Sustainability **2009**, *1*, 133-160; doi:10.3390/su1020133

OPEN ACCESS

sustainability

ISSN 2071-1050

www.mdpi.com/journal/sustainability

Article

The Challenge to Revert Unsustainable Trends: Uneven Development and Water Degradation in the Rio de Janeiro Metropolitan Area

Antonio A. R. Ioris [1,*] and Maria A. M. Costa [2]

[1] Lecturer in Geography, School of Geosciences, and Research Fellow at the Aberdeen Centre for Environmental Sustainability (ACES), University of Aberdeen. Postal address: Department of Geography, Elphinstone Road, Aberdeen, UK, AB24 3UF

[2] Doctoral Student, Urban and Regional Planning Research Institute (IPPUR), Federal University of Rio de Janeiro. Postal address: IPPUR, Prédio da Reitoria, sala 543, Cidade Universitária - Ilha do Fundão - Rio de Janeiro (RJ), Brazil, 21941-590; E-Mail: gelecolabore@yahoo.com.br

* Author to whom correspondence should be addressed; E-Mail: a.ioris@abdn.ac.uk; Tel.: +44-1224-273703; Fax: +44-1224-272331

Received: 20 January 2009 / Accepted: 30 March 2009 / Published: 14 April 2009

Abstract: The search for water sustainability requires not only a combination of technical and managerial responses, but also firm action against socioeconomic injustices and political inequalities. The recognition of the politicised nature of water problems deserves particular attention in areas marred by long-term trends of environmental degradation and social exclusion. A case study of the Baixada Fluminense, an urbanised wetland in the Metropolitan Area of Rio de Janeiro, illustrates the challenge to reverse unsustainable practices in situations where water problems have been politically and electorally exploited. The research made use of an interdisciplinary approach to assess past and present initiatives that have attempted, but systematically failed, to restore river ecology and improve water services. The empirical results have important implications for water policy making and urban planning.

Keywords: Water sustainability; water policy; water conflicts; river restoration; environmental justice; integrated water management; Baixada Fluminense; Rio de Janeiro.

1. Introduction: Water Sustainability

The meaning of sustainable water management has evolved and expanded since the early years of the debate in the mid-1980s. There is now a stronger emphasis on the dynamic interaction between nature conservation and the demands of different social groups, as well as recognition of the conflicting perceptions of environmental problems and the limits of science in dealing with risk and uncertainty. Policy-making moved away from merely meeting quantitative water demands and restoring ecological features into broader concerns about the integration of spatial and temporal scales of multidimensional management issues. Water sustainability came to include a range of interrelated requirements, such as the guarantee of the water necessary to maintain human health and sustain ecosystems, basic protections for the renewability of water resources, and institutional improvements in terms of planning, management and equitable conflict resolution [1]. However, it is often the case that the translation of sustainability principles into action encounters major obstacles to breaking the link between economic growth and water demand [2] or to effectively coordinating sectoral and local interests with political and development pressures [3]. In response, regulatory institutions have been reformed in an attempt to integrate stakeholders and spatial areas, but these reforms have often failed to address a backlog of management distortions and social inequalities [4]. There is a growing appreciation that water sustainability is, ultimately, a contested concept, and as such requires concerted efforts towards forming a shared vision about the management of 'socialised' water systems [5]. The current article makes use of a case study in the Baixada Fluminense to illustrate the influence of historical trends and discuss the persistence of institutional weaknesses that limit the achievement of more sustainable patterns of water management. The empirical results will demonstrate that, due to a chaotic urban growth, water sustainability is inextricably linked to a lack of opportunities for local populations to influence the decision-making process.

