an involvement in WP2 in the review of bibliographic work on role playing game, development of Jogoman, mainly in the Training material Development, Testing Sessions at local universities and the evaluation. The outcomes of this activity is reflected in a Master Dissertation, a paper to be published in peer reviewed journal .The group also was involved as part of WP3 in thematic field research in two water basins – Tietê/Cabeceiras and Guarapiranga and the outcomes are in texts that became an important support for two articles presented in Conferences and are published in the Annals. These articles were written by the coordinator and advisees involved in different moments in the project. In WP4 the group was involved in the review and complementation of Project Bibliographic work on conflict negotiation and consensus building methodologies, and an in depth study of conceptual framework on " Social Learning for water Management" and development of instruments to monitor and evaluate the games. The outcomes of this are presentations in two Conferences, the elaboration of two articles to peer reviewed journals already approved and to be published.

The main outcomes are preliminary working papers to be improved on Social learning in the peri-urban basins of the MRSP.

The group also concluded the study of the social practices of the agricultural segment in Tiete-Cabeceiras, and is presently working on a text to be sent for evaluation in 2007.

As to the outcomes of WP5 and WP6 in the ten games, the report outcomes indicate that the games allowed to know if the process reached its formal goals, from the point of view of actors involved, as well of the coordination and facilitators. The outcomes indicate that there was a learning process, comparing the answers from the beginning of the game with those at the end. This characterizes a collective process of participation through the dialogue and interchange of ideas between stakeholders involved without getting into specific issues. Within the process, the players had the opportunity to experience its expertise and knowledge, and the outcome of this was a more cooperative process, and the best use of each competence to obtain a common goal. All participants recognize, and this can be verified in the questionnaires applied in all games to all participants that the collective experience represented a social learning, individual as well as collective. It aggregated to its experience the challenge of negotiating, establishing agreements to reach goals related to the improvement of the living conditions and reduction of the degradation of water sources. With the games it was possible to evaluate if there was learning about the management process and the interactions between actors, through simulation. These models of decision, allow an interaction between actors that demand cooperation and not individual decisons. They also help to understand complexity of the socioenvironmental context, uncertainty of the processes and the existence of conflicts and how to deal with them, and finally the participation of heterogeneous groups in the decision making process to improve the management of peri-urban basins.

The group produced in WP5 as part of Negowat goals to disseminate and capacity building activities material on the issues of Monitoring and Evaluation, Negotiation and Mediation of Conflicts, Stakeholder Analysis, Water Management in River Basins in SPMR. The research team has gotten very engaged in an in depth literature review of articles published by the Harmonicop Project on Social Learning on Integrated and Shared Water Management and by the University of Wageningen on Multi-Stakeholders Platforms, and the outcomes are papers to be presented in national and international conferences and articles to be sent to peer reviewed journals in Brazil and abroad. In 2006 it has already proposed a project to the State Agency of Science and Technology –Fapesp – that is being evaluated. It is hoped that once approved the lessons learnt in Negowat project will be very useful for this project to be developed in partnership with two municipalities

Finally, Professor Pedro R. Jacobi – PROCAM-USP, is the coordinator of Alfa Project –GovAgua- and responsible for a three year Program of inter-institutional cooperation of a network of 10

institutions- six from LA and four European to exchange experience between LA and Europe an Water Governance, and it is important to state that this project originates from the premises that were developed along Negowat project. It also includes several of the Negowat institutional partners as Centro Agua/Cirad/University of Greenwich/Unicamp.

B. POLI/USP

Project Negowat USP in work package WP3 – task JogoMAN

Development of the computerized game "JogoMAN" that simulates a periurban catchment with a reservoir, whose quality is being affected by degradation processes. The roles represented are:

- Director of a water firm (AguaPura), 3 mayors managing 3 municipal territories, a player representing migrants families arriving in the catchment and looking for housing, and landowners.
- Decisions made by the players are related to : land market process, changes of land use, allocation of families in the plots, decision of investment in water and sanitation network or municipal services.
- The decisions made are registered in an interface which permits to modify the characteristics of the plots of in the virtual catchment. The computers them simulates the consequences of the decision in the water quality in the reservoir and the economical consequences for each players. Outcomes are provided to the players by a specific interface.
- The game includes a specific step when a catchment committee is institutionalized (election of representative of civil society and municipalities) and discussions are commonly taken during a committee meeting.

In order to be used in different situations, it was built in three versions:

- First scenario: 14 players (one water company, three city mayors, nine private land owners and one migrant representative). It is the most complete scenario of JogoMAN, where negotiations between every players are more complex;
- Second scenario: 8 players (one water company, three city mayors, three private land owners (one by city) and one migrant representative). It is a subset of the first scenario and negotiation of private land owner are reduced;
- Third scenario: 8 players (one water company, two city mayors and four private land owners (two by city) and one migrant representative). It is a subset of the first scenario too, but the negotiations of private land owner are more complex.

Project Negowat USP in work package WP3 – task SPATMAS

Development of hydrologic simulator that combines:

1. A spatial representation of the SPAT (Sistema Produtor do Alto-Tiete) area made by the importation of various layers of a GIS, especially land use cover obtained by satellite image analyses. The spatial representation is made of a grid of cells of 25 ha.
2. A representation of the main actors – managers of water system and potable treatment station, mayors of the municipalities, urban and rural dwellers. The social processes are limited to the representation of two processes: the development of sanitation and potable water infrastructure, and land use changes due to urbanization of the catchment.
3. A representation of hydrological functioning of the catchment, based on a Arc-node representation as well as integration of quality processes.

Starting with the specifications coming from the ComMod sessions that determined an hydrologic representation based in Arcs and Nodes, the LTI team implemented the necessary algorithms for the correct functioning of the model. The main ones being:

- The post order traversal used to sort the hydrologic nodes.
- Curve fitting for the cota to volume (and vice versa) conversion in the Dam's representation.
- Water distribution (allocation) according to rules established by the hydrologic experts of the Negowat team.

The modelling outcomes from the SPATMAS were used as the simulation engine for the hydrologic part of the Agualoca task.

Project Negowat USP in work package WP3 – task Agualoca

Development of the Agualoca game used in the RPG sessions to discuss allocation of water between various uses (inundation control and sewage dilution, domestic water production, industrial use, irrigation, flow to maintain quality in potable water reservoirs) in a complex system made of various reservoirs.

Agualoca augmented the SpatMAS hydrologic model by the inclusion of the modeling of::

- Pollutant gathering from the catchments;
- Pollutant decaying processes and its concentration computations, using the modeling done by the hydrologic experts of the Negowat team.
- Water rights granting mechanisms animating in the computing the decisions processes the Water Authority would use to supply the deeds.

The dynamics of population residing in the basin and the modeling of their behavior set forth by the team experts was implemented as well.

Also the Agualoca was supplemented with a GUI to be able to capture the players (actors) decisions and via printouts of the screens to communicate to them the results of their actions. One specific engine for scoring the players actions was implemented according to the RPG rules put forth by the team members doing this part of specifications.

An evolving development in the three task's projects was the logging facility, used in another project/task of Negowat (Teraguas) and presently available as a useful software artefact which may be used in other projects based in the CORMAS platform.

C. School of Public Health

As to health and sanitation , in Tietê Cabeceiras, the coverage of water supply, in most is above 90% of households, except two cities. The situation of sanitary sewers services is more complicated because the coverage of sewerage collection is low and the treatment insufficient. Some cities launch the sewers in natura in Tietê River, like Guarulhos, with more than one million inhabitants.

Precarious conditions of basic sanitation has an impact in the health conditions of the population of the areas under study, observing an inverse relation between coverage of attention of basic sanitation systems and infant mortality due to infectious and parasitic illnesses. The outcomes are in Workpage showed in I.5.1 "GÜNTHER, W.M.R., ARTEIRO, M.G. Cenários de acesso a serviços de saneamento básico na sub-bacia Tietê Cabeceiras. 2005".

Guarapiranga: The results of this study are showed in a Workpage Report, "ARTEIRO, M.G., GÜNTHER, W.M.R. Analisando impactos à saúde decorrente da falta de infra-estrutura de saneamento em áreas peri-urbanas na Sub-bacia do Guarapiranga. 2006". This report presents possible methodologies to develop this kind of study in similar areas, and the results of correlation between access of sanitation and diarrhea in young children, in 12 regions. The correlations are presents too in thematic maps.

The group had an important involvement in the Teraguas activities. It raised information in interviews of Sub-Committees (SC) members are related in a Workpage Report stated in I.5.2 "ARTEIRO, M.G. Percepções dos Membros do Sub-Comitê da Bacia Hidrográfica Cotia Guarapiranga. 2006". This document is about perceptions of the SC member's that represent São Paulo State, Municipally of Guarapiranga Basin and Civil Society, about sanitation conditions of Guarapiranga Basin and Specific Law of Guarapiranga Catchment.

3.4 Difficulties and problems

A. PROCAM

The difficulties observed are specifically linked to the dynamics of the games, and these did not interfere significantly in the outcomes of the monitoring and evaluation activities. A more detailed report is presented in the Final Report produced by the team on the monitoring and evaluation of the Negowat games.

B. POLI

The team did not present any relevant difficulties along the project

C. School of Public Health

As the team depended very strongly on data to produce its analysis, as to the *Tietê Cabeceiras, a*fter the exploratory study, it aimed to select a location and investigate the sanitation access and health conductions. The health indicator chosen (diarrhea in young children) is not available in local levels in cities of Tietê Cabeceiras basin. There was also the intention to study sanitation and health conditions in specific areas, but as there do not exist Basic Health Unit to obtain the data, the research was done with municipal information. In Guarapiranga Basin, it was done at the local level and at micro-regional level.

3.5 "Technology" implementation plan

The research team does not have any observation to make.

3.6 Publication and papers

3.6.1 Publication in refereed journal

CAMARGO M.E., DUCROT R., JACOBI P., 2004 Using role-playing game for capacity building on water and land management : comparing some Brazilian experiences. abstract submitted to Simulation and Gaming – special issue in Natural Resource Management – approved for publication in September 2006

JACOBI P. 2004 The challenges of multi-stakeholder management in the watersheds of São Paulo published in Environment and Urbanization vol.16 n. 2 October 2004 199-212 IIED London

3.6.2 Seminar and conferences

a) Complete with proceedings

GRANJA, S.I. B e DUCROT, R. CAMARGO, M. E. 2006 - Role playing games: ferramenta para construção de consensos gradativos, artigo para o III Encontro da ANPPAS – Associação Nacional de Pós-Graduação e Pesquisa em Ambiente e Sociedade, de 23 a 26 de maio , Brasília-DF. http://www.anppas.org.br/index

ARTEIRO, M.G., GÜNTHER, W.M.R., 2005. Expansão urbana, acesso aos serviços de saneamento e impactos à saúde na sub-bacia Tietê Cabeceiras. *In:* II Conferência Regional sobre Mudanças Globais: América do Sul, São Paulo, Brasil, 06th-10th of November 2005, IEA/USP. http://www.acquaviva.com.br/mudglobais/trabs.asp

JACOBI P. , MONTEIRO, F. 2004 - Determinantes do desempenho institucional em comitês de bacia hidrográfica *In:* ANPPAS III Encontro da Associação Nacional de Pós Graduação e Pesquisa em Ambiente e Sociedade, Indaiatuba, SP, 26 – 29 of May. http://www.anppas.org.br/index

JACOBI, P. R. and GRANJA, S. I. B. 2006 - Construção de Consensos Gradativos e Social Learning como Estratégias Institucionais de Aprendizado em Bacias Hidrográficas, artigo para o III Encontro da ANPPAS – Associação Nacional de Pós-Graduação e Pesquisa em Ambiente e Sociedade, de 23 a 26 de maio, Brasília-DF. http://www.anppas.org.br/index

MONTEIRO F, JACOBI P. 2004 – Impactos do capital social sobre o desempenho institucional de comitês de bacia hidrográfica *In:* Seminário Latino Americano sobre Políticas Públicas e recursos hídricos, Brasília, DF, 21 – 24 of September 2004

MONTEIRO F. 2004 – Does social capital improve watershed environmental governance ? *In:* Coordinations hydrauliques et justices socials. Actes du séminaire, France, Montpellier, Cirad, Colloques, November .

JACOBI, P. and GRANJA, S.I.B. 2005 - Aprendizagem social na gestão compartilhada de bacias hidrográficas em áreas periurbanas na américa latina". In: " Encuentro por una Nueva Cultura del Agua en América Latina, Fortaleza, December 6-8. Published Cd and site.

CAMARGO M.E., DUCROT R., JACOBI P. 2004 - O uso de jogos de papéis, como ferramenta de Educação ambiental, facilitando a negociação na gestão dos recursos hídricos *In:* II WEEC- World Environmental Education Congress, Brazil, Rio de Janeiro, RJ, 15 – 17 of September, 2004, 15 pages

ADAMATTI D F, SICHMAN J S, and DUCROT R, 2004. Using multi-agent systems and role-playing games to simulate water management in peri-urban catchments. *In*: "Sixth International Conference on Social Science Methodology", Amsterdam, The Netherlands.

ADAMATTI D F, SICHMAN J S, 2004. Inserção de Jogadores Virtuais em Jogo de Papéis no Contexto de Gestão de Recursos Naturais. *In*: "Workshop de Teses e Dissertações em Inteligência Artificial WTDIA", São Luis, Maranhão, Brasil.

b) Without proceedings

GÜNTHER, W. M. R., ARTEIRO, M. G., FREITAS, S. M, 2005. Acesso à água e afastamento de esgotos na sub-bacia Tietê Cabeceiras: Condições e Implicações Sanitárias e Ambientais. *Contribution in the* 23° Congresso Brasileiro de Engenharia Sanitária e Ambiental, Campo Grande, MS, Brasil. September.

c) Reports and student thesis

- **Negowat workpackage report**

PROCAM

Institutional dynamics in water management of the Metropolitan Region of São Paulo social capital and articulation of social networks in water basins: JACOBI, P. (coord.), MONTEIRO, F., CASTELLANO, M. and ROMAGNOLI, R. 2003-

Impactos do capital social sobre o desempenho institucional de comitês de bacia hidrográfica: JACOBI, P. and MONTEIRO, F. 2004 –

Análise dos atores e redes sociais nos SCBH Cotia-Guarapiranga e SCBH Tietê-Cabeceiras: JACOBI, P. and MONTEIRO, F. 2004 -

Capital Social e organismos gestores de recursos hídricos: o caso do Subcomitê Alto Tietê Cabeceiras. CASTELLANO, M. and ROMAGNOLI,R. 2004

JACOBI, P. anda MONTEIRO, F. 2004 Determinantes do desempenho institucional em comitês de bacia hidrográfica:

Agricultura e Recursos Hídricos no Alto Tietê- Cabeceiras: caracterização do papel da agricultura, seu presente e futuro; principais problemas, soluções e conflitos em torno das relações entre agricultura e gestão dos recursos hídricos: JACOBI, P. , LIMA, L. 2005

Monitoramento e Análise dos Jogos - Agualoca e Teráguas: JACOBI, P., GRANJA, S. I. B. 2006 –

JACOBI P., MONTEIRO F. 2004 – Análise dos atores e redes sociais nos SCBH Cotia-Guarapiranga e SCBH Tietê-Cabeceiras – *In :*WP 3 report - Negowat Project.

FSP

Tietê Cabeceiras: GÜNTHER, W.M.R., ARTEIRO, M.G. Cenários de acesso a serviços de saneamento básico na sub-bacia Tietê Cabeceiras. 2005

Guarapiranga: ARTEIRO, M.G., GÜNTHER, W.M.R. Analisando impactos à saúde decorrente da falta de infra-estrutura de saneamento em áreas peri-urbanas na Sub-bacia do Guarapiranga. 2006

Ter'águas: ARTEIRO, M.G. Percepções dos Membros do Sub-Comitê da Bacia Hidrográfica Cotia Guarapiranga. 2006

c.1) Student thesis

MONTEIRO F., 2004. Desempenho institucional na gestão de recursos hídricos: o caso dos subcomitês de bacia hidrográfica Cotia- Guarapiranga e Billings- Tamanduatei na Região Metropolitana de São Paulo. Dissertação de Mestrado. PROCAM – USP. 150 pages.

ROMAGNOLI, R. 2005. Capital social e desempenho institucional: o sub-comitê de bacia hidrográfica do Alto Tietê Cabeceiras. Dissertação de Mestrado. PROCAM-USP. 120 pages.

CAMARGO M.E.S. 2006. Jogos de Papéis em Diálogo com a Educação Ambiental: Aprendendo a Participar da Gestão dos Recursos Hídricos na Região Metropolitana de São Paulo. Dissertação de Mestrado. PROCAM – USP. 160 pages.

ARTEIRO, M.G., *Analisando impactos à saúde decorrente da falta de infra-estrutura de saneamento em áreas peri-urbanas do Município de Guarulhos.* Dissertação de Mestrado em Saúde Pública. Universidade de São Paulo, Brasil. (Will be defended in first semester of 2007)

3.7 Conclusion

The main benefits arising from the project is the possibility it brought to develop a more collective type of research, integrating fields of hard sciences with social sciences and the profile of intervention oriented work of an NGO, as is the case of Instituto Polis. There is an enormous challenge to continue this track and some important movements have been made. An action oriented research, with the complexity of Negowat, brings up an interesting perspective of interdisciplinary work as to the

integration and articulation of activities of researchers of different institutions that work in a cooperative perspective to reach an outcome that is innovative and collectively produced. We can consider it as a success story, with all the complexities it involved, mainly as to articulations between partners, as to intellectual dialogue and availability to get involved in work with new partners.

Future actions are already on the way, and the doors that Negowat opened are an important stimulus to continue to develop research on social learning practices on integrated water management in complex peri-urban basins as the São Paulo Metropolitan Region. The challenge is to engage institutional and governmental partners in research-action projects that will have an impact on water management policies.

3.8 Management aspects

We consider that as USP the work developed institutionally had no relevant management problems. Each institution involved developed its work according to the Workplan, and in several moments the work demanded collective activities, which were a very interesting way to stimulate interdisciplinary activities. The collaboration with the Bolivian partners was excellent at all levels, and it allowed a very interesting interchange of ideas and knowledge about each reality, with its particularities and its convergences.

INCO - DEV : International Cooperation with Developing Countries (1998 - 2002)

Contract number: ICA4-CT-2002-10061

Facilitating Negotiations Over Land And Water Conflicts In Latin- American Peri-Urban Upstream Catchment: Combining Agent-Based Modelling With Role Playing Game

NEGOWAT Project
Final Report
Partner n° : APTA

Yara Maria Chagas de Carvalho

October 2006

4 APTA FINAL SCIENTIFIC REPORT 2006

The APTA's team went through some adaptations during the project life time. The agreed group, that remained in activity, were: Yara M.C Carvalho coordinator; Therezinha J.F.Franca and Maria Carlota M. Vicente fromInstituto de Economia Agrícola-IEA; Jener Fernado Moraes from Instituto Agronômico-IAC and Suzana Sedacz from Instituto de Pesca-IP. During 2003, Dra. Ana Maria Pereira do Amaral substituted Dr. Richard Domingues Dulley in the social and economical group. The water quality group included new researchers: Adalberto J. Monteiro Junior, Dra, Cacilda Thais Janson Mercante and Dra. Paula Maria Gênova de Castro that introduced also a new research theme: fish ponds, complementing the tourism group. Morisson Valeriano a topographer left the Institution and was not substituted. During 2004, there were some new inclusions: Vera Lucia Ferraz dos Santos Francisco from IEA and Luciana C.B. Menezes from IP integrated the statistical and the fishpond team, respectively. A soil specialist, Marcio Rossi from IAC, integrated the team during 2004. In the 2005-06 period a new research team from IEA was incorporated in order to accomplish some late WP3 studies and a WP4 proposal: environmental quality agricultural products workshops. Dra. Sônia Santana Martins; Dra. Geni Satiko Sato and MS. Marli Dias Mascarenhas Oliveira, researchers from IEA, participated in the project Economic Aspects of Agricultural Production in Alto Tietê Cabeceiras. Paulo Coelho and Alberto Ângelo integrated the group studying the statistical relevance of the identified production system,s substituting Vera L.F.S.Francisco. It was also necessary to include Dr. Flavio Arruda an specialist on irrigation and Dr. Hamilton Ramos an specialist on phytosanitary products utilization, from IAC, to give the necessary support for the quality workshops. Along the project, NEGOWAT's project coordinator demanded contact with researchers specialized in environmental impact of phytosanitary products. Dr. Luiz Luchini and Dra. Mara d'Andrea, from Instituto Biológico-IB, gave that support receiving a student.