Participation is certainly one of the fundamental pillars of the water sustainability agenda. Not only has the understanding of water sustainability been greatly augmented, but the purpose of stakeholder participation has also evolved in the last decades. In contrast to the rigid water infra-structure programmes after the Second World War, when the construction of large dams and irrigation schemes was overseen by centralised and technocratic agencies, there has been evident change towards more inclusive and flexible mechanisms. In its beginnings in the 1970s, public participation was taken as a facilitator of project implementation or a useful tool in the production of EIA reports. Later, public involvement evolved to play a more direct role in the repair of ecological degradation [6] and in the provision of better water services [7]. The 1992 Dublin Statement, the bedrock of contemporary water governance, ascertains that "water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels" [8]. Public participation, in its various formats and strategies, is closely associated with the discourse of environmental governance, for which the involvement of stakeholders can secure greater social commitment, minimise controversy and operational delays, and even create a 'civil culture' [9,10]. Modern regulation, such as the EU Water Framework Directive, posits public participation not as an objective in itself, but something that helps to define the rationale, framework, outcomes and validity of decision-making processes. Admittedly, there is yet limited agreement on the practical meaning and actual implications

of participatory water management [11], but it is difficult today to accept policy documents or official guidance that are not first subjected, at least, to public consultation or some form of stakeholder scrutiny.

Currently there are several techniques used to structure the involvement of the public, such as 'multi-stakeholder platforms' (a roundtable that facilitates the dialogue between different stakeholder positions [12]), 'participatory multi-criteria decision analysis' (meetings that bring together public officials, elected politicians and local residents to jointly develop criteria to address a particular question [13]) and 'citizen's juries' (where a group of community representatives are invited to attend a series of meetings to listen and cross-examine expert witness and respond to specific policy questions [14]). Nonetheless, it is debatable how much these types of approaches have really helped to move water use and environmental conservation into a more sustainable direction [15]. To date, the trend of environmental problems and widespread suffering due to water degradation have not only persisted, but actually increased since the adoption of more participatory strategies, which often tend to romanticise grassroots movement without providing sensible answers to mounting management dilemmas. The World Resources Institute insists that "[g]rowing water scarcity and alarming declines in the health of aquatic ecosystems indicate that water policies in most nations are failing to protect life's most vital resource: freshwater" (the full assessment of the World Resources Institute, including country water statistics, can be found at: http://earthtrends.wri.org/searchable_db). This continued deterioration suggests the existence of ingrained institutional barriers that hinder the adoption of more effective procedures for overcoming the current unsustainability of managed water systems. To a large extent, this continuation of unsustainable trends stems from a failure to engage local stakeholders in a critical evaluation and effective resolution of collective problems. It is not enough to congregate people around a table to establish helpful alliances and partnerships, particularly when water is scarce or environmental degradation is extensive. Recent attempts have failed to incorporate the full complexity of social interaction and deal with the hierarchy of opportunities that affect the use and conservation of water.

Cooke and Kothari criticise the limits of conventional participatory approaches, such as those associated with regional and national development programmes, for ignoring the imbalance of power between local stakeholders and government agencies or multilateral organisations [16]. The formalist management of natural resources often interprets public participation as linear, cumulative and politically neutral, with a tendency to override existing decision-making mechanisms and reinforce the interests of the already powerful [17]. It maintains a rigid or preconceived understanding of social interactions, normally neglecting issues of group identity and political asymmetries. But it is power inequalities that determine how natural and cultural categories are incorporated into water regulatory institutions and influence decisions about management priorities and the allocation of resources [18]. This exercise of power can operate invisibly in the resolution of water conflicts through the skilful use of hard and soft forms of hegemony that influences stakeholder interaction and decision-making [19]. The political hegemony of some water user sectors is consolidated and contested through everyday activities, fought over through lived environments and the confrontation of particular worldviews [20]. Water management is inseparable from issues of state politics, power dynamics and the asymmetric

relation between social groups, which are factors that can only be properly addressed though democratic forms of public participation.

As pointed out by Anand, at the heart of water disputes are questions related to justice and fairness, which are directly connected to how citizens perceive and articulate their water claims [21]. Nonetheless, participation is still too often promoted without properly considering the hydro-social and spatial arrangements that underpin the origin of the environmental management problems. The very nature of the recruitment to take part in meetings and committees eliminates the less organised stakeholder groups [22], because the process can be controlled by more influential participants, who share some common attributes and are more familiarised with the rules [23]. It is normally the case that government officers are not disposed to devolve power to lower levels, which means that the participation of local people in water management becomes little more than a passive and pointless consultation [24]. Therefore, a genuine discussion of the challenges related to water sustainability should take into account the technical, managerial and political dimension of water management, exploring stakeholder demands and power disputes in the contested arenas of policy-making and public participation. What is missing in most of the environmental debate today is an acceptance of the transformative role of public participation, not only as an element of improved decision-making, but the cornerstone of active citizenship and environmental justice [25]. The next section presents the results of a case study in Brazil, where the interface between power, state and space have determined the achievements and failures of water management approaches. Such notions have been amply discussed in the water sustainability and political ecology literature. As the following case will show, however, they are also helpful for thinking about the difficulty to translate participative, integrated water management theory into practice, particularly when issues of technocracy and political inequality are ignored in the reform of water management institutions.