Objectives

The APTA's group objective was to evaluate different instruments that would empower farmer's, and particularly family farmer, to better negotiate, within the water committee, policy instruments that will enable agriculture to be transformed into an environmental service.

Specific objectives:

IEA:To provide a rural appraisal of agriculture and tourism and evaluate the possibilities of some policy alternatives to fulfil the general objective;

IAC: To provide spatial representation of land use (natural vegetation, human settlements, agricultural use) and main soil types of the catchments;

IP: Nutrients evaluation in reservoirs and main tributaries of the Alto Tietê water catchment. Provide an appraisal of fish ponds and their environmental impact.

4.1 Activities

4.1.1 WP1: Training, bibliographic review, project design and land use maps

In January 2003, occurred the MAS modelling training **(WP1.1.1)**, attended by three researchers, and the Delphi sessions, by two **(WP1.1.3)**. The APTA group participated intensively in the project's methodological discussions.

The APTA team organized a first approach to the area, for the whole research group, using the information collected through a previous project based on "landscape reading" technique. The visit to Guarapiranga and Cabeceiras helped the group identify the scope of collective and individual projects.

It also helped the APTA´s team to lead discussions to define the specific areas for concentrated field studies.

In terms of the bibliographic survey **(WP1.1.2)** the topics under the responsibility of APTA's researchers were: Land and soil use and evolution: a cartographic approach an IAC's responsibility. Agriculture evolution and characterization: an statistical approach; urban agriculture: social management and territory; irrigation and water demand; tourism and leisure: territory, landscape and multifuncionality was IEA's responsibility. Fishing activity in urban and peri-urban ponds and reservoirs; impact on superficial water of the Guarapiranga and Tietê Cabeceira's dam: evaluation of nutrients (N & P) in tributaries and fishponds was IP's responsibility.

The design of the rural project from APTA was developed during this stage (figure 1)

4.1.2 WP 1.4: Land-use and soil map of the catchments

To provide information to organize the team work some maps were provided. For Tietê-Cabeceiras it was made available for the group: geographic and political boundaries; hydrograph network; main roads; soil map; meteorological stations for precipitation analysis. Two sub-watersheds delimitation: Balainho and Garacau. For Guarapiranga was provided: geographic and political boundaries; hydrograph network; main roads; slope; soil map; land use map for 1998. Three sub-watersheds were delimited: Parelheiros, Paulistinha and Lagoa Grande.

Through digital processing of images and ground truth information the land use at Cabeceiras, has been studied for the period 1978-88-2001 and for the 18 sub-catchments, defined by the project. For the entire Tietê-Cabeceiras' the land use map considered a 1 x 1 km resolution to be implemented in Cormas Model. For the Balainho watershed (Cabeceiras) detailed information about land use and topography was acquired using aerial photographs and topographic maps. It was elaborated the land use map of 1972 and analysed the land use dynamics studies between 1972 and 2002.

For Parelheiros watershed detailed information about land use and topography was acquired using Ikonos images and topographic maps available for this area. It was elaborated the land use map of Parelheiros sub-watershed corresponding to the years of 1998 and 2003 and the land use dynamics between these years..

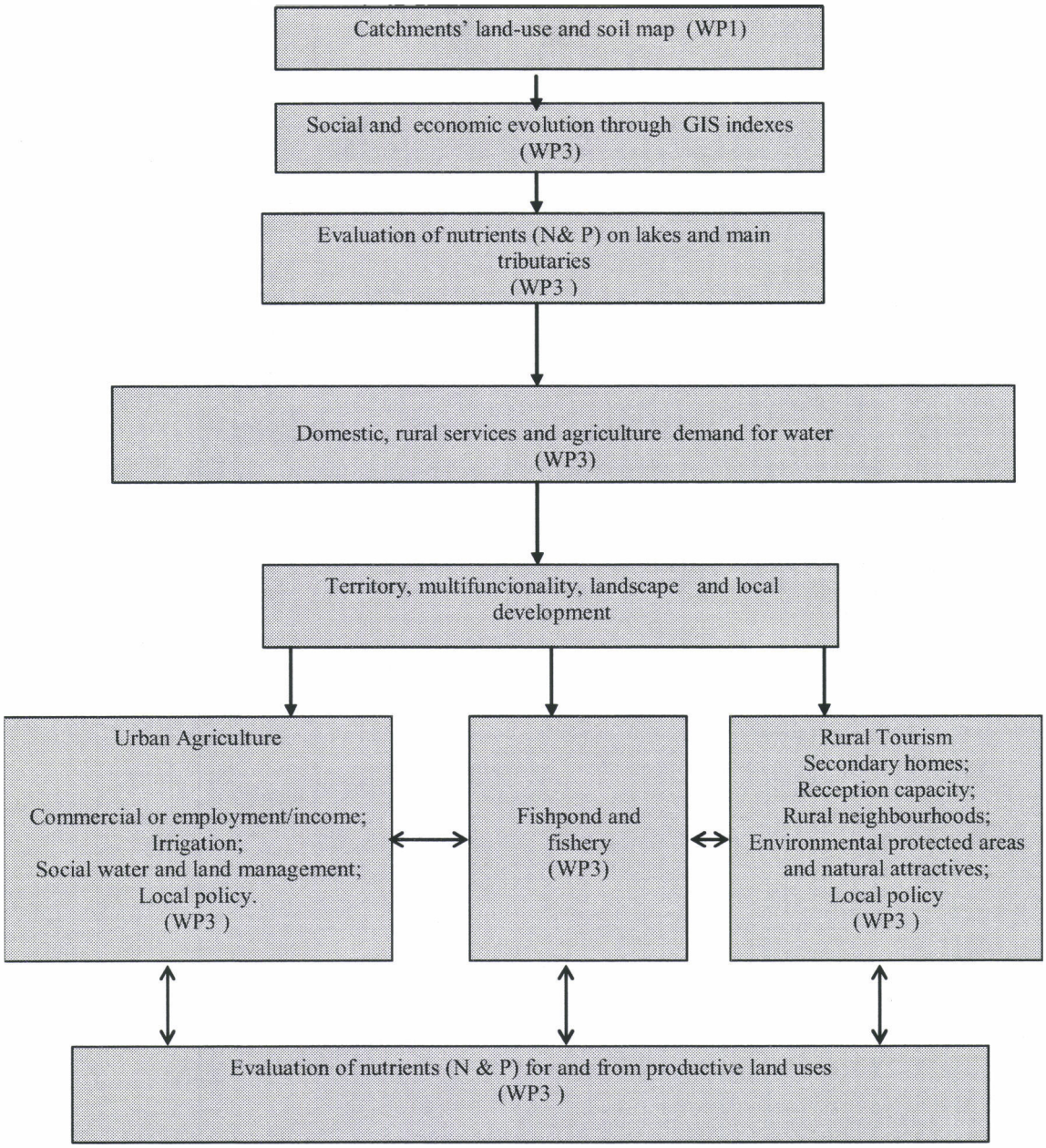
Using GIS all data available was transformed into the necessary maps for use in the project. Soil analyses was realised at Balainho microcatchment in Suzano using digital ortophoto, LANDSAT/TM images in the scale 1:50.000 and soil map (OLIVEIRA et al., 1999), geological map (IPT, 1981) to establish units of mapping (BURINGH, 1960) verified through fieldwork as proposed by LUEDER (1959) e SPURR (1960). For soil identification and classification in the field it was used the criterion established by the Brazilian System of Soil Classification (EMBRAPA, 1999).

4.1.3 WP2. Modelling

During 2004, the co-ordination organised six thematic groups to develop the researcher's contribution to the modelling group **(WP2.1)**. APTA was mainly in one group: the rural, but it participated in all groups, except modelling. There was a significant participation of APTA in the hydrological team. Besides the ones responsible for water quality, the water demand and land use map specialists also participated. There was one APTA´s researcher participating in four groups, four contributing in three groups and other four in two.

Cormas Modelling: The base maps of temporal land use variation (1977, 1988 and 2001), urban areas and hydrology were created and imported to Cormas Model as the geographical database used in the modelling studies (SpatMas).

Figure 1: Rural project's components:



4.1.4 WP3. Collect complementary data

4.1.5 WP3.1.Hydrological process

IP Projects:

Nutrient Load (Nitrogen and Phosphorus) from tributaries and fishponds at Tietê Cabeceiras and Guarapiranga Systems. Evaluation of the concentration of Nitrogen and Phosphorus through the collection of water samples representing the cold and dry period and the warm (August and September/2004) and rainy period (January and February /2004), in tributaries of Tietê Cabeceiras and Guarapiranga systems. N and P loads, in kg/day, were calculated as a function of the flow (m3.s-1) of each sampling station.

In the Tietê Cabeceiras system the following arches and knots were represented: Ponte Nova Reservoir (downstream), Biritiba Mirim elevatory station, Biritiba-Jundiaí channel, Jundiaí-Taiaçupeba channel, Taiaçupeba Reservoir (downstream) and Taiaçupeba Mirim river. In the Guarapiranga system, samples were taken at the Itaim spring, the Caixa de Dissipação, through which is realized the water transposition from Billings, Taquacetuba arm to Guarapiranga, and the tributaries: Parelheiros (downstream from Caixa de Dissipação) and Embu-guaçú.

a) WP3.3 Agriculture dynamics

a.1) IEA Projects:

Social and economic evolution through statistical data base was not integrated in GPS data base. Evolution was analysed through some selected indicators applied on IBGE county level data base for 1970; 1980; 1990 and 2001. Using LUPA (SAA) it was possible to characterize the watersheds for the year 1995.

Water demand from agriculture was estimated based on the technical demand for each culture, field information obtained for lettuce and expanded to the whole watershed using secondary data about production area by culture. The technical demand was estimated considering the local referee evapo transpiration (ETO) and the culture coefficient demand for water (KC) through the equation ETC=ETO*KC. KC assumes different values associated to the different stages of culture development. For horticulture, the main activity, due to the short period of production and the difficulty to identify different phenologics stages it was assumed a constant value of 1. For different crops it w used values from literature[1]. The ETO is estimated considering a pattern tank known as class A (E) and an evapo transpiration coefficient (KP), determined locally, associated to the tank (E). ETO = E*KP. It was not possible to cover domestic rural service, particularly in the rural neighbourhoods.

Urban agriculture: Field work preparation involved contact with local administrative bodies and other research teams to identify legislation related to land use, the existence of any specific policy towards agriculture; and available local information and maps. Maps and data were made freely available by these new partners. There was also a brief inventory using the snow ball technique to identify churches, social and cultural organisations, elementary schools and public transportation to characterise the social net in the selected areas and re-define the physical boundaries determined by topographic and water conditions.

[1] Doorenbos, J. & Pruitt. W.O. Crop water requirements. FAO: Irrigation and Drainage. Rome: # 24, 1977. Doorenbos, J. & A.H. Kassam. Yield response to water. FAO: Irrigation and Drainage.Rome: #33, 1979.

Two microcatchments were selected to focus all NEGOWAT project: Balainho in Suzano and Parelheiros in Guarapiranga. The research concentrated in the commercial/traditional agriculture and the sample was determined by diversity of the production systems and the crafting of the typology. It ended up being around 25% of total population. A third area was chosen only for the agriculture study and results demonstrated that it is more of the complementary income or temporary employment type of activity. The used methodology was agrarian system analysis complemented by a statistical evaluation of its representation using the data base LUPA.

The pré-typology considers different combinations of agricultural and animal production, the source of irrigation water, social and economical conditions. It was prepared three main parts in the questionnaire. The first one aims to characterise the territory in a historical perspective, the whole system of production, social organisation and economic evaluation. The second is oriented particularly to irrigation and the third is more related to evaluate farmer's willingness to participate in a participatory action plan to empower farmers in the water committee.

Some complementary economic studies were undertaken. Analyses of agriculture relative prices trend; local trade channels and profitability of main 10 sub-production system, in some specific social and geographic conditions, complemented the previous work.

a.2) WP3.4 Dynamics of eco-tourism

IEA Projects:

Perspectives for tourism on the rural areas of the Tietê watershed was analysed from counties' perspective. Field work was realised in all counties using closed questions. Secondary homes and tourist equipments were identified and analysed looking for their contribution as a protection against urban sprawl. A typology approach was used to analyse the different alternatives. Sample in the field work was determined by the universe, with people capable and willing to give the information.

Tourism was considered within the agriculture multifunctionnality perspective, but they are not a joint activity in the Alto Tietê watershed. Agriculture and tourism field work identified that still remains some social organization, basically related to the traditional agriculture in the area, which can be the initial support for crafting a local agreement for a rural development contract-project.

IP Project:

The most outstanding rural tourism equipment in the area the so called "fish and pay". The number had increased in the last decade and a field work was realized in order to evaluate technically, economically and environmentally. Fieldwork was based on the application of a questionnaire to all fishponds established in the selected areas: Balainho-Suzano, Guaracau and Ribeirão do Tanque (upstream from Guarulhos water supply reservoir)-Guarulhos, Paulistinha-Embu-Guaçu and Parelheiros-São Paulo. The group considered not only the first defined option but also the second NEGOWAT alternative. No other sub-project has been developed in those areas. A sample,10% of the universe, was defined for other areas of Guarapiranga and Cabeceiras. An economic typology was used to analyse the fish pond's perspective, in the area. Water samples were taken to analyse the impact of agriculture, secondary homes and fish ponds. Since the most important effect was the fishponds, the study has been concentrated on it.

Interaction with partners

Another set of activities were related to interaction with partners giving support to their activities or just presenting the research results. The most relevant are:

a.3) WP3.1 Hydrological process (IP)

Guarapiranga's Specific Law Regulamentation in 06/2006. It was given contributions to the committee's public sector proposal: land use issues, particularly, fish ponds, fishing and fish diversity in the watershed.

- Guarapiranga Seminar organized by Instituto Sócio Ambiental-ISA. Solo Sagrado from 30/05 to 1-06. ISA is a large NGO, very active in the Guarapiranga sub-committee and all the Alto Tietê committee. The seminars objective was to realize a participatory planning for water and land use in Guarapiranga. Coordination of the group: Water transposition and water quality.

IEA:

- Workshop Multiple Stakeholders Platform-MSP-NEGOWAT organised by Centro A.G.U.A and CERES. It was realised in Cochabamba through December 6 and 7, 2004 to produce a template for water negotiation with an empowering perspective.

4.1.6 WP3. 2 Agriculture Dynamics (IEA)

- Follow up of the Guarapiranga's Water Committee through the Technical Chamber with one meeting per month in average, during 2003-05. The main issue has been actualisation of PDPA (the legal management plan) to involve a more participatory methodology.
- Guarapiranga's Specific Law regulamentation: May-June/2006. Contribution to the committee's public sector proposal on land use issues, particularly on agriculture and large gardens. Standards according to the zoning areas were proposed but also whole conception for empowering farmers to enroll in a gradual technological change pattern. The committee's final deliberation was to leave the matter for a future specific regulamentation.
- Guarapiranga Seminar organized by Instituto Sócio Ambiental-ISA. Solo Sagrado from 30/05 to 1/06/2006. ISA is a large NGO, very active in the Guarapiranga sub-committee and the Alto Tietê committee. The seminar's objective was to realize a participatory planning for water and land use in Guarapiranga. Coordination of the productive activities group.
- Student's report presentation: Agriculture in Balainho: Mogi das Cruzes Rural Syndicate and Suzano Rural Syndicate. Agriculture in Guaracau: Cultural Center in Guarulhos to stimulate the group to initiate an urban agriculture project.
- Assistantship to Guarulhos'county government to design a urban agriculture program (2005).
- Reserva da Biosfera do Cinturão Verde de São Paulo. Council member for 2005-2007.
- Metropolitan Area of São Paulo Urban Agriculture Forum. Organised by the legislative power of São Paulo County, during 2003-2005 and passed a specific legislation. Invited to give a speech on urban agriculture in the Alto Tietê Water Basin, on April 16, 2004. Assistantship to the methodological group concerned in developing a common strategy to promote complementary income urban agriculture, through 2004-05. The group integrated local government's initiatives from São Paulo, Guarulhos and Santo André.
- Partnership with a social-political group, which worked mainly with landless farmers in Cabeceiras, and recently conquered Suzano's county government. 2005-2006.
- There has also been involvement with the RMSP agroecological net integrating initiatives: environmental groups, consumer's groups, local farmer etc., to promote urban agriculture.
- During November 17 –21, 2004 hosted a CIRAD Mission that visited the area and met partners to define guidelines for project development. During 2005 French

student oriented by Serge Marlet from CIRAD stayed at Instituto Biológico for six months. Meeting with local farmer's support agencies in Alto Tietê Cabeceiras to present the results and organize partnership for a possible project. Presenting the Cabeceira's area to some French researchers visiting São Paulo.

4.1.7 WP3. 3 Dynamics of eco-tourism (IEA).

Following up local government initiatives on rural tourism, in São Paulo and Guarulhos. Support has been give to Fundação Boticário's initiative to buy land in the Itaim microcatchment (Parelheiros' tributary) in order to protect it from urbanisation. A community project being supported by them.

- Student's report presentation. Guarapiranga at Parelheiros local office. Balainho at an interviewer's second house.

IP:

- Fieldwork and interviews with sport fishermen and representatives of the Association of Aquaculture – ABRACOA.

4.1.8 WP4 Role Playing Games

IEA and IP

Jogoman. Participation in early tests and also when used with different student's groups.

IEA:

- Course on Role Playing Games in monitoring modelation. Chapare, Cochabamba, March, 23-27, 2005.

TerÁguas. Contribution with information to its formulation: agriculture and tourism. Followed its application through Guarapiranga.

ÁguaLoca.Participation in early tests. Two sessions exclusively with researchers from IEA, on early tests. Participation in some sessions in Cabeceiras.

IEA;IAC

Environmental quality agricultural products workshops. Conception, organization and implementation. A set of 5 sessions in each of the four microcatchments. The first two were based on students report: local market channels and profitability of some selected sub-systems of production. The next three oriented to discuss quality and the guarantee system; standards for phytosanitary products and irrigation and procedures for the verification system and the social control guarantee system.

4.1.9 WP5. Validation

Power point presentations

IP

Water quality in the Alto Tietê watershed

Fish and fishponds in the Alto Tiete watershed

IEA

Rural Dynamics in the Alto Tietê watershed

IEA;IAC

Land use in the Alto Tietê watershed

Book:

Characterization of the experience: Environmental quality agricultural products workshops.

The IEA team organised the III Conceptual Framework Meeting realised in Ponte Nova-Salesópolis and in IEA/APTA, São Paulo from September 16 to 21, 2004.

4.2 Main results and outcomes:

A series of papers and students reports are fully presented in two publications. They are refered to WP1.4 and WP3. The articles are oriented to formulate a policy strategy for the rural sector in the Alto Tietê watershed, which will contribute to preserve the natural conditions for water production. The proposed instruments are: agriculture's multifunctionality and a social control guarantee system to evaluate conformity of environmental quality agricultural products. A series of partial appraisals were realized, in order to better understand the environment. It was complemented by evaluation studies about the possibility of utilizing the two proposed instruments. It has been organized in eight thematic chapters.

Chapter 1. Agriculture as an environmental service

The first article: "Agricultura: um serviço ambiental para a Bacia do Alto Tietê Cabeceiras" summarizes the specific studies integrated to present the general proposal of the NEGOWAT-APTA project. It is a joint article written by the authors of the most crucial researched themes.

Chapter 2. Land and water management appraisal: getting the necessary information

The following three articles: "Caracterização e evolução do uso das terras na sub-bacia Tietê Cabeceiras"; "Indicadores da atividade agropecuária e dos produtores nas sub-bacias de Tietê-Cabeceiras e Guarapiranga"; "Sistemas em cascata: concentrações e cargas de nutrientes no sistema produtor Alto Tietê, São Paulo" characterize land use and water quality in Alto Tietê Cabeceiras. Land use is analysed first through satellite images, aerial photography and maps and next, by statistical data. The last approach was also realized for Guarapiranga, since the cartographic analyses was already available in APTA. The evidence shows that agriculture is being pushed to the watershed limits and urbanization is growing over farm land and riparian areas. Nevertheless, the agriculture that still resists is significant and very market oriented. The last paper considers water quality and analyses the possible cause for its degradation. Agriculture does not seem to be the cause.

Chapter 3. Is the multifunctionality policy an alternative?

A third group of papers is associated with the issue of multifunctionality. A first article addresses the issue of social organization: urban and rural; social and environmental groups. It analyses if the social net is being capable of answering, in any measure, to the appalling impact of disorganized urbanization: "The São Paulo's Metropolitan area: environmental protection and poverty alleviation". The second addresses the specific issue of agricultural multifunctionality: "A preservação dos mananciais da Região Metropolitana de São Paulo e a multifuncionalidade". The main conclusion is that, despite the fact that rural social organization is increasingly fragile; it still preserves some conditions that justify an empowering attempt to in fact evaluate the possibilities of pursuing a multifunctionality policy.

Chapter 4. Agriculture

A fourth set of studies is oriented to analyse agriculture itself in two selected micro catchments: Balainho in Cabeceiras do Alto Tietê and Parelheiros in Guarapiranga. "Caracterização e evolução do uso das terras nas microbacias do Córrego Balainho e Parelheiros" is a cartographical approach that complemented the statistical analyses presented also in chapter 2. Based on production system

analyses the micro catchments were analysed in: "Perspectivas para a agricultura da Bacia do Alto Tietê." A third micro catchments Guaracau, in Cabeceiras was also studied through a complementary funding from Ministério de Assuntos Extrangeiros-MAE, from France. It demonstrates that despite the lack of policy support (Guarapiranga and Guaraçau) and the increasing difficulties brought by disorganized urbanization, farmers have a strong feeling of belonging and tend to resist moving to new areas. A complementary study: "Representatividade da tipologia de sistemas agrários nas sub-bacias Tietê-Cabeceiras e Guarapiranga e nas micro bacias de Balainho e Parelheiros, em São Paulo, Brasil" was realized to analyse statistical relevance of the previous field work.

Chapter 5. Economic aspects of agricultural production

A fifth study collection was oriented to analyse some economic aspects of agricultural production: Local trade channels on: "Fluxo de comercialização de hortaliças produzidas na região Cabeceiras do Alto Tietê"; economic trend for horticulture production, in particular for lettuce, the outstanding regional crop : "Evolução dos custos de produção de alface na sub-bacia Cabeceiras do Alto Tietê" and finally a more broad approach to the diversity of the production systems: " Indicadores de custo de produção e rentabilidade de alguns sub-sistemas de produção na Cabeceiras do Alto Tietê "

Chapter 6. Agriculture and water need.

A sixth group is related to water. A brief analyses of the irrigation systems is presented in: " Observações e sugestões sobre a irrigação em alguns produtores de hortaliças na bacia do Alto Tietê" followed by a soil analyses in the Balainho micro catchment: "Solos da microbacia do córrego Balainho – Suzano". A statistical evaluation of agriculture's water demand in Cabeceiras do Alto Tietê', finalizes the perspective: Demanda de água na agricultura na sub-bacia Cabeceiras, Alto Tietê".

Chapter 7. Changing agricultural technological pattern

The seventh group is associated to evaluating the possibility of changing technological patterns to transform agriculture in an environmental service activity. The first paper considers this possibility with a family farm focus "Desafio para a gestão de bacia peri-urbana: transformar em serviço ambiental a produção da agricultura familiar". The second analyses the possibility of their involvement in a gradual technological change process: "Changing patterns of agricultural production in São Paulo (Brazil) peri-urban provisioning watershed". Based on four family farmer's communities it is possible to ascertain that it is necessary and possible to enrol them into a gradual technological change project that will contribute to strength social organization and the viability of a multifunctionality policy.

Chapter 8. Tourism on the rural area

The last set of papers is related to tourism. The first paper analyses the touristic policy on the rural sector in the Alto Tietê watershed: "A política de turismo e o turismo no meio rural nos municípios da bacia hidrográfica do Alto Tietê: políticas implementadas pelas prefeituras e possíveis cenários". A field work was developed to evaluate its possible contribution to a multifunctionality policy: "Turismo e lazer em áreas peri-urbanas de proteção de mananciais: território, paisagem e multifuncionalidade". Fishing ponds have been increasing in the area. It was subject of a technical and economic analysis in: "Perspectivas da atividade de pesqueiros no Alto Tietê: contribuição à gestão de usos múltiplos da água". The environmental impact on water was addressed in: "Cargas de nitrogênio e fósforo de efluentes de pesque-pague visando a gestão de recursos hídricos: estudo preliminary"

Volume II presents eight students papers that contributed to the NEGOWAT-APTA project and particularly to the corresponding article where they enter as co-authors.

The NEGOWAT-APTA project created the necessary knowledge and conditions to stimulate a next step that shall be oriented to consolidate partnerships on a common ground: need to craft new institutions adequate for a gradual technological change of agriculture and consequently increase conditions for a rural development contract based on the concept of agriculture multifunctionality.

4.3 Difficulties and problems

The main problem is related to relative foreign exchange rate. It gives an uncertainty that might affect institutional involvement. Another problem was related to financial resources and discontinuity through almost all 2005. This put a very heavy burden on 2006 work, mainly for field work, that had to occur during Brazilian summer holidays.

4.4 "Technology" implementation plan

- The environmental quality workshops are an experience that can be reproduced in other watersheds. The APTA team is determined to develop a new project to follow the track opened by this work. At the same time is also determined to evaluate if it would work in a different watershed, but still considering only horticulture. A project first draft is ready.
- The proposal is also going to be presented to Agência de Bacia Alto Tietê; Sub-committees and to Agência Nacional de Águas-ANA, to the agronomist in charge of defining policies related to agriculture. The power point Rural Dynamics together with the power point workshops are the instruments to promote the idea. A booklet will be developed to complement with the needed information.
- The group is also considering having a book published with NEGOWATs outcome. An easier proposal is to publish it virtually in the IAC's or IB's website that is a refereed bulletin publication.

4.5 Publications:

4.5.1 Publication in refereed journal

BOUZID, M., DUCROT, R. CARVALHO, Y. M. C. , IMBERNON, R.A L. 2005 Dynamiques agricoles périurbaines et gestion intégrée de l´eau: cas d´un bassin-versant producteur d´eau dans la région métropolitaine de São Paulo (Brésil). Cahiers Agricultures v.14(1).p.131-138.

CASTRO, P. M. G.; MARUYAMA, L. S.; MERCANTE, C. T. J.; BEZERRA DE MENEZES, L. C. .2006. Perspectivas da atividade pesqueira no Alto Tietê: contribuição à gestão de usos múltiplos da água. São Paulo, Boletim do Instituto de Pesca, v32(1).p 1-14.

CARVALHO, Y.M.C.;MORAES, J.F.L.;VICENTE, M.C.M; SENDACZ,S.; FRANCA, T.J.F. (prelo). Agricultura: um serviço ambiental para a Bacia do Alto Tietê. SEADE, São Paulo em Perspectiva.

4.5.2 Seminar and conferences

a) Complete with proceedings

MORAES, J.F.L.; CARVALHO, J.P.; VALERIANO, M.M.; CARLSTROM FILHO, A.A. 2005. Evolução do uso das terras na sub-bacia hidrográfica Tietê-Cabeceiras entre 1977-2001. In. Anais do Simpósio Brasileiro e Recursos Hídricos, XVI, João Pessoa, PB. (CD-ROM).

CARVALHO, Y. M.C.; FRANCA, T. J. F.; BARBAN, V.; VICENTI, M. C.; FRANCISCO, V. L.a F.S. 2005. The São Paulo´s Metropolitan area: environmental protection and poverty alleviation. XI World congress of Rural Sociology. Trondheim, Norway. July, 25-30, 2004. (available http://www. irsa-world.org/XI/papers/groups.html group 18; captured 31/12/2005)

CARVALHO, Y.M.C ;FRANCA, T.J.F. 2005. A preservação dos mananciais da região metropolitana de São Paulo e a multifuncionalidade. IN: VI Simposio Latino Americano sobre investigación Y Extensión en Sistemas Agropecuarios (IESA-AL-VI). Colombia, 20-22 /07/2005. Proceeds.... (and CD-ROM).

CARVALHO, Y. M. C.; ZUCHIWSCHI, E.; FERREIRA, S. E.; FRABETTI, G. L. 2005. Perspectivas para a Agricultura da Bacia do Alto Tietê. IN: VI Simposio Latino Americano sobre investigación Y Extensión en Sistemas Agropecuarios (IESA-AL-VI). Colombia, 20-22 /07/2005. Proceeds.... (and CD-ROM).

CARVALHO, Y.M.C ;FRANCA, T.J.F. 2005. A preservação dos mananciais da região metropolitana de São Paulo e a multifuncionalidade. IN: XLIII Congresso da Sociedade Brasileira de Economia e Sociologia Rural – SOBER / 2005 FEA Ribeirão Preto-USP. Ribeirão Preto, 24 a 27/07/2005. Proceeds.... (and CD-ROM)

FRANCA. T.J.F. ; CARVALHO, Y.M.C. ; ANDRADE, J.P.; VIÉGAS, J. . 2005. Turismo e lazer em áreas periurbanas de proteção de mananciais: território, paisagem e multifuncionalidade. IN: VI Simposio Latino Americano sobre Investigación y Extensión en Sistemas Agropecuarios (IESA-AL-VI). Colombia, 20-22 /07/2005. Proceeds (and CD-ROM)

FRANCA. T.J.F. ; CARVALHO, Y.M.C. ; ANDRADE, J.P.; VIÉGAS, J. . 2005.Turismo e lazer em áreas periurbanas de proteção de mananciais: território, paisagem e multifuncionalidade. IN: XLIII Congresso da Sociedade Brasileira de Economia e Sociologia Rural – SOBER. Universidade de São Paulo-USP-Ribeirão Preto–SP, 24-27/07/2005. Proceeds....(CD-ROM)

CARVALHO, Y.M.C, BRITO, P.R. B., NAKAGAWA, E.K; ARRUDA, F.; RAMOS, R.; NASCIMENTO, F.M.A; BUENO, C.R.F; MASCARENHAS, M.D.; FRANCA, T.J. F. Changing patterns of agricultural production in São Paulo (Brazil) peri-urban provisioning watershed. New Delhi, International Society of ecological Economics, December, 15-19,2006.

SATO, G.S.; MARTINS, S.S., CARVALHO, Y.M.C.,MILANI, A.A., CUNHA, R.P. 2006. Fluxo de comercialização de hortaliças produzidas na região Cabeceiras do Alto Tietê. IN; XLIV Congresso da Sociedade Brasileira de Economia e Sociologia Rural – SOBER. Fortaleza, julho 2006,.Proceeds (CD RON)

b) Summary with proceedings

CASTRO, P. M. G.; MARUYAMA, L. S.; MERCANTE, C. T. J.; BEZERRA DE MENEZES, L. 2005. Diagnóstico da atividade pesqueira no Alto Tietê (São Paulo, Brasil): contribuição à gestão de usos múltiplos da água. IN: XVI Encontro Brasileiro de Ictiologia . João Pessoa, Jan. 2005. Proceeds....

CASTRO, P. M. G.; MARUYAMA, L. S.; MERCANTE, C. T. J.; BEZERRA DE MENEZES, L. C. 2005. Perspectivas da atividade pesqueira no Alto Tietê, São Paulo: contribuição à gestão de usos múltiplos da água. IN: XIV Congresso Brasileiro de Engenharia de Pesca. Fortaleza, 18-22/10/2005. Proceeds....

SENDACZ, S.; MERCANTE, C.T.J.; MONTEIRO, A.J.; MENEZES, L.C.B. 2005. Cargas de Nitrogênio e Fósforo relacionadas a impactos antropogênicos na bacia hidrográfica do Alto rio Tietê (Cabeceiras), São Paulo. IX Congresso Brasileiro de Limnologia. Ilhéus, BA, 24- 29/07/ 2005.

SATO, G.S.; MARTINS, S.S., CARVALHO, Y.M.C.,MILANI, A.A., CUNHA, R.P. 2006. Análise da comercialização de alface produzida na região do Alto Tietê.Contribution in the 19 RAIB, São Paulo, 06-09/2006. 4 p. http://www.biologico.sp.gov.br/arquivos.

SATO, G.S.; MARTINS, S.S., CARVALHO, Y.M.C.,MILANI, A.A., CUNHA, R.P. 2006. Vegetables commercialization at the Alto Tietê River catchment, São Paulo, Brazil.Contribution in the III Congresso Internacional de La red SIAL, Sistemas Agroalimentarios Locales « Alimentación y Territorios, out. Espanha, 18-21-2006. 4p..http://www.gis-syal.agropolis.fr/ALTER06 .

CARVALHO, Y.M.C. 2006. Políticas públicas para gerenciamento de bacias hidrográficas: o espaço rural. Contributions in the 19 RAIB, São Paulo, 06-09/2006. 4 pages. http://www.biologico.sp.gov.br/arquivos.

c) Without proceedings

SENDACZ, S.; MONTEIRO, A.J.; MERCANTE, C.T.J.; MONTEIRO, A.J.; MENEZES, L.C.B.; MORAES, J.F.. Water quality in reservoirs and main tributaries of Alto Tietê watershed.

Partial results. Workshop on "Ecology of Reservoirs: impacts, management and cascading systems. São Paulo, UNESP-Botucatu, July 2004.

FRANCA. T.J.F. ; CARVALHO, Y.M.C. ; ANDRADE, J.P.; VIÉGAS, J. 2005 Apresentação da exposição fotográfica e visita virtual "Turismo e lazer na Bacia do Alto Tietê - uma visita virtual em Parelheiros e Balainho" .IN: Encontro por uma Nova Cultura da Água na América Latina. Fortaleza, 05 a 09/12/2005

FRANCA, T.J.F.; FALEIROS, K.S. A política de turismo e o turismo no meio rural nos municípios da bacia do Alto Tietê: implementação de políticas pelas prefeituras e possíveis cenários. IN: 33º Encontro Nacional de Estudos Rurais e Urbanos – CERU. São Paulo, USP-CERU, 17-19/05/06.

CARVALHO, Y. M. C.; ZUCHIWSCHI, E.; FERREIRA, S. E.; FRABETTI, G. L. 2005. Perspectivas para a Agricultura da Bacia do Alto Tietê. IN: 33º Encontro Nacional de Estudos Rurais e Urbanos – CERU. São Paulo, USP-CERU, 17-19/05/06.

DUCROT, R; JACOBI, P; BOUZID, M; AMARAL, A; CARVALHO, Y : Facilitating concertations in a Brazilian periurban catchment: to what extend does irrigation compete with potable water supply? Communication pour Water resources management for local development : governance, institution and policies : November 8-11 2005, Loskop Dam, South Africa.

ANTONIAZZI, L.B; AMARAL, A.M.P.(2004) Custos de produção de Alface na Sub-bacia Cabeceiras Tietê: o papel da água. Piracicaba, SIICUSP, 24 /11/2004. (painel)

4.5.3 Books contribution

SENDACZ, S.; MONTEIRO, A.J.; MERCANTE, C.T.J.; MONTEIRO, A.J.; MENEZES, L.C.B.; MORAES, J.F. 2005 Sistemas em cascata: concentrações e cargas de nutrientes no Sistema Produtor Alto Tietê, São Paulo. in Nogueira, M.G.; Henry, R. & Jorcin, A..(eds) Ecologia de Reservatórios: Impactos Potenciais, Ações de Manejo e Sistemas em Cascata. p.417-434.

4.5.4 Reports and student thesis

a) Negowat workpackage report

a.1) Students reports:

WP3.3 Agriculture Dynamics

Zuchiwschi, Elaine. Agricultura Peri-urbana nos Mananciais Urbanos da Região Metropolitana de São Paulo: estudo de caso no município de Guarulhos, Estado de São Paulo

Ferreira, Sérgio E. Caracterização do Sistema Agrário da Região da Microbacia Hidrográfica do Ribeirão Balainho, pertencente à Sub-bacia Hidrográfica Alto Tietê-Cabeceiras - Município de Suzano

Frabetti, Giancarlo. L. Agricultura em Parelheiros

Milani, Aline A. e Cunha, Rodrigo P . Estudo da Comercialização de Olerícolas Produzidas na Região de Cabeceiras na Sub-Bacia do Alto Tietê: alface crespa e couve-flor como exemplos para análise.

Nosse, Tânia O. e Antoniazzi, Laura B. Custo de Produção e Rentabilidade de Subsistemas de Produção, na Região de Cabeceiras do Alto Tietê - Parte I e II

WP3.4 Dynamics of eco-tourism

Andrade, João P. S. de. O Turismo no Espaço Rural da Microbacia do Balainho

Viégas, Jéssica F. Diagnóstico Sócio-ambiental do Turismo Rural na Microbacia de Parelheiros, São Paulo

WP4:

Brito, Paulo R. B. de; Nakagawa, E. K.; Nascimento, F. M. de A. do. Construindo a Qualidade Ambiental do Produto Agrícola no Alto Tietê Cabeceiras

a.2) Student thesis

VIÉGAS, J. F.. 2005. Turismo em áreas de Manancial: Uma Análise da Vocação Turística na Região de Parelheiros, RMSP. Dissertação, Brasil, Universidade São Marcos–USM, 159p.

4.5.5 Communication in other media (internet, video, magazines, newspaper etc)

VICENTE, M.C.M.; KULAIF, J.T.; FRANCISCO, V.L.F.S. Bem preservado, Cinturão controla até enchentes. Estado de São Paulo- Suplemento Agrícola 6/07/ 2005. pg 6. From: Uso do solo rural e indicadores sócio-econômicos nas sub-bacias de Tietê Cabeceiras e Guarapiranga.

CARVALHO, Yara et al. (2004) NEGOWAT: Negociação sobre a água. Série Discussão APTA 4: Desenvolvimento Regional: um painel de contribuições de economia agrícola. P. 26-36. The paper was presented in a workshop realised on November 28, 2003.

SATO, G.S.; MARTINS, S.S., CARVALHO, Y.M.C.,MILANI, A.A., CUNHA, R.P. 2006. Fluxo de comercialização de hortaliças produzidas na região Cabeceiras do Alto Tietê. www.iea.sp.gov.br/trabalhos (captured in 30/10/2006)

FRANCA. T.J.F. ; CARVALHO, Y.M.C. ; ANDRADE, J.P.; VIÉGAS, J. . 2005. Turismo e lazer em áreas periurbanas de proteção de mananciais: território, paisagem e multifuncionalidade. www.iea.sp.gov.br/trabalhos (captured in 30/10/2006)

CARVALHO, Y.M.C ;FRANCA, T.J.F. 2005. A preservação dos mananciais da região metropolitana de São Paulo e a multifuncionalidade. www.iea.sp.gov.br/trabalhos (captured in 30/10/2006).

CARVALHO, Y.M.C ;FRANCA, T.J.F. 2005. A preservação dos mananciais da região metropolitana de São Paulo e a multifuncionalidade. www.icarrd.org/en/proposals/Multifunc_rural.pdf. (captured 30/10/2006)

4.6 Conclusion

The role playing games brought an important contribution introducing the concept of land and water collective management (JOGOMAN) among undergraduate students and promotes their interest in pursuing research on the subject.

The TerÁguas introduced the jurisdiction superposition of the county government and the water company. It addresses the need to understand different perspectives and negotiate to find the best common solution. It leads to the formulation of a new game that prepares the group to play TerÁguas in the sense that allows them to craft a common perspective of their immediate reality. The game has the benefit of empowering participants to elaborate a participative appraisal of the reality and the means to overcome the problems through a negotiated strategy. It seems to attract all participants.

The ÁguaLoca is a more hydrological technical game. The main actors are the water related agencies. There is a close description of the SPAT system and it seems to attract mainly the technical people from the water agencies. It reflects the present reality that the Water sector worries and activities dominate the action of the watershed committees. A process of negotiation or of collective management can arise but it depends heavily on the players. It seems to be an important tool for education of public workers from the water sector, in the new water management scenario.

The most important limitation, related to these games, is that it has not yet trained personnel to organize games, after the project is over. It must provide computer training and material multiplication.

Farmer's environmental quality workshops are a simple strategy to make information on the new water management scenario available for farmers and promote comprehension of the new possibilities that it brings. The main proposal was to craft a social control guarantee system for environmental friendly agricultural production. The proposal not only opens new market opportunities but also promotes a gradual environmentally adequate technological change and strength social organization. It is a win-win-win (economic; environmental and social) alternative. The proposal was tested with a small group of farmers and was highly accepted. The NEGOWAT project only proved that farmers assumed the proposal and are willing to negotiate with the water committee. The negotiation process has to be pursued. More than that, the social control system also depends on a research and action project to strength farmer's supporting agencies in their challenge to change its working paradigm towards a more bottom up perspective.

4.7 Management aspects

The project stimulated integration among Brazilian researchers and more particularly among those of APTA. The most important result has been the incentive for an environmental research group. Three Institutes: IAC; IP and IB have initiated their graduate courses with emphasis on environmental issues. Nevertheless they are three independent courses that could greatly benefit from integration. The project stimulated it but it will certainly depend on some research continuation. Unfortunately, IEA does not even have an environmental research organized area, what made coordination a harder task. The present coordinator is considering institutional reallocation.