2. A Case Study of Water Unsustainability in the Baixada Fluminense

2.1. Research Methods and Methodological Approach

The challenges involved in the contemporary search for water sustainability can only be properly understood through a combination of theoretical and empirical investigation. Our research focused on water management and river restoration in an impoverished urban area called Baixada Fluminense, situated to the north of the city of Rio de Janeiro, in Brazil. The aim of the study was to compare and contrast past interventions with current water projects and ongoing changes in the institutional framework. The research followed an inductive and interdisciplinary approach that allowed a synthesis of natural and social processes associated with water management. As proposed by O'Riordan, the assessment of environmental sustainability is fundamentally a process of connecting and revealing the multiple causes of environmental questions [26]. The materiality of social and natural problems was analysed in relation to the subjective circumstances of social action, as much as in relation to the objective influences of higher structures [27]. The paradigm guiding the research was critical realism [28] and grounded theory [29] was used as the key methodological tool. Critical realism recognises that the selection of a method depends on a careful consideration of the interrelations of the objects under

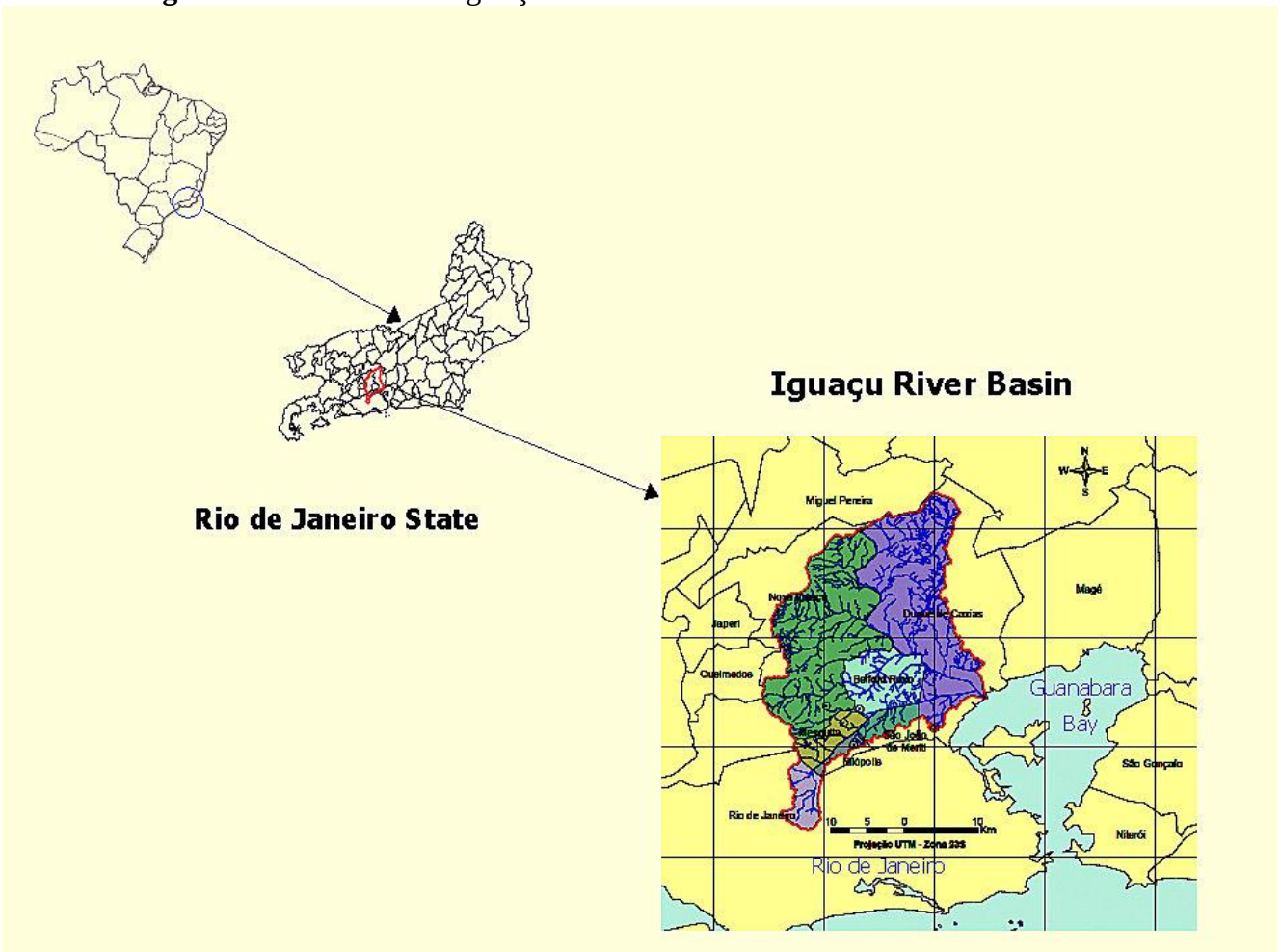
study, which have emergent powers and cannot be simply reduced to their constituents. The theory of critical realism recommends that the research should include an intense 'immersion' in the world in order to understand difference and stratification. As recommended by Sayer, realist explanation in social sciences emerges from the intensive study of the dialectical movement from the abstract (the isolation of particular attributes and relationships from the whole) and the concrete (the articulation between events, mechanisms and structures that comprise the world) [28]. Following a grounded theory procedure, data collection and analysis were concomitant processes, which enabled the capture of all potentially relevant aspects as soon as they were perceived. Hypotheses were developed and verified as much as possible during the research campaign, making use of constant comparisons and building the processes back into the theory. Sampling proceeded also on theoretical grounds with a systematic investigation of incidents, events, and happenings, but also addressing broader structural conditions that create and feed water management problems.