The lack of initial understanding about how did the project financing operated created some resource availability problems. The need for resources was concentrated in WP3. The initial disbursement was much less than expected and it was not yet understood that it was necessary to spend in order to be reimbursed. This led to problems all along the project but particularly for the year 2005 when there was a clear institutional orientation to end the project and also 2005-2006 when resources were received because it demanded a very intense activity in a very inappropriate time (Christmas and summer holiday

There was a clear misunderstanding about project development since the APTA's team was very much interested in the relation water and agriculture but from the agriculture perspective. The project's perspective gave much less importance to agriculture since the main impact in the watershed is in fact management ad urbanization. The final coordination decision opening the possibility of developing the workshops were highly appreciated and made participation in the project worthwhile. There was an expectancy of a more strong partnership with CIRAD since it is mainly an agriculture related research institution.

4.8 Appendices :

Scientists visits

MARLET, Serge. CIRAD. November, 16, 2005. Meeting with scientific partners and stakeholders . Presentation: BRIGNOL, V. Water pollution from agriculture in Cabeceiras Tietê. EDR Mogi das Cruzes.

BRIGNOL, V. Polution from agriculture in Cabeceiras do Alto Tietê basin: data from São Paulo's Metropolitan Region. Visiting French scholar at Instituto Biológico and Instituto de Economia Agrícola. Oriented by Serge Marlet and Raphaele Ducrot. Co-oriented by Luiz Luchini and Mara D'Andrea, researchers from Instituto Biológico's (APTA).

CERDAN, Claire (CIRAD) Assistantship to develop quality economics' project, initiated through the quality workshops. Financed by MAE-Fr.

Intervention in existing training course

CARVALHO, Y.M.C. Aspectos da sócio economia pesqueira: o caso do Alto Tietê. 03/05/2005. Instituto de Pesca' Graduate School. Course: Fishing, Sustentability and Scientific Research.

CASTRO, P.M.G.. Perspectivas da atividade pesqueira no Alto Tietê: contribuição à gestão de usos múltiplos da água. August/2005. Instituto de Pesca' Graduate School. Course: Fishing, Sustentability and Scientific Research.

Material provided

1. Projeto Negowat APTA Serviço Ambiental da agricultura. Alto-Tietê- Região Metropolitana de São Paulo. Relatório
2. Projeto Negowat/APTA : Serviço Ambiental da agricultura. Alto-Tietê- Região Metropolitana de São Paulo. Artigos.
3. CD ROM : Serviço Ambiental da agricultura. Alto-Tietê- Região Metropolitana de São Paulo. Projeto Negowat / APTA
4. CD ROM: Promovendo serviços ambientais. Turismo no rural e agricultura, Projeto / Negowat APTA

INCO - DEV: International Cooperation with Developing Countries (1998 - 2002)

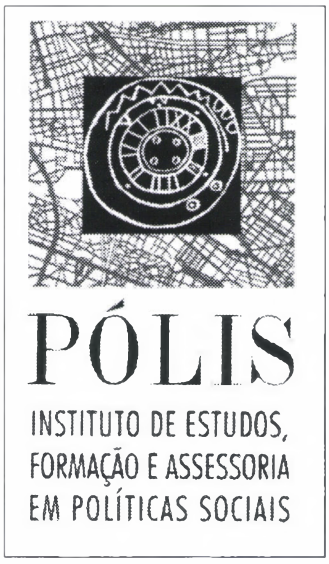
Contract number: ICA4-CT-2002-10061

Facilitating Negotiations Over Land And Water Conflicts In Latin- American Peri-Urban Upstream Catchment: Combining Agent-Based Modelling With Role Playing Game

NEGOWAT Project Final Report

Partner n°7

PÓLIS - Instituto de Estudos, Formação e Assessoria em Políticas Sociais



COORDINATOR: Dra. Vilma Barban

October 2006

5 INSTITUTE POLIS FINAL SCIENTIFIC REPORT (2006)

Pólis – Instituto de Estudos, Formação e Assessoria em Políticas Sociais, (Instituto Pólis), under the coordination of Dr. Vilma Barban, has been involved in the entire course of the Negowat Project, being directly responsible for actions in the following phases - WP1: Map Land and Water Management Issues in Periurban Catchment, (WP 1.3 : designing and implementing a method for land and water issue mapping with stakeholders) and WP4 – Test of Tools in a Patrimonial Approach (WP 4.2 validation session workshop), WP 4.3 scenario building workshop, WP 4.4 Negotiation session workshop; and WP5 (response the methodology and results dissemination).

During its development, the project had the participation of technician MSc. Kazuo Nakano for the elaboration of Intra-urban Social Indicators (2003/1st sem). Vinicius Madazio, technician, was involved in phases WP4, WP5, in the end of 2005 and in 2006. Student Márcia Renata Itani participated in WP1, 2003; Clarissa de Oliveira and Luiz Sertório Teixeira took part in WP1 and WP4, 2003 and 2004. Camille Rojot, a student at INA-PG Agronomic National Institute - Paris Grignon, and an intern at Pólis Institute, was involved in WP4, 2005/2nd sem., whereas Cecília Kayano de Morais, undergraduate student in Education participated in the phases WP4, WP5, 2004-2006.

5.1 Objectives

In the general objectives of Negowat Project "to develop a methodology to facilitate the negotiation and resolution of conflicts over access to land and water resources in upstream metropolitan catchment areas with all relevant stakeholders" Instituto Pólis' participation was tied to the following phases: (a) methodological development of the conceptual model; (b) to investigate the societal, economic, technical and institutional factors affecting the hydrological and social functioning of peri-urban upstream catchments; (c) implementation of discussion sessions and the methodological development, which combined multi-agent and role playing models; (d) to develop a methodology with the social actors in order to conduct negotiation sessions on land and water resources management; (e) to monitor and evaluate the approach and method in order to help stakeholders to explore and discuss scenarios and build agreements; (f) preparation and dissemination of the methodology.

Instituto Pólis' initial participation objectives in the project were:

a) participation in the methodological development of the conceptual model;
b) Social actors: Identification, mapping and analysis of the actors and conflicts regarding the management/use of water and land at the Guarapiranga and Tietê-Cabeceiras sub-catchments, and
b) Organization and animation of workshops with stakeholders, session monitoring and observation of the process following the methodology proposed;

With the development of the project, the meetings with the Guarapiranga sub-committee, city hall, and other public administration institutions, as well as the experiences with the actors has shown that a deepening of the project's intervention in the local urban communities was needed, thus resulting in other activities developed by Pólis:

cooperation in the construction of methodologies and Role-play Games to approach the issue of districts in spring areas;

in the elaboration, the testing and dissemination of programs for local actors capacity building, enabling them to participate in decision-making on issues arising from this context – The Ter'Águas Process.

Moreover, Pólis, together with NRI and Centro Agua, has taken part in the development of the project's products (games and publications).

Cooperation with part of the Brazilian team involved in the conception and development of the role-play games and production of texts

Mobilization of the Brazilian team partners for the development of more accessible texts about respective research viewing a related publication

review/edition of a power point presentation of the final texts about the Brazilian partners research to be included in the www.negowat.org website.

5.2 Activities

Instituto Pólis was involved in several activities throughout Negowat.

I. activities with social actors:

During WP1, besides the bibliography review and systematization of data about actors and conflicts in the use and management of water and land, Pólis has presented an Intra-urban Social Indicators systematization and has developed two researching strategies for mapping and analyzing actors and conflicts. Firstly, it carried out a survey under the Delphi methodology with the Committee and sub-committees representatives. This methodological approach was revised by the body of Project partners, who decided that other - more suitable - methods should be employed.

Secondly, it made the qualitative survey to identify the local organizations, their characteristics and actions at the micro-basins of Ribeirão Parelheiros, in Parelheiros/SP, and Ribeirão Balainho, in Suzano/SP, as well as to map the existing social organizations at the Tietê Cabeceiras water basin. In order to accomplish these surveys the team made field recognition visits, qualitative interviews and held meetings with sub-committees and city hall representatives, and technicians of related public bodies and other institutions. A guideline of questions was designed for the interviews with the local social organizations. The results of this study have been systematized and returned to all the actors who cooperated in the survey.

Based on the survey, our work with the local actors focused mainly on the Guarapiranga Basin region. A series of workshops with local actors was implemented: a) at first viewing a more detailed recognition of the local administration reality and b) also an agreement with stakeholders on the definition of the system studied, specifically land and water issues in each catchment as well as to provide information to the local community about the project, with the specific purpose of designing and implementing a method to map land and water issues with local actors (WP1.3).

The proposal for a participative development of tools to facilitate processes of negotiation for the conflicts on land access and use (WP4) posed several challenges regarding the involvement and participation of the local actors in the negotiation and management processes. This included the following activities:

1. Field study with the social organizations present at the micro-basins of Ribeirão Parelheiros/Guarapiranga and Ribeirão Balainho/Suzano/SP, creation and analysis of the results. (2003/2004)

2. Return of the research results to the local actors with the mapping of the main conflicts pointed by the interviewees. The methodology made use of group dynamics, focus groups to discuss the main conflicts, such as pollution, and problems related to land and water access and use, as well as life and health conditions (2004).

3. Organization of a series of encounters with representatives of Ribeirão Parelheiros micro-basin social organizations involved in the joint development of capacity-building tools and role-play games. The methods used were group dynamics, construction of models, drawings, negotiation simulation, etc (2004).

4. Development and testing of several tools and educational games and RPG about the occupation of spring areas and its environmental and social consequences - Jogopol, JogAtores (2005/2006).

Role Playing Games[1] (RPG) is a form of communication in which the participants, given a chosen situation that might be real or imaginary, identify the main agents in that situation and start performing, elaborating strategies and acting according to those agents roles. Thus, they become able to communicate with each other through the role-play, expressing themselves with their bodies, voices, knowledge, and imagination, in a virtual and ludicrous space. This allows a broader participation and involvement in a collective action. (Caprirolo and Faysse, 2006) [2]. The action is always based on a context, a scenario, a scene, that is, a space defined roughly or in depth, where the actions and relationships between the agents represented occur.

The JogAtores role-play game has been tested basically among the work team, Pólis Institute technicians and students. Objectives: highlight and rank the social agents involved, the roles they play when negotiating the issues indicated, and actions and strategies used. It motivates the interaction between the actors and the awareness about the consequences of territory occupation X absence or implementation of sanitation.

JogoPol was presented to the local actors groups. This game has got its main focus on access to water and pollution of potable water, putting in evidence the essential problems related to environmental degradation, in the view of civil society, obtained by Pólis through the research, which were: health, sanitation and lots regularization. The players deal with the following aspects: pollution caused by rainfall; arrival of residents in the lots, both in urban zones and parts of 'disordered occupation'; provision of potable water to part of the lots; pollution generated by different uses of the soil; pollution effects over the environment and life conditions.

In their evaluation of this game, the actors highlighted its importance as an environmental education method and indicated their interest in repeating it with the residents in their communities and schools.

5. Organization of a program of capacity-building workshops for the actors and verification (tests) of the process of using the negotiation facilitating tools with the local actors in Embu Guaçu and Parelheiros, both at the Guarapiranga sub-catchment. The program was called Processo Ter´Águas.(WP4 e WP5, 2006).

The objective of this process was to produce, test, finalize and disseminate training materials that can be used by other researchers and organizations to strengthen skills of discussion, decision-making, conflicts negotiation and water and soil management in peri-urban areas.

Instituto Pólis' team was specifically concerned about researching and testing methodologies that contribute for a more informed participation, stimulating organizations and residents of the neighborhoods located in spring areas to take part in discussions. Once they are generally not aware of their rights, they are excluded both from the negotiations as well as from the administration of the territory and waters. Due to the fact that these methods articulate the actions of the several local actors represented in the decisions made on management, their realization requires the involvement of different actors, such as city halls, public institutions and organizations responsible for water, pollution control, housing, environment, industries, farmers, land owners, residents associations, etc. Even so, it wasn't always possible to count on their presence in all sessions.

In this program we applied a participative methodology, making use of several group dynamics and role-playing games that aim at the integration of different types of knowledge – the scientific one and

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1 Moreno, J.L. *Psicoterapia de grupo e Psicodrama.* São Paulo: Mestre Jou, 1974. Antona M., D'Aquino P., Aubert S., Barreteau O., Boissau S., Bousquet F., Daré W., Etienne M., Le Page C., Mathevet R., Trébuil G., et J. Weber (Collectif Commod). 2003. *Our companion modelling approach (La modélisation comme outil d'accompagnement).* Journal of Artificial Societies and Social Simulation 6(2). http://jasss.soc.surrey.ac.uk/6/2/1.html; Barreteau, O. 2003. *The joint use of role-playing games and models regarding negotiation processes: characterization of associations.* JASSS 6(2). Online: http://jasss.soc.surrey.ac.uk/6/2/3.html; D'Aquino, P., Le Page, C., Bousquet, F. et Bah, A. 2003. *Using self-designed role-playing games and a multi-agent system to empower a local decision-making process for land use management: The SelfCormas experiment in Senegal.* JASSSS 6(3). http://jasss.soc.surrey.ac.uk/6/3/5.html

2 Caprirolo, Ronald P., Faysse, Nicolas. *Pautas generales para la elaboración , uso y empleo de Juegos de Roles en processo de apoyo a una acción coletiva.* Agosto 2006, Cochabamba, Bolivia: Centro Agua- UMSS, Projeto Negowat.

that produced by popular wisdom, both of which are considered to be of the same nature (LATOUR, 1994)[1]. We have also employed the "monitoring model" methodology, which can be considered as a platform of collective learning with the objective of facilitating dialogue, sharing knowledge and making collective decisions in an intervention [2]. In the perspective of the systems theory, teaching/learning is an interconnection space between the agents involved, their surrounding scenario, the environment and the world. According to John Dewey(1976), who poses the importance of action in learning, or better, learning through doing (Courtney, 1980), it is important to overcome the vision of learning as a merely theoretical acquisition, and understand that it occurs through all senses[3]. In this process, we sought to include the agents' actions in the understanding of the local reality. With this, we were able to amplify the access to information and understand the conflicts and tensions as knowledge mobilizing elements, thus valorizing everyone's knowledge and ideas to create a shared knowledge.[4]

In short, the monitoring model is a process constituted by different phases in the perspective of approaching the issues raised with the actors and developed by the researchers (Barreteau e al. 1996, Bousquet 1996)[5].

It also proposes an indirect integration of representation view: the actors present their points of view on several issues, such as the mapping of the local reality, the relationship between housing conditions, access and use of water and the community health situation, etc. In debates with other actors and researchers different points of view confront or complement each other, articulating a shared vision about this reality that might compose a model – an intermediate object, or objects, that will mediate the construction of knowledge – which is close to the local reality. The model is once again analyzed by the group of actors and is gradually enriched by the contributions and debates. Therefore, the model process can be understood as a collective learning platform with the objective of facilitating dialogue, sharing knowledge and making decisions collectively in an intervention, whereas the scientific work contributes with researching processes, search and elaboration of data that contribute to amplify information about the system. All in one, it is possible to increase the management skills of the local communities and actors, who add their knowledge.

In general terms, the program was formed by the workshops with the following objectives:

(i) to map district development, actual situation, problems, and their respective relations and impact to the local resources (land and water) to identify similarities and differences

(ii) to map the stakeholders involved in the management of the related problems (focusing in land and water) to distinguish their responsibility, their effective legal and illegal actions on the resources.

(iii) the relationship between actors and resources - actions on resources, how they transform the resource and how it affects the actors, their health and life conditions (relation of reciprocity actor/resource)

(iv) Dramatization about an important issue for local dwellers about land/water management focusing on role-playing and negotiation attitude.

(v) Teraguas Role Playing games.

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1 LATOUR, B. 1994. *Jamais fomos modernos: ensaios de antropologia simétrica*. RJ: Editora 34; FREIRE, P. 1999 *Pedagogia da esperança: um encontro com a pedagogia do oprimido*. 6ª ed. SP: Paz e Terra.

2 Commod: http://cormas.cirad.fr/pdf/ComModCharter2004.pdf; ETIENNE, M. (2005). *Fase Concepción de um Juego de Roles. Curso de Formación. Efoque de Juego de Roles em la Modelación de Acompañamiento*.Cochabamba, 23-27 May, 2005

3 DEWEY, J.(1956). *Democracia e educação*. São Paulo: Cia Ed. Nacional.; (1976). *Experiência e educação*. São Paulo. Cia Ed.Nacional. COURTNEY, R. *The Dramatic Curriculum*. New York: Drama Book Specialists, 1980.

4 BARBAN, V. (2000) *Comunicação, Educação e Sistemas - Experiências em Comunicação Oral*. COS-PUC/SP. Tese de doutorado, em CD-rom.

5 BECU, N. 2006.*Identification et modelisation des representations des acteurs locaux pour la gestion des bassins versants*. These de doctorat. Univ. Montpellier/Sciences Et Techniques du Languedoc. http://www.montpellier.cemagref.fr/

(vi) Discussion about the City plan and the specific law for Guarapiranga, Law no. 12233 of January 16, 2006.

(vii) Elaboration of an action plan (planning negotiations) to solve a real issue selected by the group. This helps the stakeholders to prepare a specific action or negotiation by helping them to identify information needs, mobilization needs, actors involved, etc.

The following actions were accomplished in this program:

- Five workshops in Embu Guaçu with health officers, residents and the participation of representatives of City Hall, SABESP, and a local NGO.
- Four workshops in Parelheiros in the districts JD Oriental, JD das Fontes, and Parque Sumaré with the associations, residents and representatives of sub-city hall, SABESP, industries.
- Workshop with the Guarapiranga sub-committee, with representatives of SMA/DUSM, SABESP, Environment Secretary of Embu das Artes and SMA São Paulo, CDHU, Agriculture Secretary, Instituto Sócioambiental, Fórum pela Vida e contra a violência of M´Boi Mirim.

The report on these workshops is attached.

We'd like to highlight that this process, called Processo Ter'Águas, specially the Ter'Águas Game, the games assessment and validation developed in the Negowat Project counted on the participation of other partners in the project and has had a broader scope.

Results

The results from the local survey and the development of the workshops program and debates show several positive aspects: the recognition of the Project's role in promoting the debate on the issues involved, the need and possibility of involving these actors in the identification of problems, participation in negotiations and in the definition of social policies. The local representatives have emphasized the lack of information, meetings and articulation in the places and in the town; they stress the importance of knowledge, particularly an articulate one, clearer procedure norms, planning of policies and actions that organize the possibilities of living properly in those places. These measures could help to regularize their situation, thus avoiding environmental degradation and pollution, which also make their living conditions worse.

Furthermore, the process has shown the possibility of organization and dialogue with the public power and institutions involved in the issues of environment, water supply and network, pollution, etc.

In Parelheiros we observed that since 2004, when the survey was returned, there has been a mobilization of the organizations in forming a local forum that is still active and counts on a great attendance.

During the development of the "processo Ter´Água" program (2006) with the local actors there was involvement in the entire process; mobilization on the research issues, conceptualization of conflicts, involvement of the public sector, and capacity-building for the actors.

In Parelheiros the representatives of organizations and local residents of the districts Jd das Fontes, Jd Oriental and Parque Sumaré got together, discussed and practiced negotiation possibilities. They developed an action plan to intervene in the current conflict - the demand for the extension of the regular water network by Sabesp. The company has demanded in exchange that the residents install individual cesspits. This has proved to be impossible due to the high installation and maintenance costs. The games have made it possible for the participants to map possibilities of dealing with the problem, to think of many alternatives of action and to forward the issue to the public power, the water company and other actors present in the region.

Unfortunately, we did not have enough time in the project to follow the implementation of these activities, even though they would be good opportunities.

In Embu-Guaçu the health officers who participated in the workshops program were able to implement a dialogue with the technicians in the local public administration and get involved in the process of configuration and implementation of the town's city plan. The participants appreciated the integrated district reality mapping and the negotiation exercises, becoming aware of the diversity of interests, partnership possibilities and of a dialogue not only with other residents, but also with the public power. Those agents are interested in learning the methodology developed in the Negowat and replicate it with the residents.

"Since the first meeting the whole experience has been worthwhile and can be used at other moments, like that magnet game (Jogobairro), that's not expensive for us to apply in our reality, the moments were very well conducted, the dynamics were very nice, controversy took part in the process and the conduction was done in a nice way. I'll miss it. We have to meet again. I think we could've had more written material on the negotiation and the conflict, like bibliography references." (health officer, Embu).

Activities with the Negowat Project partners.

a) Cooperation with part of the Brazilian team in the conception and development of the role-playing game and production of texts (CIRAD, APTA, PROCAM/USP, F. Saúde Pública/USP).
b) Coordination of the Brazilian team partners for the development of more accessible texts about the respective surveys viewing a publication directed to the social actors, leaderships, and people interested in working with this topic.
c) Coordination and edition of the Brazilian partners' final product on "power point" to be published in the Negowat Project website.
d) In all of these moments the Instituto Polis' team revised the texts, made adjusting suggestions and proceeded with the edition for publication.

5.3 Main results and outcomes:

The project results are in many levels:

Instituto Pólis' team participated in the bibliography survey about the actors and conflicts, the surveys - Research with the Committee and sub-committees representatives; and the identification of the social actors and their organization/action, these included in the activity reports and in the Negowat publication, being also a basis for articles and conferences.

The survey carried out in Parelheiros was the base of Luiz Sertório Teixeira's undergraduate thesis at the USP Geography department, defended in March 2005 and co-advised by the Pólis' team coordinator.

The development of the games and the capacity-building program for the local actors, whose detailed report is enclosed, resulted in texts presented at conferences and will be available on the Negowat and Instituto Pólis websites. They are also being prepared for publication.

During the development of the "processo Ter´Água" program (2006), it was possible to systematize and test a participative methodology to approach local issues in a series of activities that allow individual and collective learning; we also formulated the introduction of Role-Playing Games as a methodology to approach the water and land conflicts in spring areas, including negotiation between the various actors, and regional planning.

These processes and tools cooperate in the capacity-building programs offered by Instituto Pólis in the areas of Direito à Cidade (Right to the City), Fortalecimento da Sociedade Civil Local (Strengthening of Local Civil Society), Escola da Cidadania (School of Citizenship) and Fórum da Reforma Urbana (Urban Reform Forum).

The creation of the JogoPol Role Playing Game was the internship program of Camille Rojot, a student at INA-PG Agronomic National Institute - Paris Grignon, and a trainee at Pólis Institute – Negowat Project, between July and December/05. It is part of the report "Concepção, elaboração e testes de jogos de papéis – JogoPOL". The Role-Playing Games, JogAtores, Local reality mapping, Negotiation and Action Planning counted on the cooperation of Cecília Kayano de Morais and are part of her internship program in School Administration. It is important to state that the development of these games, processes and the Ter´Aguas Game were under the general coordination of Raphaéle Ducrot, the Negowat coordinator, and have also counted on the participation of other partners of the Project.

For Instituto Pólis, the participation in the Negowat Project has made it possible to open a new area of activity, the Água como direito (Water as a right), stimulating and establishing connections with National and International Forums for the defense of water and basic sanitation, public rights and social control. Also, Pólis' was able to make alliances with other NGOs in the environmental area, as in the case of the "Diagnóstico do Guarapiranga"[1] (Guarapiranga diagnosis) project, realized by ISA-Instituto Sócioambiental, and the publication "Seminário Guarapiranga 2006 – proposição de ações prioritárias para garantir água de boa qualidade para abastecimento público", to which Pólis has become a partner. A project developed in partnership with that organization and with SOS Guarapiranga was developed, and is currently at selection stage by IDRC. It has opened new possibilities of future projects, not only with NGOs and other institutions, but also with city halls, SABESP(Water Company), Secretaria de Meio Ambiente, and Negowat Project partners.

5.4 Difficulties and problems

Difficulties were inherent to the research, creation and tests of the tools. There were many occasions when the project's schedule for preparation, application and evaluation of the tests and actions monitoring were not in accordance with the social actors' time. On the other hand, difficulties do open new perspectives for projects and action.

5.5 "Technology" implementation plan

The research team does not have any remarks to make.

5.6 Publications and papers

5.6.1 Seminar and conferences with proceedings

BARBAN, V. 2005. *Spring Areas in the MetroPólis of São Paulo/Brazil: the Residents, their Organizations and Social Participation.* EFFICIENT 2005 - 3rd Conference on Efficient Use and Management of Water, Chile, 14 a 19/03/2005 – em Cdrom e disponível na página http://www.efficient2005.com/

BARBAN, V. 2005. *Conflicts and participatory management in Alto Tietê Water Basin Regions.* Panel in EFFICIENT 2005 - 3rd Conference on Efficient Use and Management of Water, Chile, 14 a 19/03/2005 – em Cdrom e disponível na página http://www.efficient2005.com/

BARBAN,V., ROJOT, C. e MORAIS, C.K. 2005 *Gestão partilhada – informação e formação para a participação cidadã.* Encontro Por uma nova Cultura da Água. Fortaleza, Brasil, 5 a 9/12/05. em Cdrom e disponível na página http://www.unizar.es/fnca/america

DUCROT, R., JACOBI,P., MONTEIRO, F., BARBAN, V. and CARVALHO, Y. 2003 De la métropole aux communautés local de la périphérie. Comen articuler les différentes échelles de gestion de l'eau dans les bassins versant péri-urbains de São Paulo, Brésil, Séminaire PCSI "Gestion intégrée de l'eau parité de bassin versant" 2-4 décembre 2003. Montpellier, France CD ROM

1 Waterly, M. e Cunha, P.M. *Guarapiranga 2005: como e por que São Paulo está perdendo este manancial: resultados do diagnóstico sócioambiental participativo da bacia hidrográfica do Guarapiranga.* São Paulo: Instituto Sócioambiental, 2006.

CARVALHO, Y. M. C., VICENTE, M. C., FRANCA, T. J. F., BARBAN, V. 2004. "The São Paulo's Metropolitan area: environmental protection and poverty alleviation. Contribution in the IRSA XI World Congress Rural Sociology, Trondheim, Norway,July 25th-30th http://www.irsa-world.org/XI/papers/index.html

5.6.2 *Seminars and conferences without proceedings*

Seminar held at PUC/Campinas. Environmental Sustainability and the water issue. Presentation: Estado e Sociedade – repensando as Políticas Públicas (State and Society – rethinking public policies) – Dec/ 04

Seminar held at UNICAMP/ Engenharia Ambiental – The Negowat project and the possibilities of researching and interfering in the management of water and land. Dec/ 04

BARBAN, V. Participation in "First International Conference – Governance and environmental sustainability – The water question, carried out by Senac São Paulo, from 19 to 21 August / 2005. Book launch – Managing water as if it was important: environmental management and sustainability. São Paulo: Senac São Paulo, 2005. (with Vilma Barban's article)

5.6.3 *Books contribution*

BARBAN, V. 2004. La extrema pobreza ... ¿cómo enfrentarla? In Barrera A. G.(ed) La Era Urbana. Programa de Gestión Urbana - Coordinación Regional para América Latina y El Caribe- PGU-ALC, p.19. (Edición Especial: Pobreza y Exclusión en las ciudades., Marzo 2004).

BARBAN, V. 2005. *Entre o legal e o real – a necessidade de informação para a participação cidadã.* Em Dowbor, L. e Tagnin, R.A. (org). *Administrando a água como se fosse importante: gestão ambiental e sustentabilidade.* São Paulo: Ed. Senac São Paulo.

5.6.4 *Reports and students' thesis*

○ *Students thesis*

TEIXEIRA, Luiz Sertório. A água e o desenvolvimento metropolitano da capital paulista – vetor sul. Trabalho de Graduação individual, apresentado à FFLCH-Depto.Geografia. 2005.

ROJOT, Camille. Elaboração de jogo de papéis: JOGOPOL. Relatório de estagio. Instituto Pólis – Projeto NEGOWAT, Julho 2005 – Dezembro 2005, (Student at INA-PG Agronomic National Institute - Paris Grignon)

a) Negowat workpackage report

BARBAN,V., SERTÓRIO, L., COSTA, C. 2004. *Atores Sociais e conflitos em torno da gestão e uso da água e do solo nas Bacias Hidrográficas Guarapiranga e Tietê-Cabeceiras.* In:WP 3 Report - Negowat Project. www.negowat.org.br

5.7 Conclusion

We believe the Negowat Project was able to reach the objectives proposed. The approach of a systemic, multidisciplinary study, together with the contributions of different specialties, the project's focus on conflicts and negotiation, and the effort to build a vision of reality shared with the social actors introduces a more comprehensive look over the reality studied. It also opens new methodological and analytical perspectives. It has been an intense process in which we have all learned a lot.

Future actions are: a deepening into the issues developed during the project, including the multiplication of the social actors' capacity-building program for participation, and the definition of more adequate management ways to be used on challenges as big as the ones existing in spring areas of great metropolis like São Paulo.

▪ Management aspects

We believe the Project was well managed and had the cooperation of all participants. The exchange with the Bolivia partners has created a comparative understanding between similar yet specific situations, and a lot of learning.

▪ Appendices:

1- Report about the Workshops with Local Actors: TER'ÁGUAS PROCESS: Capacity-building for local actors to negotiate local development actions in preserved peri-urban areas.

INCO - DEV : International Cooperation with Developing Countries (1998 - 2002)

Contract number: ICA4-CT-2002-10061

Facilitating Negotiations Over Land And Water Conflicts In Latin- American Peri-Urban Upstream Catchment: Combining Agent-Based Modelling With Role Playing Game

NEGOWAT PROJECT
FINAL REPORT
PARTNER N°: 8 UNIVERSIDADE ESTADUAL DE CAMPINAS/UNICAMP

Bastiaan Philip Reydon

October 2006

6 UNICAMP FINAL SCIENTIFIC REPORT (2006)

6.1 Objectives

(i) to characterize the variability and dynamics of land rights and markets in the catchments studied taking into account: relationships with water, the urban and rural area, (ii) to identify constraints and opportunities for transformation of land market patterns related to rural, urban or environmental policies (implemented or in discussion). (iii) to identify and discuss the possible effects of regulation mechanism (taxes, municipal planning) on land markets in the catchments.

6.2 Activities

Task 1: Training on agent - based modelling *(WP 1.1 in technical annex)*

Objectives: **(i)** Training the consortium partners on the use of agent-based modeling for natural resources management, in order to allow them to understand the possible use potentiality and constraints of this type of modeling and to discuss the creation of the model with the modelers

Methods: (1) Organization and implementation of a training session on the Cormas software and on the use of agent-based modeling and natural resources management by CIRAD (partner 1). The training was focused on land and water management and was adapted to type of public (non specialized scientist). However, it was sufficiently specific to allow the scientists to understand constraints and potential of this type of modeling and the software to be used. During the training, a first version of the 3 preliminary models was developed by the trainees.

Results (partials or finals): The partners have received training documents and a CD with practical work developed during the training session 1.

Difficulties and problems: The training session 1 was an introduction of agent-based modeling and natural resources management, using Cormas software (Multi-Agent Simulator developed by Partner 1).

Task 2: Bibliography Survey ***(WP 1.2 in technical annex)***

Objectives : (i) assess for each city/catchment the available data, information and tools (data base, GIS, models, typology) for land rights and markets.

Methods: This survey was made through expert interview and literature review.

State of advancement: The survey was finished in June of 2003.

Results (finals): Report including the thematic bibliographic survey.

Difficulties and problems: It was difficult to find literature of illegal urban land markets.

Task 3: Dynamics of land rights/land markets (WP 3.3 in technical annex)

The area of study of this report is the Basin of Parelheiros that is a peri-urban region of the city of São Paulo. The main sources of the study are the 71 processes of illegal human settlements registered at the Mayors Office. The illegal settlements that have processes are the ones with more than 200,000 m^2. The urban land market analysis methodology was based on:

- analyses of economic, social, institutional and territorial processes at the Mayors Office of Parelheiros that possess historical information;
- interviews with legal and illegal real estate traders, local associations and technical advisors of the Mayors Office.

The document research and the interviews made clear that the main process of urbanization of the peri-urban areas is through the illegal land markets. Real state agents and the local population make this through the illegal markets of urban land. Another important aspect of the research was to

understand the legal institutional arrangement that the illegal real state agents adopted to infringe the law and to transform legal agricultural land in to illegal urban human settlements.

6.3 Main results and outcomes:

The participation of the Institute of Economy of the UNICAMP in the project NEGOWAT was related with thematic of the use of land for human illegal settlements and the impact in the quality of the catchments for the water supply for the metropolitan region of São Paulo. The central subject was the transformation of agricultural land in to urban plots of land for low-income population. The main conclusions can be so summarized:

- The growth of the urbanization in the metropolitan area of the city of São Paulo, affecting the catchments occurs in 2 distinct forms:

1. the rural plot is divided into smaller plots by the owner and he is responsible for the illegal settlement.
2. the rural plot is divided into smaller plots by an enterprise with lawyers, politicians, financiers and investors.

- The main characteristic of the illegal real estate market: it is a market of plots and not of houses. This fact indicates that the region is still not consolidated and with increasing demand for plots. The prices of the plots in this areas oscillates between R$ 3.000,00 to the R$15.000,00, depending of the characteristics of the plot and quality of the illegal settlement. The square meter price at the illegal settlements of Park Aruã and Jardim Almeida are between R$ 60,00 the R$ 120,00, very near to prices of legal urban settlements. This fact shows that illegal settlements for low-income population of the catchments interfere directly on the land prices of the metropolitan areas of São Paulo. The case studies had also allowed verifying the specific logic of the incorporation of the land divisions and the valuation of the rural areas in the metropolitan region of São Paulo.
- The growth of prices of the plots will depend on the organization of the settlement based on the formal laws of use and occupation of urban land. In this aspect, the role played by the organizer of settlement and its relations with other actors is very important in this reality of no clear laws and enforcement mechanisms.
- The data obtained show that the increase of the prices through the transformation of agricultural land into illegal urban settlements is a very profitable enterprise. This increase is mostly is of more than 60 times, being able to arrive, in certain economic conjunctures, to more than 200 times. This number represents the profits with the speculation of the land obtained by the illegal real state and others members of this organization of interests.
- The gain from the increase of prices after its urbanization was also quite high between 1996 and 2003: between 100% 460%. The case studies on the negotiation of land in the areas of catchments showed that the main factor that makes the LPM fragile is that it does not contain the urban occupations and the speculation with land.
- A trend of the public sector in regularizing the illegal urban settlements exists, guaranteeing the heading of the property and improving its environment through infrastructure installation: water, sewer, asphalt and electric energy. The laws and the public policies point out in this direction: the Managing Plan contemplates areas with zoning of popular interest, adjusting the areas of the plots; a new law of protection of the sources is sufficiently flexible possessing legal instruments for the regularization; the government of the State of São Paulo approved one policy of infrastructure installation (asphalt, water, sewer and electric energy) with the official agencies.

6.4 Difficulties and problems

There was the necessity to interview some actors to perceive the reality of the facts. Many interviewed lied or they did not want to answer the questions. One another aspect mentioned high violence of the areas of the field study.

6.5 Publication and papers

6.5.1 Publication in refereed journal

DUCROT, Raphaelle, BUENO Ana K. e REYDON, Bastiaan, 2005. Institutional Arrangements Articulating Land And Water Management In Peri-Urban Catchment: Example Of The Metropolitan Region Of São Paulo, **International Journal of Water Resources Development**. Vol 3, N. 2. pp.186-203.

6.5.2 Seminar and conferences

a) Summary with proceedings

BUENO, Ana Karina; REYDON, Bastiaan. As áreas de proteção dos mananciais e o mercado imobiliário informal: um estudo sobre os loteamentos clandestinos na bacia do Guarapiranga. **II Encontro da Associação de Pós Graduação e Pesquisa em Ambiente e Sociedade** (ANPPAS). Jundiaí, 26 a 29 de maio de 2004.

b) Books contribution

BUENO, A.K.S., REYDON, B.P.(2006). Os loteamentos clandestinos e as áreas de mananciais: um estudo sobre a lei de proteção aos mananciais e a especulação imobiliária. *In: Mercados de Terras no Brasil: estrutura e dinâmica. REYDON, B.P., CORNÉLIO, F.N.M., Brasília (Brasil), NEAD, p389-418.*

c) Reports and student thesis

c.1) Student thesis

BUENO, AKS (2004). A Lei de Proteção aos Mananciais e Mercados de Terras: um estudo sobre os loteamentos clandestinos. Máster in Economic Sciences. Universidade Estadual de Campinas, Brasil, 187p.

6.6 Conclusion

This could be divided in two main groups of results:

a. There is now a clear vision of how the process of illegal settlements works: the agents, the interests and the results. The process occurs mostly because of two reasons: the lack of habitations and the possibility of high gains in the land markets;

b. The solution for those kind of cases cannot be of strict laws and legal arrangements, they are not enforced. The solutions have to deal occur in win-win arrangements, where the agents and the environment can improve their situation. So, settlements have to be made taking in account the possibility of speculative gains for the real state sector and environment gains with protected areas.

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Facilitating Negotiations Over Land And Water Conflicts In Latin- American Peri-Urban Upstream Catchment: Combining Agent-Based Modelling With Role Playing Game

NEGOWAT Project
Final Report
Partner n° 8 and 9 : UMSS and CERES

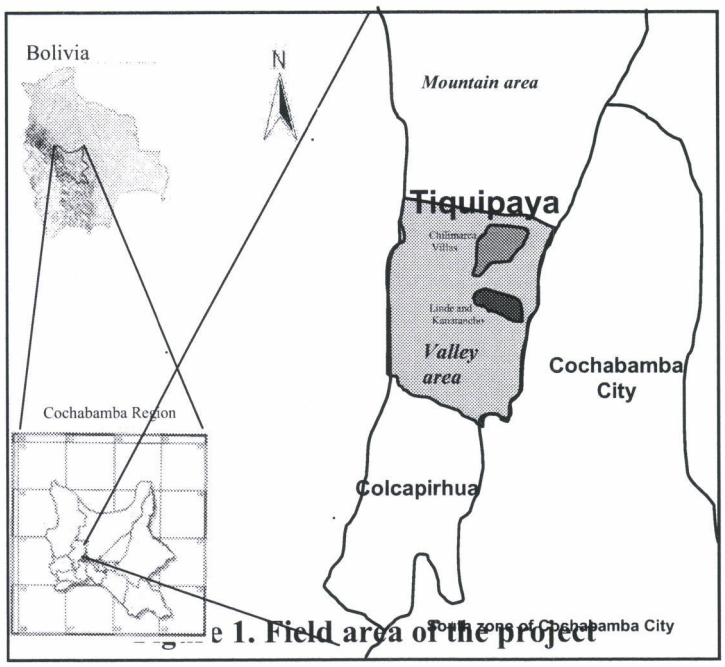
Alfredo Duran, Pablo Cuba, Nicolas Faysse

October 2006

7 BOLIVIA (UMSS and CERES) FINAL SCIENTIFIC REPORT (2006)

7.1 Objectives

The Negowat project in Bolivia aimed at organizing action research to design and test methods to support conflict resolution and strengthen local organizations, in relation to land and water use in peri-urban areas. The project had a specific methodological objective of testing Role Playing Games and Multi-Agent Systems, as tools to support discussion and negotiation over land and water use. The project focused its activities in the valley area in Tiquipaya Municipality (see Figure 1).



e 1. Field area of the project

7.2 Activities

Work Package 1: Prepare Modelling Work

Five researchers from Centro AGUA and one from CERES attented a course in 2003 in Sao Paulo on multi-agent modelling. A map of land use evolution from 1983 to 2003 was made on Tiquipaya peri-urban area.

Work Package 2: Model design and development

An initial theoretical model was designed, as well as a joint role playing game. However, it was later decided to focus on more specific processes (see work package 4).

Work Package 3: Conduct Thematic Field Research

A series of thematic field research was undertaken. Land use change was evaluated, through a comparison of land use in 1983, 1993 and 2003 showing how urbanization has advanced. This also showed that farming activities were becoming –paradoxically- less intensive in most of the studied area (Rocha and Iriarte, 2006). An analysis of land markets revealed a very active land market (1280 cases registered in the Municipality between 1997 and 2003). It also appeared that the decrease in land prices from 30 USD in 1998 to 23 USD in 2003 was due to an ever increasing offer of land from farmers willing to sell up in relation to a largely stagnant demand (Lizarraga, 2006).

In relation to water management, an initial study assessed the performance of the existing water committees, which until then had been unstudied (Van der Meer et al., 2004, Bustamante et al., 2005). Another study focused on multiple uses of water, and showed that households often use the diverse

sources of water they have (irrigation water, wells, springs, piped water supply) for multiple uses such as irrigation, gardening, and keeping livestock, as well as more typical domestic uses (Duran, 2005). Finally, wastewater re-use was investigated because untreated sewage is used as an important source of water and nutrients by some farmers (Ampuero and van Rooijen, 2006). This showed a complete lack of monitoring of this activity which is associated with serious health hazards.