In order to understand the barriers and potentialities of involving local actors in the improvement of water management, our study followed an inductive strategy that tried to compose a synthesis of multifarious processes associated with water use and management in a specific geographical context. Preliminary visits and attendance to open meetings started in 2007, but the bulk of the fieldwork took place between May and December 2008. In total, 44 semi-structured interviews were conducted with local residents, water abstractors, and municipal, state and federal authorities. All interviews were later transcribed and only the most relevant parts were translated into English. During the period of research (2007-2008), it was possible to maintain regular contact with some key interviewees, which allowed the researchers to register changes in perception and attitudes through time. The preparation of interviews and field trips followed the recommendation that overall research questions should be subdivided into secondary questions and then related and cross-referenced to relevant issues [30]. Each interview topic comprised a cluster of points related to the management of water in the Baixada and were identified according to the methodical scrutiny of relevant documentation and government databases. The research effort also included regular visits to the communities more seriously affected by water problems, as well as participant observation in meetings and public events (i.e. river basin committee and other discussion forums, public hearings related to a river restoration project, election campaign events, etc.). In addition, the study dedicated special attention to the performance of the key organisations responsible for water management and regulation, namely, the water agency (SERLA; it should be mentioned that in January 2009, SERLA was merged with other agencies and is now part of the State Environment Institute, INEA), the water utility (CEDAE), local authorities and the river basin committee. The investigation was complemented with the content analysis of public policies and the systematic consultation of newspaper material, technical archives and university libraries. Throughout the study, the researchers tried to be as reflexive as possible, following the observation of Sarewitz that the responsibility of the scientist should expand from doing the right thing as an individual, to participating in the reflexive process of creating institutional consciousness, which demands a radical shift away from the constricting notion of science as an 'autonomous republic', to embrace the realization that science and society are moving together in an 'intimate coevolution' [31]. As a result, the science of sustainability cannot avoid questions about the social responsibility of academics and how to secure a more equal and just society.