Work Package 4: Development and Test of the Discussion Methodology

At first, the Negowat team wanted to organize an overarching dialogue or multi-stakeholder platform on development in Tiquipaya Municipality with specific reference to urbanization and water resource management. However, at the beginning of 2004, the Negowat team realised that it would be very difficult to generally 'improve' management of water and urbanization. A first constraint was that some stakeholders (irrigators) were not interested in opening up a dialogue over water resource management, and they had the capacity to block any initiative in this regard. Second, it became clear that the urbanization process itself was very difficult to control (as enforcement of land use plans established by the Municipality was a tough task) and that there was no real willingness from the municipality to try to control it anyway. Overall, this underscored the difference that can exist between the necessity to tackle an issue from an external point of view (for instance water used by irrigators is not well-managed and often spills over on the streets, meanwhile some water committees face water shortages) and the possibilities to do it, given local stakeholders' strategies.

Once it appeared that the initial idea could not be implemented, and after a general diagnostic phase had provided a general baseline of land and water issues in Tiquipaya (Work Package 3), an identification and characterization of competition and conflictive issues were carried out. This identified negotiation processes that were either existing, scheduled or possible, and that the Negowat team could usefully support.

As a result of this analysis, three processes were selected for support: i) a technical roundtable about a planned water and sanitation project; ii) improving drinking water committee management; and iii) addressing the impacts of urbanization over irrigation canals. The first intervention process was an opportunity that appeared just after the priorization process, as a product of the demand of some stakeholders for the socialization of the project, and the willingness of the Vice Ministry of basic services to pay attention to this socialization process. The second one came from the initial diagnostic made with the drinking water committees, and from the assessment that these committees were completely invisible to local and national institutions, with no support received in practice. The last process came up progressively after a short study made during the diagnostic phase, which underlined the strong potential for discussion between irrigators and urban dwellers regarding local canal use.

In Tiquipaya, there was no institutionalized space to address these water and land issues, so the Negowat team had to design from scratch the three processes. This was a very different situation to Brasil where the project activities revolved around the existing River Basin Committees. An advantage of the Bolivian case was that it was possible to organize in a coherent way the whole facilitation process, especially in terms of choosing where to insert the role playing game sessions (one of the methodological objectives). Another advantage was that the Negowat team was to a certain extent able to control the rhythm of the process. The main drawback is that the processes were not institutionalized, which led to subsequent problems of implementation of agreements after Negowat ended its activities.

The interventions were designed from a Habermasian perspective, where win-win solutions were thought possible and sought[1]. Power relationships were not given a specific focus. It would have been possible to take a more political and conflict-sensitive approach. For instance, it would have been possible to work on the issue of water resource control between communities in the upper part of Tiquipaya and the irrigation farmers in the Valley area or the issue of competition over water in the valley between irrigation farmers and drinking water users. These themes are of great importance in Bolivia, but firstly, addressing these themes would have entailed not using a strategic empowerment approach rather than a multi-stakeholder platform as originally planned. Second, the demand of local

[1] Habermas theory of communicative ethics is the theoretical basis often used by those who see lack of genuine communication as the main stumbling block to efficient negotiation processes.

actors to seek a facilitation process on these themes, which until now have not led to open conflicts, was not clear.

Initially, there was a well-defined focus on the twin use of two specific tools for modelling and communicating resource management options: Multi-Agent Systems and Role Playing Games. Previous research had shown the value of this pairing of tools to address natural resource management problems. However, in the three organized facilitation processes, there was no real need to represent the dynamics of natural resource availability and use, and therefore it did not appear necessary to have a computer-based representation of the local reality. Consequently, after initial testing, Multi-Agents Systems were not used. The project finally focused on the use and evaluation of Multi Stakeholder Platforms (MSPs) and Role Playing Games. MSP approaches were tested in the case of the Technical Roundtable and the process on managing impacts of urbanization on irrigation canals, while role playing games were tested in the urbanisation and irrigation canal work as well as in the support to drinking water committees.

7.2.1 A technical roundtable to discuss a water and sanitation project

Given the rapid increase in population, Tiquipaya together with the neighbouring Municipality of Colcapirhua decided in 2001 to develop a US$4-million water and sanitation infrastructure project called MACOTI. A new sewerage network would collect household wastewater and a water supply network would distribute treated water to the inhabitants. The project was funded through a loan from the National Fund for Rural Development (FNDR), which itself secured a loan from the Inter American Development Bank. In 2003, as the project moved towards implementation, MACOTI began to be heavily criticized by many drinking water committees. They were concerned that: (i) the project plans were not well communicated to the public and there were suspicions of corruption; (ii) the 25-year duration of the loan seemed too long and the interest rate too high; (iii) and the two municipalities were initially planning to take over the assets and the management of the drinking water committees' infrastructure, in a compulsory way and moreover without any compensation. The local association of irrigation farmers, ASIRITIC, also opposed to the project for similar reasons and because they felt that the project would speed up the urbanization process. This in turn would lead to a further decline in the agricultural character of the area and would potentially threaten their control over the upstream lakes, to supply water for the water and sanitation system.

These tensions led to a series of conflicts in 2003, with the Army called to intervene at one stage of the conflict. As a consequence, the Mayor of Tiquipaya was forced to resign and one group of communities that were part of the project, called the Chillimarca Villas, walked out of the project to set up their own alternative and more decentralised sanitation project. The Vice-Minister of Basic Services sought a negotiated solution to the conflict and in June 2004, during workshops with the opponents of the project, he proposed to organize a Technical Roundtable (*mesa técnica* in Spanish) in Tiquipaya to undertake an in-depth review of the project and to try and reach agreement on the way forward. The Negowat team proposed to help facilitate this process, and this was welcomed the Vice-Ministry, the Tiquipaya Municipality and local organizations as the team was part of the local University, which was considered having no financial or political stake in the MACOTI project.

The m*esa técnica* was implemented during the second semester of 2004. The official aim of the *mesa técnica* was to raise awareness, analyse and provide a discussion space for the MACOTI project in order to reach a negotiated agreement and a common vision of the project between participants and propose changes to improve it. Five two-day sessions were implemented that in turn tackled the technical, financial and institutional aspects of the project. The *mesa técnica* was designed based upon a methodology to design and evaluate an MSP elaborated by the Negowat team. The methodology lists key points to address during the ex-ante analysis, design, implementation and ex post evaluation of the platform (Faysse et al., 2005).

It took two months to obtain an agreement between local stakeholders regarding the formal composition of the *mesa técnica*. Both supporters and critics of the project initially objected the participation of the other side. Eventually, it was agreed that the participants in the *mesa técnica* would be the stakeholder groups directly involved with the MACOTI project and its consequences, i.e., the

Tiquipaya Municipality, the Vice-Ministry of Basic Services, the OTBs[1] and the drinking water committees located in the valley part of Tiquipaya, and the ASIRITIC irrigation farmers association. Other MACOTI stakeholders such as FNDR or the constructing and supervising contracting companies participated also in some sessions. Though the project includes Tiquipaya and Colcapirhua municipalities, it was decided that there were already many conflicts in Tiquipaya, and that adding those in Colcapirhua would lead to an unmanageable roundtable. After the *mesa técnica* had started, participants agreed that anybody could participate as long as (s)he would bring constructive elements to the discussion.

Several recommendations on improvements to the project were reached by consensus on the technical and financial components of the project. From the institutional discussions, two models were developed. The majority of the participants supported the design of a federation of the existing drinking water committees to manage the MACOTI project. A minority preferred to have a cooperative belonging to all water and sanitation end users, with no direct participation of the drinking water committees.

However, in 2005 and 2006, these conclusions of the *mesa técnica* were neither implemented nor officially rejected. A new municipal government was elected shortly after the last session of the *mesa técnica*, and the new municipal team did not feel bound to implement the motions approved during the roundtable. The main reason for this is that the *mesa técnica* did not give clear recommendations on the technical part, gave some for the financial one, and only for the institutional part really achieved clear proposals. On the other hand, in 2005, the MACOTI project faced technical problems and significant delays in its execution because of disagreements between the two municipalities, the banks providing the credit and the constructing and supervising companies. Second, the new team in the Municipality prioritized the execution of the project and postponed any discussion regarding the payment of the debt and the institutional design to after the project had started running. In particular, while there had been in-depth discussions about how to manage the burden of the debt during the *mesa técnica*, this new municipal team preferred to put the theme aside, and wait for the project to be completed before lobbying the government to have the debt cancelled. Finally, by mid-2006, the key institutional component that will be critical to operation of the system had not yet been considered. Because recommendations of the *mesa técnica* were largely ignored, several participants formed the opinion that it had turned out to be a mere simulacrum of participation and a smoke screen to calm the conflict and keep social actors busy talking while following the original plan.

The *mesa técnica* was built on Habermasian principles that all stakeholders should participate: "no party affected by what is being discussed should be excluded from the discourse". However, while power might have been reasonably fairly balanced between local actors, other important decision-makers such as the FNDR or the construction and supervision companies clearly had a different kind of power that enabled them to remain uninvolved in the debate. A more strategic approach that would have taken into account these power relationships would probably have been needed to ensure genuine incorporation of these stakeholders in the negotiation. For instance, the Negowat team may have linked its participation as a Facilitator to a halt in the project construction.

A major weakness was that the *mesa técnica* was set up when the project was already at the beginning of its implementation stage, when the design had already been completed and where there was limited scope for change. Moreover, participants' lack of knowledge to understand and critique the technical components of the project limited their ability to come up with significant proposals for change on these issues. For instance, they could not question the diameter of the planned tubes (nor could the Facilitators), though later in 2005 it appeared that several of the calculations had been wrong. Surely, though there were initial expectations from participants of a complete review of the project, one could have forecast from the outset this lack of technical expertise. In 2005, after the completion of the *mesa técnica*, a monitoring committee was elected to follow-up the project. This committee initially planned to undergo a detailed revision of the technical design, but then they evaluated that it was out of the reach of a committee working on a voluntary basis, and that it would be much better to ensure enforcement of the supervision company contractual obligation to evaluate the project. However, the

[1] In Bolivia, Base Territorial Organizations (OTBs) were defined by the 1994 People Participation Law as the formal representation unit at community level. According to this law also, the government provides a given budget to each municipality.

Municipality did not follow the committee's advice to take a stronger stand with this supervision company. This experience shows that in 2004, during the *mesa* técnica, the technical evaluation issue could have better revolved around question of power: instead of undergoing a costly evaluation of the project, the issue could have been how to make sure that the supervision company would comply with its contractual obligation to evaluate the technical design of the project. Finally, a last weakness of the *mesa técnica* was that the municipality saw this process much more as a way to ease tensions than as a real opportunity to improve the project.

However, the *mesa técnica* did manage to move the debate in Tiquipaya from general judgments, and even insults, between local leaders and other representatives to much more detailed and positive discussions on the different aspects of the project. Local leaders gained the capacity to understand different components of the project, and two proposals for an institutional model for the entity to be in charge of operating the water and sewerage system were formulated.

The cost of implementation of the technical roundtable was approximately USD20,000 all included. This amounts to 0,6% of the total costs of the MACOTI project. Though the actual *mesa técnica* proved to be a mix of successes and failures, that justifies that this process could have been planned during the design stage of the project. In the MACOTI project (as well as in many similar projects), the priority for the engineers that designed the project and local authorities, had been to come up with a complete design as soon as possible, as deadlines for getting a loan from the Inter American Development Bank were tight and they judged that any discussion with social actors would lead to an useless loss of time (and a useless sharing of the decision-making). The paradox is that local governments will be interested in organizing public discussion about a project only when a conflict seems unavoidable...which may be too late a moment for a fruitful involvement of the public, as it appeared in the experience of the *mesa técnica.*

7.2.2 Capacity building of community-managed water supply systems

It is estimated that around 500 community-based drinking water committees are supplying water to approximately 500,000 inhabitants in the whole metropolitan area of Cochabamba. These drinking water committees function in an autonomous way. In Tiquipaya, the 37 existing committees have on average 200 families. 80% of these committees pump groundwater, the others get water either from rivers or from a drain in riverbeds. Half of them provide water 24 hours a day. However, water analyses from the MACOTI project found that 18 out of 52 samples from boreholes, tanks and taps were contaminated with total coliforms and only one of the 37 committees purifies the water produced. These committees charge a relatively low fee of 0,1 USD/m3 (interestingly almost all the water committees that use boreholes have installed and use water meters on their own initiative). However, the entrance fee is rather high, on average 300 USD/m3 (Van der Meer et al., 2004). Half of committees do not have any legal status and their water supply activity is not recognized by the national or local government.

In the Southern zone of Cochabamba, where the poorest inhabitants of the city live, water is generally delivered by private water tanker-trucks and bought by individual households at a very high price (2,5 USD/m3). Moreover, consumers are not guaranteed quality, since tankers get water from springs with no quality control from neither the source nor the truck tank. Some communities have as a result invested in local networks, that are still filled by the same private trucks but enabling water to be bought at a better bulk price of 1,2 USD/m3.

In the peri-urban area of Cochabamba, these committees have managed to provide a continuous service for many years especially in the areas with better groundwater availability. However, many of them face different types of problems, technical, economic, and organizational. Generally, consumers accept only to pay a low tariff that just covers for the operation costs. In the Tiquipaya area, it is because of a lack of trust in the management of the committee, while in the South zone of Cochabamba, it stems from the very high price of water compared to household incomes. As a

consequence, after years of functioning, most of the committees do not manage to enter into a spiral of improvement of the quality of service, the management and the sustainability of the whole system.[1]

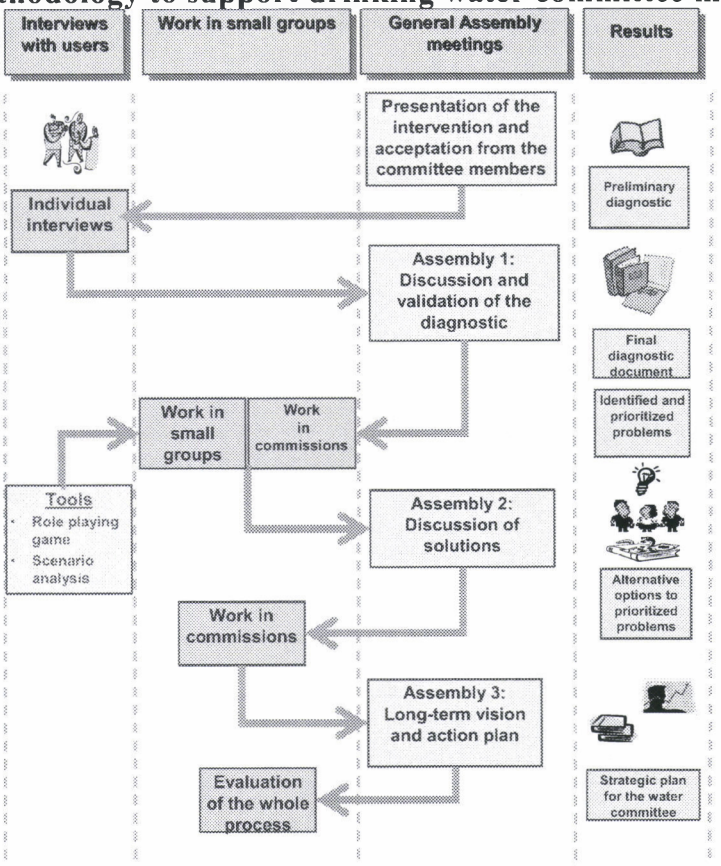
In Bolivia, much work has been achieved to design and implement methodologies for supporting drinking water committees in rural areas (Quiroz, 2006). However, there is a marked absence of such methodologies for supporting peri-urban committees which are very different from rural (and urban) systems. Compared to rural systems they are technically more complex, involve operation costs and tariffs that are generally 5 to 10 times higher, and users often have more formal education. To fill this gap the Negowat team worked to develop and test a methodology to strengthen the management of the community-driven drinking water committees in peri-urban areas (Ampuero et al., 2006). Four pilot communities were supported: two in Tiquipaya that have their own groundwater resources, and two committees in the Southern Zone that are supplied by private trucks.

The methodology aimed to improve the management capacity of the management team and of grassroots users. To achieve this, it created a space for discussion and followed a participatory approach to find locally-specific solutions to the problems faced by the committees. Many grassroots members participated in an active and informed way. The Negowat project was a research project, which made it impossible to invest into infrastructures, but this actually proved a useful constraint since it helped to encourage a focus on the critical management issues.

The methodology developed is based on a rather classical sequence of activities at different levels: interviews with individual members, work in small groups, and formal general assemblies involving all committee members (Figure 3). The interventions were divided into three phases. First, an analysis of the system was undertaken involving identification of problems through individual interviews of persons from the different zones and sub-groups of the community (e.g., women). Then, a prioritisation of the problems was made during a general assembly (with anonymous voting procedure in one of the committees). Second, for each of the prioritized problems, a small group was identified and designated to discuss alternatives or solutions with the support of the Negowat team. Finally, in general assembly meetings, options were selected and key decisions taken (Figure 3). The methodology scheduled a final step involving the definition of a long-term vision and an action plan, but because of slow implementation of the whole process, this step was actually not implemented.

[1] In Bolivia, the figure for larger scale systems is actually as diverse as for the small-scale water committees. On the one hand, the Cochabamba City municipal company has not proved able either to enter into such a virtuous circle. On the other hand, medium-scale entities such as the Montero cooperative in the Eastern part of the country have managed to reach satisfying management.

Figure 3. The methodology to support drinking water committee management



Tested tools

Two tools were used as part of the awareness raising and training in order to help communicate the issues and encourage participants to find better solutions than had been tried in the past. In this case these were role playing game and scenario analysis. Both methods were used during the group sessions after the diagnostic phase and in parallel with the commissions. The first tested tool was a role-playing game called SosteniCAP (for Sustainability of Drinking Water Committees). It is a generic game that can be adapted to help raise awareness and discuss the problems faced by different committees (Faysse et al., 2006a). This game enabled to: i) build capacities of the members regarding the functioning of the committee (e.g. how the accounts of the committee were calculated); ii) create awareness on the problems faced by the committee such as debts or the tariff levels; iii) discuss problems in open atmosphere; and iv) ensure the participation of more marginalised community members, such as women, young people and seniors who generally do not express their opinions during formal general assembly meetings. The game was played six times overall in three of the four intervened committees with on average 13 participants per session.

In three of the intervened committees, scenario analysis was used with a group of committee members to identify possible future scenarios focusing on financial management of the committee. This work helped to inform a debate on possible changes in the tariff system. The main issue was generally to try to increase the tariff in order to be able to save every month, and to plan for future possible replacement costs.

However, no actual changes were made in the tariff structure for the following reason. Grassroots members are sceptical about paying more than the minimum required for operation and maintenance for fear of corruption and misuse of possible savings (especially since in the committees that do not have legal status, the bank account is under the name of a member of the management team). The most commonly used solution to this problem is to obtain a legal status for the committee and a specific bank account under the name of the committee. Management of this account will need various signatures, which will reduce opportunities for corruption. However, obtaining the legal status and opening the bank account ended up being a very long process, which was not achieved before the end of Negowat team's intervention.

The methodology made it possible to address a large range of problems faced by the committees. Although tariffs were not changed, other results that are visible in the short-term were obtained. Firstly, the two older committees in Tiquipaya valued very much the diagnostic document, as a milestone which would permit them to later measure their improvements in committee management. Second, an improved organizational model was also defined in these two committees, and through a participative but long process, by-laws were discussed and implemented. This made it possible for the committee to get legal status. Third, from the discussion based upon the scenario analysis, one committee expressed its interest in using computer software to facilitate the financial management. Such software was later developed based on the existing financial management undertaken in a drinking water cooperative of Colcapirhua.

The Negowat team also supported the committees in undertaking negotiations with organizations external to their organisation. Previous lobbying by the Cochabamba Region irrigation farmer organization had led to the creation of a specific tariff category for electrical pumps set up in wells for drinking water use. Tariff may be reduced between 50% and 70%. However, most of the committees in the peri-urban area of Cochabamba are not aware of this opportunity and of the required procedure to obtain this category. In one of the Tiquipaya committees, the change of the category was supported by the Negowat team and this enabled an important reduction of monthly operation costs. This decrease in operation costs enabled the committee to hire a manager. In the two systems in the South zone, the priority was to decrease water purchase costs. The Negowat team supported a negotiation between the committees, the Cochabamba City water company and private tanker operators so that contracted trucks could get treated water from the Cochabamba City network. As a result of these negotiations, water costs for the committees were reduced by 20% and the water became of safer quality.

In terms of less visible results, in one of the Tiquipaya committees, local church historical involvement in the management of the committee had led to internal tensions within the committee. New by-laws were discussed and voted, which did not make reference to the church anymore. These by-laws and the legal status enabled to restore the links between grassroots members and the institution "committee". Role playing games were used to build the skills of people that usually remain passive during formal meetings but who actively participated during the game sessions. However, such short game sessions are clearly insufficient to alone lead to visible changes in terms empowerment of weaker groups within the communities (e.g. women participation in discussion and decision-making in general assemblies or having women members in the management team). Finally, some members of the management team improved their ability to interact and negotiate with external organizations.

The approach used is especially relevant to systems that have been functioning for several years, since these committees tend to have more management problems than newer systems. A constraint of the support provided however is that it implies a long process that needs follow-up. Another limit found is that the benefits of such processes are not always clearly visible to the members, such as the implementation of new by-laws. In the communities where the Negowat team worked, these members were more used to short term interventions with rapid results, and with participation of grassroots members only being in terms of funding and collective work. Finally, the success of the intervention depends highly on the active participation of one or several legitimate representatives of the community, who become intermediaries between the facilitation team and the community.

7.2.3 Impacts of urbanisation on irrigation canals

Linde and Kanarancho are two communities in Tiquipaya where the water table is close to the surface and there are many springs. In this low lying area, flooding from raining events taking place upstream and from local springs is common. The local irrigation canal network has a double function. In the dry period (winter), the canals are used to convey irrigation water to the fields from both local springs and the mountain lakes. In the wet period (summer), the canals play an important role in local drainage. Though the canals are not large enough to evacuate peak flows during a rain event, they play a key role in ensuring correct drainage after the event, so that water does not remain days and even weeks stagnating in houses and fields. Local irrigation farmer associations operate and maintain the canal network.

The urbanization process is especially rapid in these two communities given their proximity to Cochabamba City. But development is not well planned. Many newcomers build their houses and garden walls without knowing local rules or patterns of drainage. As a consequence, they often block drainage or irrigation canals. Some properties span these watercourses and urban dwellers often do not maintain the canals crossing their properties, and even discharge sewage water, trash or green wastes into the canals. Sometimes canals were even moved or filled in. Around 20% of the canals present in the Line and Kanarancho communities face problems to the urbanization (Peñarrieta et al., 2006).

At the same time farmers have also been less motivated to keep on maintaining the canals due to a decline in the flow of springs. As a consequence, operation and maintenance of the canals became poor, leading to increasing problems to irrigate for the farmers, as well as increasing drainage problems for both new urban dwellers and farmers. In spite of this common problem, there was generally no communication between the two groups. The canals were seen by all community members as the property of the irrigation farmers and as an issue to be dealt with by them only.

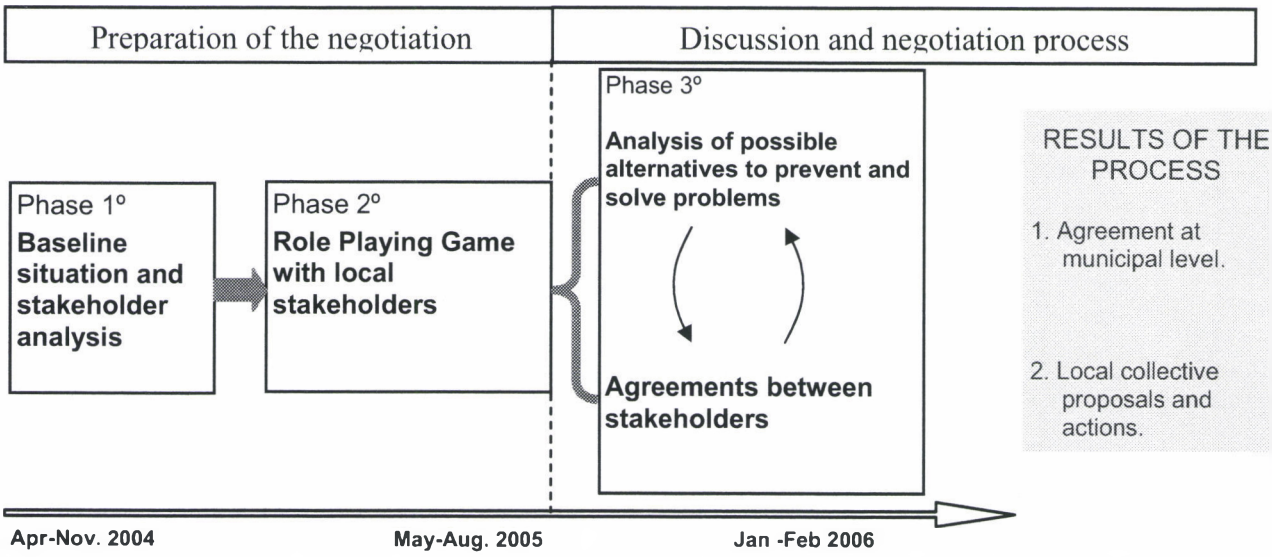
In that context, a facilitation process was organized (Peñarrieta et al., 2006). It was based on the idea that retaining functioning canals was of interest to both new urban dwellers and irrigation farmers. Thus, whatever the future pattern of land use, canals would still be needed, at least for their role in drainage. The process official goal was to "*motivate and facilitate a negotiation process at local level between farmers and urban dwellers to organize the common management of urbanization impacts over irrigation canals*". This objective entailed two main facilitation activities. The first one dealt with the preparation of the dialogue, in terms of getting the two groups closer, raising awareness and motivating the participation. The second objective was to facilitate a negotiation process, oriented towards the search of possible alternatives of solutions to prevent and solve the problems. Since this objective was a bit theoretical for local inhabitants, it was important to include and foster a more concrete goal, i.e., the design of small projects to protect and improve the canals in the communities.

The process met high interest from grassroots inhabitants, as during the previous rainy period (Nov. 2004 to Feb. 2005) important and long-standing inundations had taken place. The process was designed by the Negowat team, but leadership was assumed locally by the OTB in Kanarancho and the local irrigation association in Linde.

The intervention process was divided into 4 phases (Figure 4). First, an assessment of the communities was undertaken. The results enabled to reach a consensus locally regarding the urbanization process and its impacts. Moreover, the diagnostic enabled the Negowat team to know the area and the inhabitants (and them to get to know the team). The diagnostic phase was finally completed by a local stakeholder analysis to assess the possibilities of facilitating a negotiation process.

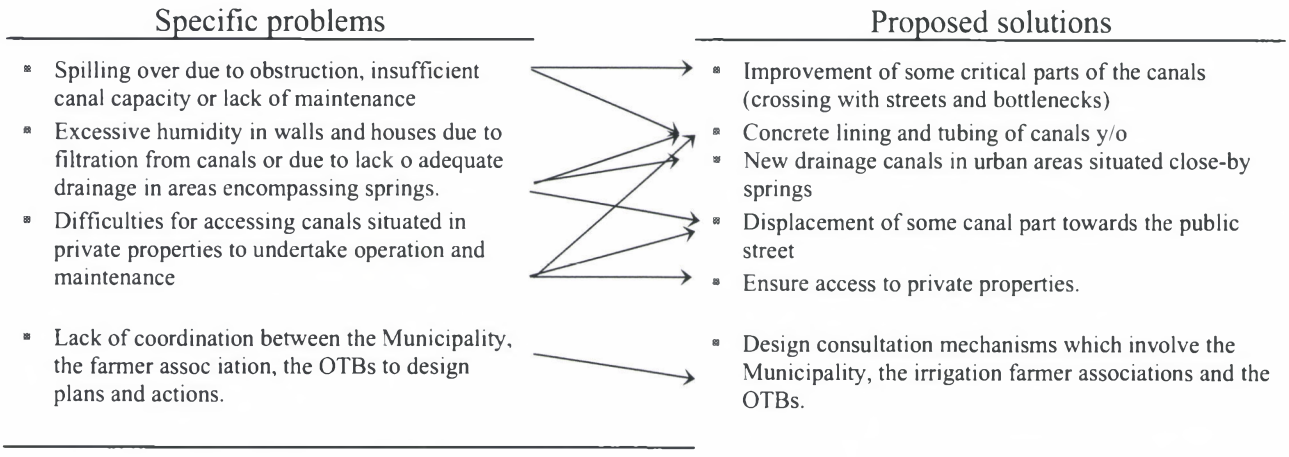
Secondly, a role playing game was played with residents. The game (called *Larq'asninchej*), aimed to help local inhabitants understand the issues associated with irrigation canals. Each of the two communities was divided into 4 areas, and a session of the role playing game was played in each of the defined zones (with on average 11 participants per session).

Figure 4. General structure of the facilitation process about urbanization impacts on irrigation canals



After the role playing game phase, the third discussion phase aimed to develop concrete proposals for: i) works to improve some trenches of canals; ii) agreements between stakeholders regarding the operation and maintenance of the canals. This phase was divided into three steps: i) identification of specific problems in the canal network and general ideas for solving them; ii) discussion of possible solutions, priorization and establishment of agreements; and iii) detailed design of prioritized solutions. Figure 5 shows some of identified problems and proposed solutions.

Figure 5. Some of the identified problems and proposed solutions



This process enabled the two stakeholder groups to come closer together. Their vision was really changed from one of mono-use to another of multiple uses of the canals. The Mayor started using the vocabulary of "multiple use" of the canals. Moreover, an agreement was signed between the local community, the Tiquipaya irrigation farmer association, and the Tiquipaya Municipality to formalize the use of some canals as part of a general drainage system: During high peak flows, irrigation canals would be used to drain out rain water that comes from an upper urbanized zone and remains usually stuck in Kanarancho. The agreement provided also that the Municipality would help in the maintenance of these canals. Some works to improve the canals were also discussed and accepted, and the Municipality had started to implement them in 2006. However, six months after the agreement was signed, the works to do the connection were not made, as the theme had gone down on the Municipality's agenda. This shows that the main weakness of this process stands in the lack of capacity of local institutions. Local community-based OTBs, farmers associations and the Tiquipaya

Municipality are fairly weak, and many agreements and agreed works may not be implemented because of a lack of a leading institution to ensure follow-up.

Work Package 5: Validate Method and prepare diffusion

In 2006, the final phase of the project focused on dissemination of results through different types of publications and activities and academic training based on the project experiences. First, the findings were used to organize a specific course within the University at Centro AGUA. This course was organized around three modules: i) the diagnostic of a peri-urban area; ii) methodologies and tools to support negotiation processes; iii) role playing games[1]. Second, a large range of publications were produced for different public targets (Box 1).

Apart from the results in the communities where the processes were implemented, dissemination of the experiences was organized with a view to encouraging scaled up implementation. The Negowat experience about the impacts of urbanization on irrigation canals was presented in a regional workshop that was attended by various irrigation farmer associations of the Cochabamba Valley. Regarding the support to community-based drinking water committees, the scaling up was done more at a professional level, with the edition of a book that recollected experiences of support in drinking water committees' management for 10 institutions from Bolivia and Colombia.

As part of the dissemination process of the Negowat experiences, a workshop in La Paz was organised, sponsored by the French Embassy, and with the participation of authorities from the Water Ministry and othe institutions, in which the publications and other material was provided to the participants.

Later, another workshop aimed to discuss the outcomes of the Negowat project, took place at UMSS, with the participation of most of the main institutions which work in the Cochabamba department.

Box 1. Targeted publications for various publics

Publications for a broader public
Three cartoon based books to raise awareness about the problems related to land and water issues in Tiquipaya. They address: the urbanization process; the drinking water committees in Tiquipaya; and the MACOTI project and related problems.
Publications for drinking water committee management team
Three cartoon based books to help strengthen the internal management of committees, which address respectively: the legal issues and especially how to obtain a legal status; how to design a tariff structure; and how to manage the accounts of the committee.
Publications for NGOs and professional institutions
A guide to design role-playing games (Peñarrieta and Faysse, 2006).
A book recollecting experiences of support the management of drinking water committees in Bolivia and Colombia (Quiroz et al. 2006).
Publications in scientific and professional journals
An assessment of existing drinking water committees in peri-urban areas of Latin America (Courivaux et al., 2006).
An assessment of the potential and limits of multi-stakeholder platforms (Faysse et al., 2006b; Faysse, 2006).

7.3 Main results and outcomes:

In terms of local impacts, the project improved the management of irrigation and drainage in the Linde and Kanarancho communities. Internal management of four drinking water committees was improved. Local stakeholders underlined the changes in visions and their increased local management capacities.

[1] Training materials as well as most of the publications can be downloaded from www.negowat.org

This is an important success, since usually stakeholders tend to value only tangible results such as built infrastructure. A local leader of a drinking water committee testified that "Negowat helped us being more unified"; other irrigation farmer association leader said that "Negowat helped us open the eyes". At national scale, awareness was raised about the existence and functioning of drinking water committees in peri-urban areas.

In terms of the scientific work, the aim was to develop and test tools for supporting negotiations about access to land and water in peri-urban areas, and in that regard clear results were obtained. In particular, detailed evaluation of the potentials and limits of multi stakeholder platforms and role playing games was undertaken.

An important outcome of the Negowat project, has been the building of capacities to propose new action-research projects with similar characteristics, like the Alpha project funded by the European Union, in which participates UMSS as well as several former partners of the Negowat project. Also other projects, like the URSI project, have been submitted with good outcomes.

On the other hand, the Negowat experiences show the need to re-design several modules within the UMSS Postgraduate programme "Integrated Water Resources Management", in which both approaches and methodologies are becoming part of the new Curriculum.

Finally, a negotiated approach is currently seen by several stakeholders as the best way to take over both water management and land use planning conflicts. The learning process and experiences from the Negowat project are being rooted in several institutions, and there are increasing demands on capacity-building and methodologies for such negotiations.

7.4 Difficulties and problems

The main difficulty the project faced was the adaptation of the initial framework to the local conditions of Tiquipaya, especially the way negotiation processes could be supported.

CERES periodic turnover of staff involved in the project weakened its participation throughout the project.

7.5 "Technology" implementation plan

The knowledge acquired during the Negowat project was inserted into Centro AGUA's teaching courses.

7.6 Publication and papers

7.6.1 Seminar and conferences

a) Without proceedings

AMPUERO, R. FAYSSE, N., QUIROZ, F. 2005. *Metodologia de apoyo a Comités de Agua Potable*. Paper presented at the seminar Agua 2005, CINARA, Cali, November 2nd – 4th, 2005.

b) Complete with proceedings

COSSIO, V. 2005. Use of a methodology to support the design of a short-term multi-stakeholder platform in a water and sanitation project in Tiquipaya (Bolivia). Contribution in the Stockholm World Water week, Sweden, 21-27 August 2005.

DURÁN, A. 2005. Lineamientos de una política de concertación para la gestión multisectorial del agua en los Andes. Contribution in the conference "encuentro por una nueva cultura del agua en América Latina", Fortaleza, Ceara, Brasil, 5-9 December, 2005.

QUIROZ, F., AMPUERO, R., FAYSSE, N. 2005 Metodología de fortalecimiento a comités de agua potable en zonas peri urbanas. Desarrollo y validación en base a experiencias de Cochabamba, Bolivia. Contribution in "encuentro por una nueva cultura del agua en América Latina", Fortaleza, Ceara, Brasil, 5-9 December, 2005.

PEÑARIETTA, R. 2005. Facilitando procesos de dialogo sobre el problema de la invasión urbana en zonas agrícolas bajo riego. Contribution in the conference "encuentro por una nueva cultura del agua en América Latina", Fortaleza, Ceara, Brasil, 5-9 December, 2005.

7.6.2 Books contribution

FAYSSE, N., COSSIO, V., QUIROZ, F.; AMPUERO, R.; PAZ, B. (2006a). Less tension, limited decision: A multi-stakeholder platform to review a contested sanitation project in Tiquipaya, Bolivia. To appear in: In: Warner, J. (Ed.), *Democratising Water Governance? Multi-stakeholder Platforms for Integrated Catchment Management*, Ashgate Ed., Aldershot.

QUIROZ, F., FAYSSE, N., AMPUERO, R. (Eds). 2006. Apoyo a la Gestión de Comités de Agua Potable. Experiencias de fortalecimiento a Comités de Agua Potable con gestión comunitaria en Bolivia y Colombia. Etreus Editor, Cochabamba, Bolivia.

PEÑARRIETA, R.; FAYSSE, N. 2006. Pautas Generales para la Elaboración, Uso y Empleo de Juegos de Roles en Procesos de Apoyo a una Acción Colectiva. Etreus Ed., Cochabamba, Bolivia.

7.6.3 Reports and student thesis

a) Negowat workpackage report

AMPUERO, R.; VAN ROOIJEN, D. 2006. Wastewater irrigation in the peri-urban area of Tiquipaya (Cochabamba, Bolivia). Negowat research report n. 3. www.negowat.org.

LIZARRAGA, A. 2006. Land Market in Tiquipaya. Period 1997 – 2003. Negowat Research Report n. 2. www.negowat.org.

BUSTAMANTE, R.; BUTTERWORTH, J., FAYSSE, N. 2005. Is there a future for locally-managed domestic water supply systems in peri-urban Cochabamba, Bolivia? Analysis of performance and some possible scenarios. Centro AGUA Negowat report, Cochabamba, Bolivia. www.negowat.org.

DURAN, A. 2005. Dinámica de los usos y la gestión del agua en Tiquipaya y Colcapirhua. Centro AGUA. Negowat report, Cochabamba, Bolivia. www.negowat.org.

DURAN, A. y M. SÁENZ. Estudios hidrológicos en la cordillera de Tiquipaya. Centro AGUA. Negowat report, UMS. Bolivia. www.negowat.org.

FAYSSE, N; COSSÍO, V.; PAZ, B.; QUIROZ, F.; AMPUERO, R. (2005). A Methodology for intervention in the design and evaluation of a short-term Multi-Stakeholder Platform. Centro AGUA Negowat report, UMSS. Bolivia. www.negowat.org.

ROCHA, R. AND IRIARTE, J. 2006. Land Use Changes in the Valley Area of Tiquipaya Municipality. Negowat Research Report n. 1, www.negowat.org..

b) Student thesis

COURIVAUD, A. 2005. Relaciones entre las organizaciones comunitarias de abastecimiento de agua con empresas municipales y el Estado en zonas peri-urbanas de América Latina. Aplicación al caso de Cochabamba.

HILLION, B. 2003. Etude des multi-usages de l'eau de familles paysannes de Tiquipaya (Bolivia). MSc Thesis, INA-PG, Paris – France.

KEETELAAR, E. 2004. Bolivian Water Management: Stakeholders' views beyond the water conflicts in the Central Valley of Cochabamba Political Field Analysis Cochabamba – Tiquipaya. Msc Thesis, Wageningen.

VAN DER MEER, 2004. La Gestión del Agua Potable en Colcapirhua y Tiquipaya. Resultados de la investigación realizada en los municipios de Colcapirhua y Tiquipaya. Centro AGUA, UMSS. Bolivia.

WOUDSTRA, R. 2003. Desempeño de los comités de agua potable en Tiquipaya y Análisis del proyecto de la EPSA Macota. MsC Thesis, Wageningen University.

7.6.4 Communication in other media (internet, video, magazines, newspaper etc)

COURIVAUD, A., FAYSSE, N., BUSTAMANTE, R. 2006. El papel de los Comités Comunitarios de Agua Potable en las zonas peri-urbanas: Enseñanzas para Cochabamba, Bolivia. Revista n. 21 Water and Sanitation Programme, Lima, Peru.

COURIVAUD, A., FAYSSE, N. BUSTAMANTE, R. 2005. *Organisations communautaires et entreprises de distribution d'eau en Amérique Latine. Typologie d'une coexistence aux modalités varies. Letter PsEau no. 49, December 2005.*

COGNAC, J., ZAMMITO, F. 2005. A video on water use and water access problems in the South Zone of Cochabamba, realized from November 2004 to August 2005.

7.7 Conclusion

Local stakeholder involvement in research design

Local stakeholder involvement in research design appeared a key issue. Facilitation processes have to be demand-led if local stakeholders are to get really involved. The initial planned processes in the Negowat project were based on an assessment of the needs as seen by external scientists, and not related to the demands of local stakeholders. The three intervention processes later designed met the explicit demands of involved stakeholders.