2.2. The Area of Study and the Local Water Problems

Eight municipalities form the Baixada Fluminense (Duque de Caxias, Mesquita, Nova Iguaçu, Belford Roxo, Nilópolis, São João de Meriti, Queimados and Japeri), but to most Brazilians, the Baixada Fluminense is an area equally associated with violence, deprivation and the bizarre behaviour of some of its politicians. This stereotypical image, constantly reinforced by the mass media, certainly conceals the full extent of a complex web of interactions between local people and the territory where they live. The use and management of water epitomises some important aspects of the dynamic and contested exchanges between social groups and their environment. As the name implies – Baixada means Lowlands – this is a flat floodplain area under tidal influence and formed by the rivers that drain to the western side of the Guanabara Bay. It is revealing to observe that 'fluminense' comes from the Latin 'flumen', which means river. The main hydrological system, which was the main focus of our investigation, includes the Iguaçu River and its tributary the Sarapuí River (Figure 1), a catchment that occupies around 700 km^2 or 53% of the area of the municipalities that form the Baixada. A small proportion of the Iguaçu River Basin is located in the municipality of Rio de Janeiro, therefore beyond the Baixada Fluminense. Perhaps ironically today, 'Iguaçu', in the indigenous language, means 'plenty of water'.

Figure 1. Location of the Iguaçu River Basin in the State of Rio de Janeiro in Brazil.



Historically, the Baixada evolved as an appendix of the city of Rio de Janeiro, the former capital of the country. Since the early colonial times, local alluvial soils were explored to cultivate sugar cane and subsistence crops. The river network facilitated the commercialisation of local produce and served as a transport corridor for gold and, later, coffee brought from the inland. The use of Baixada as a passage area was later reinforced with the construction of the first Brazilian railway in the mid-19th century (the railway network included the Dom Pedro II Railway in 1858, followed in 1883 by the Príncipe do Grão-Pará and the Rio do Ouro Railways – the latter was built to transport water to the City of Rio – and the Norte Railway, constructed between 1886 and 1888) and the São Paulo-Rio de Janeiro Highway in the mid-20th century. The availability of public transport attracted a great influx of immigrants (mainly from the Northern provinces) that arrived in search of jobs and opportunities. After several decades with very high rates of immigration (which peaked to around 10% per year in the 1950s and 1960s), the total population reached 3.2 million in 2007 (population data from IBGE statistics, available at www.ibge.gov.br).

It was mainly the arrival of a large contingent of migrants to an area with limited public infra-structure (other than the public transport to take them to the workplace) that deeply shaped the recent history and the geography of the Baixada. Incoming residents were forced to occupy any piece of land available and transformed a rural wetland into a highly populated periphery of the large metropolis. The majority of the poorest migrants could only afford to live in the more flood-prone terrains and along the river courses. A system of polders and dikes was introduced in the 1930s to reclaim land for agriculture (i.e. which means relatively less flood protection than equivalent systems designed for urban drainage), but the floodplains were soon engulfed by the dramatic pace of urban expansion [32], as can be seen in Figure 2. Following the inauguration of an oil refinery in 1961, numerous industries, particularly chemical and petrochemical, were installed in the Baixada. The overall consequences of this fast pace of transformation is that, except in the headwaters, the Iguaçu River and its tributaries now show severe levels of pollution and degradation, especially due to faecal coliform, depleted oxygen, and heavy metal contamination of sediments [33]. There are also additional pressures related to the removal of riparian vegetation, uncollected waste, and impermeabilisation of urban surfaces [34].

Due to intense manipulation of the land and rivers, there has been a dramatic shift from a situation of water abundance to the current condition of (man-made) water scarcity. In effect, the Baixada was converted from being a water exporter to Rio de Janeiro (in the 19th century) to a net importer of 90% of its water demands (by the end of the 20th century). Most of the water distributed in the Baixada now comes from the Guandu River (in the west of the Metropolitan Region), which first has its flow significantly increased by a transfer of water from the Paraíba do Sul River Basin. The transfer of water may not be a problem in itself, at least to the receiving sites, but in the case of the Baixada it results in a highly unreliable water supply system, given that the abstraction from the Guandu River was primarily designed to serve the city of Rio de Janeiro. It means that the Baixada receives excess water from Rio de Janeiro, which creates constant problems of intermittency and, because of the precarious status of the pipeline, water quality below the desired threshold. As described below, several water works recently constructed in the area (especially through the PDBG programme) still remain out of

operation due to bad project design, incomplete infra-structure and malfunctioning of the distribution network.