However, this involvement leads to its own issues, especially when the local stakeholder organizations are weak. First, when the organization is weak, it will respond to urgent demands and lobbying much more than to analyses of the important themes to tackle. For instance, between 2003 and 2005, there was no real interest from the Tiquipaya Municipality to tackle the theme of land use. This interest came out only in 2006, when this municipality started designing its Municipal Development Plan. Second, there are many themes related to natural resource management that are of high importance in Tiquipaya, such as water management at catchment level, or the regulation of groundwater use. However, given the local context and stakeholders' strategies, it will not be always possible to tackle the themes that appear the most urgent from an external point of view. This shows the necessity of a stakeholder analysis and of the local political scenario, which will show the possible differences between the themes that are important from an external point of view, from the ones that can be dealt with given the local context. Third, interest (and demand) from grassroots dwellers and local organizations does not entail that they will be able to actively co-lead a process to address an issue. In Linde and Kanarancho, all involved institutions (Municipality, OTBs, farmer associations) were genuinely interested in addressing the problems of urbanization of canals. However, while in 2005 many discussions were held and agreements made, in 2006 the theme began to progressively fall down in the agenda and many of the agreed proposals remained unimplemented.

Negotiation support tools

MSPs are a way to tackle problems that get more and more importance these days. These MSPs are usually designed for "horizontal" situations, where there are no large power asymmetries between stakeholders. Other approaches have been designed in "vertical" situations of power asymmetries, and

often refer to the empowerment of the weaker groups in the negotiation. The Negowat team could have refused to facilitate an MSP on the MACOTI project and may have supported some groups in their refusal of the project. However, with such a conflict-based approach, the very interesting and constructive discussions between supporters and opponents of the project on the institutional component, which took place during the technical roundtable, would not have taken place. This shows the needs to further study how to mix an MSP with some strategic actions based on power asymmetry analyses.

Role playing games proved to be a useful tool, though its purpose to make the participants moving away from real conflicts made it difficult to exactly measure its results (Faysse et al., 2006b). Furthermore, it appeared a rather heavy tool to design and implement (but any tool that aims at involving grassroots users in active discussions will necessarily be implemented at high costs).

It was earlier pointed out the importance of the local stakeholder organization strength to adequately co-design a research project that aims at improving land and water management. This condition is actually also a necessary one for the relevant use of negotiation tools. The Negowat project was indeed based on the idea that methodologies and tools for negotiation were suited to answer the lack of adequate planning and management of local resources in peri-urban areas. The experience showed that, while indeed methodologies and tools are necessary, they may be of limited use in situations where all local organizations (being either the Municipality or local user-based ones) are weak. The experience showed the importance of assessing the capacity of the possible local partner organisations to go on processes once the facilitation phase is over. In areas such as Tiquipaya, the strengthening of possible partner organizations may appear as necessary so that what was obtained during the facilitation process does not remain isolated results.

Integrated water resource management from the bottom-up

The theme of urbanization impacts over irrigation canals gave concrete examples of how it is possible to get a shared use of the water infrastructure. In the Bolivian context where so little has been achieved in terms of integrated water resource management, experiences of sharing water infrastructure use may help to tackle later the issue of co-management of water resources.

Beyond the outputs achieved by the Negowat project, what is remarkable is the scaling-up process which is following from the Negowat projects. At regional level, the Federación de Regantes de Cochabamba (FEDECOR) are pushing authorities from Prefectura and Municipalities, about the need to build-up mechanisms to control urbanization, mainly regarding the interference with hydraulic structures and irrigation management. From a multi-sector perspective, it became clearer that in the next years a negotiated approach to deal with the increasing problems between the irrigation and the water supply sectors, has to be established. Such kind of outcomes aimed by the Negowat project in the beginning, somehow are taking place now.

Support to local stakeholders

Drinking water appears as high on the agenda in the current context of Bolivia. Beyond the work on methodologies, what needs to be thought now is how to organize support to these committees at a larger scale, and how to design a long-term vision for the provision of the water services, that may entail the transformation and merging of drinking water committees. These committees have proved important internal management capacities. These systems can do a lot on their own but they do need external support. Similar conclusions have also been made for rural drinking water committees in many other developing countries.

In Tiquipaya, many community-based drinking water or irrigation organizations would accept to enter into a process of internal improvement of its structure and management, possibly with the support of an external facilitator. However, other associations have weak internal social control and the management team may not be interested in improving the management and opening it up to external scrutiny. That is why, if such support is to be institutionalized, it should also come with monitoring from the government.

In the same way, in such peri-urban areas, the municipality is to take more and more responsibilities. Due to the very fast urbanization process, the Tiquipaya Municipality proved unable to propose a vision and to cope with the changes. Strengthening this organization should also be part of the support process to local stakeholder organizations.

7.8 Management aspects

The project did not face large management difficulties. An important turn over of the staff responsible for the project within the CERES partner NGO limited its involvement throughout the project. An important coordinator of the Negowat project in the Centro AGUA left the team in 2005, but this did not impact much the implementation of the program as planned.

7.9 Appendices :

1. Book "experiencia de apoyo a los Comitês"
2. Book "experiencias del proyecto Negowat"
3. Guidelines "Juego de papeles"
4. KIT Cuadernillos de capacitación para el fortalecimiento de la gestión de los Comités
5. DVD containing all information produced within the Negowat project, inclusively publication and complementary information
6. CDs with all publications of Negowat Bolivia.

INCO-DEV : International Cooperation with Developing Countries (1998-2002)

Contract number : ICA4-CT-2002-10061

II ANNEXES

Project NEGOWAT

Facilitating Negotiations Over Land And Water Conflicts In Latin American Peri-urban Upstream Catchment : Combining Agent-Based Modelling With Role Playing Game

1 Data Sheet

Contract number : ICA.-CT4 2002 10061 **Year** : 2006

Data sheet for final report

1. Dissemination activities	Published	Submitted
Number of communications in conferences (Submitted : without proceedings)	34	18
Number of communications in other media (internet, video, magazines…)	18	0
Number of publications in refereed journals	13	0
Number of articles/books	15	1
Number of other publications (reports, working papers, videos CD)	87	

2. Training	
Number of PhDs	1
Number of MScs	10
Number of visiting scientists	2
Number of exchanges of scientists (stay longer than 3 months)	2

3. Achieved results	
Number of patent applications	
Number of patents granted	
Number of companies created	
Number of new prototypes/products developed (RPG)	5
Number of new tests/methods developed (methodology of implementation and assessment included)	6
Number of new norms/standards developed	
Number of new softwares/codes developed	3
Number of production processes	
Number of new services	
Number of licenses issued	

4. Industrial aspects				
Industrial contacts	yes	☐	no	☒
Financial contribution by industry	yes	☐	no	☒
Industrial partners : - Large	yes	☐	no	☒
- SME[15]	yes	☐	no	☒

[15] Less than 500 employees

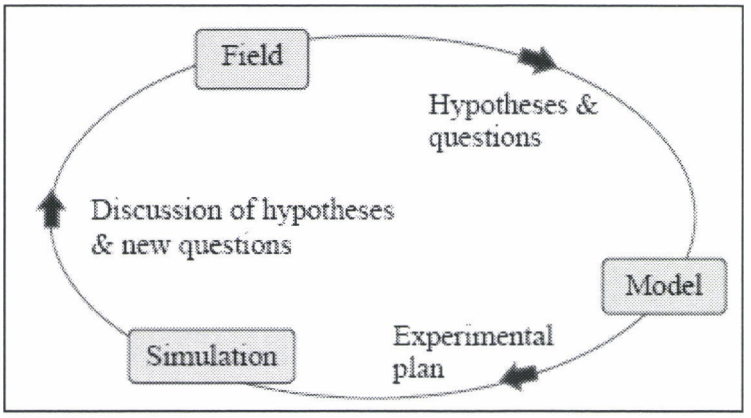
5. Comments

Other achievements (use separate page if necessary)

- Elaboration of 2 videos (Bolivia)
- Support to 4 drinking water committees in Bolivia, legal by laws for 2 of them, improved organizational models for 2 of them.
- Mediation of a technical table for implementation of the Macoti project in Bolivia and elaboration of 2 organizational models.
- An agreement about maintenance of irrigation canals in the Tiquipaya municipality signed (Bolivia)
- A training course about conflict management in peri-urban areas (3 weeks) implemented in Centro-Agua (20 people attending) and reorganisation of the Msc course on water management of Centro Agua.
- Awareness raised at regional level about community based water drinking committees in peri-urban areas and multi-fonctionality of canals in urbanizing areas.
- Participation to training courses for the technician of the water firm and environmental department (Brazil) (50 people).
- Capacity building in negotiation processes of about 20 communities leaders in Brazil about negotiation and headwater catchment management and 30 smallholders about agriculture and water management in headwater catchment
- Awareness raised about agricultural environmental services in peri-urban catchment and Rapprochement and approximation of sub-committees with farmers
- Participation to the elaboration of the contents of specific law of Guarapiranga (Brazil)concerning rural aspects
- Coordination of 2 workshops in a mobilization seminar organised by an NGO to mobilize civil society about headwater catchment management.
- Awareness raised in sub-committees about the discrepancies between points of view of the sub-committees and the main negotiations interests of local actors. Approximation of local communities, Water firm and municipalities in 2 small areas in Brazil, preparing other negotiations.
- Contribution to the participation of local actors in integrated water management at catchment levels thus to water policy implementation in Brazil by approximation of different stakeholders, pointing out negotiation possibilities for win-win agreements.

2 Annexe 2 : Companion Modelling approach

"Companion modeling (ComMod) is an approach which makes use of social simulation in various forms (computer simulations, role playing games) to understand and strengthen the collective decision making process of stakeholders sharing a common resource. The principle is to use simulation models integrating various stakeholders' points of view and to develop and use them as a process within the context of platforms for collective learning. The different stakeholders, including scientists, work out a common vision on resource management that leads to new indicators, shared monitoring procedures, information systems and concrete alternatives for action.
Models are used in a cyclic process (Figure below) composed of three stages which can be repeated as many times as needed: (i) Field studies and bibliography, which supply information and hypotheses for modelling and raise questions to be resolved using the model; (ii) Modelling , i.e converting current knowledge into a formal tool to be used as a simulator; (iii) Simulations, conducted according to an experimental protocol (computer model or roleplaying game), challenge former understanding of the system and raise new questions for a new batch of field studies."



www.commod.org

3 Annexe 3 : Completed Catalogue page

Resumé

In a rapidly urbanising world, population densities no longer allow for unlimited access to safe water. Competition for water, often associated with a struggle for land, is exacerbated in per urban areas. The NEGOWAT project will elaborate, structure and test a methodology combining an agent-based modelling approach and role game playing as a mediating tool for facilitating negotiations over land and water management, in the context of metropolitan upstream catchments in Latin America. The research aims to provide (i) a conceptual tool that will allow to analyse land and water management in this context (ii) a methodology and computing tools (including guidelines for its implementation) to explore, test and discuss scenarios, reinforcing the participation of marginalized stakeholders of the city fringe in all stages of the negotiation process.

Results achieved

Better knowledge of the hidro-social functioning of the peri-urban areas in Sao Paulo (Brazil) and Cochabamba (Bolivia) was achieved. Tests of role playing games in different negotiation processes have contributed to new insights about the use of simulation tools in multi-stakeholders processes that completed by an analysis of the potentialities of multi-stakeholders platforms for natural resources management. Locally, the project has contributed to the definition of new water regulations and institutional arrangements either directly or indirectly by capacity building and empowerment of local representatives, supporting specific negotiation processes, and raising awareness on different issues related to water management in peri-urban areas at regional level. It has also contributed to reduce tensions between locally competing groups.

4 Annexe 4 : Lists of 2006 new publications (annexed to present reports).

4.1 Joined in a specific Negowat 2006 Annexes report.

1. BUENO, A.K.S., REYDON, B.P.(2006). Os loteamentos clandestinos e as áreas de mananciais: um estudo sobre a lei de proteção aos mananciais e a especulação imobiliária. In: Mercados de Terras no Brasil: estrutura e dinâmica. REYDON, B.P., CORNÉLIO, F.N.M., Brasília (Brasil), NEAD, p389-418.
2. BUENO A.K, REYDON B. 2006. Mercados de Terras rurais peri-urbanos: caso dos mananciais da grande São Paulo. NEGOWAT, WP3, UNICAMP/IEA/NEA 19p.
3. ARTEIRO, M.G., GÜNTHER, W.M.R. 2006 Guarapiranga: Analisando impactos à saúde decorrente da falta de infra-estrutura de saneamento em áreas peri-urbanas na Sub-bacia do Guarapiranga. FSP/USP, NEGOWAT, 14 p.
4. GÜNTHER, W.M.R., ARTEIRO, M.G. 2006 Tietê Cabeceiras: Cenários de acesso a serviços de saneamento básico na sub-bacia Tietê Cabeceiras. FSP/USP, NEGOWAT , 10 p.
5. ARTEIRO, M.G. 2006 Ter'águas: 2006 Percepções dos Membros do Sub-Comitê da Bacia Hidrográfica Cotia Guarapiranga. 2006, FSP/USP, NEGOWAT ; 23 p
6. ADAMATTI D.F, SICHMAN J.S , COELHO H: Jogadores Virtuais em Jogos de Papéis V Brazilian Symposium on Computer Games and Digital Entertainment (SBGAMES´06). Recife, PE, Novembro de 2006
7. Diana F. ADAMATTI, Jaime S. SICHMAN and Helder COELHO. 2007. Virtual Players in RPG Proc. International Workshop on AI for Human Computing (AI4HC´07), 20th International Joint Conference on Artificial Intelligence (IJCAI´07), Hyderabad, India, January 2007
8. GRANJA, S.I. B e DUCROT, R. CAMARGO, M. E. 2006 - Role playing games: ferramenta para construção de consensos gradativos, artigo para o III Encontro da ANPPAS - Associação Nacional de Pós-Graduação e Pesquisa em Ambiente e Sociedade, de 23 a 26 de maio , Brasília-DF. http://www.anppas.org.br/index
9. JACOBI, P. R. and GRANJA, S. I. B. 2006 - Construção de Consensos Gradativos e Social Learning como Estratégias Institucionais de Aprendizado em Bacias Hidrográficas, artigo para o III Encontro da ANPPAS - Associação Nacional de Pós-Graduação e Pesquisa em Ambiente e Sociedade, de 23 a 26 de maio, Brasília-DF. http://www.anppas.org.br/index
10. JACOBI, Pedro Roberto . Social Capital and Institutional Performance - Methodological and Theoretical Discussion on the Water Basin Committees in metropolitan Sao Paulo, Brazil. In: ISA 2006 Congress, 2006, Durban. XVI World Congress of Sociology Abstracts. Bethesda : Sociological Abstracts. p. 116-117
11. JACOBI, P., GRANJA, S. I. B. 2006 Monitoramento e Análise dos Jogos - Agualoca e Teráguas: PROCAM/USP NEGOWAT, 45 p + annexes
12. CLAVEL Lucie, RABAK Cesar, 2006. AguAloca: Um jogo para facilitar as discussões sobre alocações nos Comitês de Bacias hidrográficas peri-urbanas. Caso da Sub-Bacia Alto Tietê Cabeceiras, São Paulo. 53 p. + annexes.
13. BARBAN, V., MADAZIO, V., MORAIS, C.K, DUCROT, R. (2006). PROCESSO TER´ÁGUAS- Atores em negociação de conflitos no acesso e uso do solo e água em áreas de mananciais hídricos da RMSP. Relatório, POLIS. NEGOWAT. 136pp.

4.2 Materials provided independently

4.2.1 APTA

Carvalho Y.M.C ed. Projeto NEGOWAT / APTA. Serviço Ambiental da agricultura. Alto Tietê – Região Metropolitana de São Paulo. Artigos. Governo do Estado de São Paulo – Secretaria da Agricultura e Abastecimento – Agencia Paulista de Tecnologia dos Agronegocios. 360 p (with CD ROM).

Projeto NEGOWAT / APTA. Serviço Ambiental da agricultura. Alto Tietê – Região Metropolitana de São Paulo. Relatorios. Governo do Estado de São Paulo – Secretaria da Agricultura e Abastecimento – Agencia Paulista de Tecnologia dos Agronegocios. 360 p (with CD ROM).

Containing the following reports

1. ZUCHIWSCHI, Elaine. Agricultura Peri-urbana nos Mananciais Urbanos da Região Metropolitana de São Paulo: estudo de caso no município de Guarulhos, Estado de São Paulo; WP3.3 APTA NEGOWAT 55 p.
2. FERREIRA, Sérgio E. Caracterização do Sistema Agrário da Região da Microbacia Hidrográfica do Ribeirão Balainho, pertencente à Sub-bacia Hidrográfica Alto Tietê-Cabeceiras - Município de Suzano. WP3.3 APTA NEGOWAT 43 p.
3. FRABETTI, Giancarlo. L. Agricultura em Parelheiros. WP 3.3 APTA NEGOWAT. 81 p.
4. ANDRADE, João P. S. de. O Turismo no Espaço Rural da Microbacia do Balainho ; WP3.4 NEGOWAT. APTA, 34 p.
5. VIÉGAS, Jéssica F. Diagnóstico Sócio-ambiental do Turismo Rural na Microbacia de Parelheiros, São Paulo; WP3.4 NEGOWAT. APTA, 58 p.
6. MILANI, Aline A. e CUNHA, Rodrigo P. Estudo da Comercialização de Olerícolas Produzidas na Região de Cabeceiras na Sub-Bacia do Alto Tietê: alface crespa e couve-flor como exemplos para análise. WP3.3 APTA NEGOWAT 34 p.
7. NOSSE, Tânia O. e ANTONIAZZI, Laura B. Custo de Produção e Rentabilidade de Subsistemas de Produção, na Região de Cabeceiras do Alto Tietê - Parte I e II. WP3.3 APTA NEGOWAT 15 p.
8. BRITO, Paulo R. B. de; NAKAGAWA, E. K.; Nascimento, F. M. de A. do. Construindo a Qualidade Ambiental do Produto Agrícola no Alto Tietê Cabeceiras. WP4, NEGOWAT; APTA, 28 p + annexes

4.2.2 UMSS

QUIROZ, F., FAYSSE, N., AMPUERO, R. (Eds). 2006. Apoyo a la Gestión de Comités de Agua Potable. Experiencias de fortalecimiento a Comités de Agua Potable con gestión comunitaria en Bolivia y Colombia. Etreus Editor, Cochabamba, Bolivia.

PEÑARRIETA, R.; FAYSSE, N. 2006. Pautas Generales para la Elaboración, Uso y Empleo de Juegos de Roles en Procesos de Apoyo a una Acción Colectiva. Etreus Ed., Cochabamba, Bolivia.

NEGOWAT. 2006. Experencias del proyecto Negowat en Bolivia. Facilitando negociaciones sobre el acesso a agua e uso de la tierra en zonas peri-urbanas. Centro AGUA, CIRAD. Etreus Ed., Cochabamba. 253 p. www.negowat.org

Containing the following contributions :

1. QUIROZ F. 2006 Contexto General del Municipio de Tiquipaya. In. "Experencias del proyecto Negowat en Bolivia." Centro AGUA, CIRAD. Etreus Ed., Cochabamba. www.negowat.org
2. LIZARRAGA, A. 2006. Land Market in Tiquipaya. Period 1997 – 2003. Negowat Research Report n. 2. www.negowat.org.
3. COSSIO, V., FAYSSE, N, QUIROZ, F., AMPUERO, R., , PAZ, B. 2006. Utilización de una Metodología Genérica para Diseñar una Plataforma Temporal de Múltiples Grupos de Interés: Aplicación en el caso de un Proyecto de Alcantarillado y Agua Potable en Tiquipaya. In. "Experencias del proyecto Negowat en Bolivia." Centro AGUA, CIRAD. Etreus Ed., Cochabamba. www.negowat.org
4. VEJA D, PEÑARRIETA R, FAYSSE N: 2006. Proceso Multi-actor y Uso de Juego de Roles: Concertación para Manejar los Impactos de la Urbanización sobre Infraestructura de riego. In. "Experencias del proyecto Negowat en Bolivia." Centro AGUA, CIRAD. Etreus Ed., Cochabamba. www.negowat.org
5. FAYSSE, N. PEÑARRIETA, R., QUIROZ, F., AMPUERO, R. VEGA, D. COSSÍO, V. 2006. El uso de Juego de Roles para apoyar discusiones sobre una acción colectiva: Experiencias en zonas peri-urbanas de Bolivia In. "Experencias del proyecto Negowat en Bolivia." Centro AGUA, CIRAD. Etreus Ed., Cochabamba.. www.negowat.org

DVD containing all information produced within the Negowat project, inclusively publication and complementary information

CDs with all publications of Negowat Bolivia.

4.2.3 Cirad

1 CD : Jogo de Papeis Ter'Aguas e AguAloca : software, Manual do usuários e materiais. CD-ROM.