Figure 2. Houses built in the floodplain and along an abandoned drainage canal in the Iguaçu catchment.

2.3. The Difficult Dialogue between the Population and Official Agencies

The transformation of the river system according to urban and regional development pressures produced an uneven pattern of impacts and outcomes, which regularly re-emerges in the form of conflicts and disputes. One of the first court cases involving the protection of water rights in Brazil happened in 1886 between local landowners and tradesmen around the construction of bridges over the Iguaçu and Sarapuí Rivers [35]. Their claim was based on a number of decrees that protected river navigation and required bridges to follow certain standards that were not being observed. It took until 1898, with a succession of appeals, for a final decision from the high court ordering the demolition of the bridge and restoration of pre-existing navigation conditions. In the end, it was a pyrrhic victory, given that river transportation soon entered into decline with the preference for rail as a form of transport. A recent 'map' of environmental conflicts listed 28 of water-related disputes in the municipalities of Baixada involving river contamination, industrial leakage, inadequate disposal of toxic material, poor rubbish collection and landfill operation, urban flooding and various failures of public water supply [36]. As conceded by the authors of this assessment, that figure is probably an underestimation of a much larger number of water-related conflicts. The most illustrative case was related to a series of accidents and soil and water contamination affecting the Sarapuí River caused by a large chemical industry in Belford Roxo. Local residents started to complain in 1992 about the

careless operation of the company and the case quickly escalated to involve the public attorney, international activists and scientists from Exeter University. After a long list of reports and visits, an agreement was reached in 2002 to give the company the opportunity to improve its performance; moreover, there are doubts about actual compliance. Water conflicts are rarely referred to the courts, especially because the judiciary system is onerous and beyond reach for the majority of the population, who can only resort to assistance by the public attorney's office [*Ministério Público*]. After the 1988 Constitution, public attorneys became legally responsible for environmental management issues and the protection of public health in Brazil, but in the majority of the cases when public attorneys were involved there was no conclusive decision due the difficulty to legally prove the responsibility for environmental infractions. In the Baixada, an additional constraint is the fact that those who have their houses illegally built on public land are reluctant to present formal complaints given the risk of losing their homes [37].

Another major source of controversy between local residents and governmental agencies is related to water scarcity and lack of basic sanitation. For many years, researchers have identified a deficient water supply as the main problem affecting the quality of life of the local population [38]. According to the national sanitation statistics bureau (www.snis.gov.br) around 71% of the population has access to water supply and only 28% is served by public sanitation (additional statistics for the Baixada Fluminense related to the year 2006: average household demand = 23 m^3/month; per capita water use = 0.205 m^3/day; rate of leakage = 54%). Those not officially served by mains water (i.e. 29% of the population) rely on a combination of boreholes, water tanks, help from neighbours and unauthorised connections to the public network (it is often the case that a group of residents, without being authorised by the water utility, collectively divert and distribute treated water among themselves). There exists an exceptionally difficult relation between the public water utility (CEDAE) and its customers, with frustration on both sides. One the one hand, the company has had a low investment capacity to expand service coverage; on the other, a significant proportion of the service is unaccounted for due to water thieving and lack of payment. Customers complain that the minimal payment for water service (the so called 'social tariff') is significantly higher in Rio de Janeiro than in other parts of Brazil, which certainly contributes to the high rate of unpaid debt: CEDAE (Rio de Janeiro): R$ 30 for 15 m^3/month; DMAE (Porto Alegre): R$ 7.5 for 10 m^3/month and SABESP (São Paulo): R$ 4.42 for 10 m^3/month (all 2008 data). Residents interviewed in July 2008 provided a vivid illustration of the problem:

"Our [water] service is in the ITU [intensive treatment unit]. (…) When it rains, my street becomes a river. Fresh water then mixes with sewage, it is really difficult. (…) The problem gets worse because the population is always increasing; the last investment in pipelines here was in 1986".

"Water supply is very precarious. There is only water when it rains. (…) The company [CEDAE] only charges, but doesn't deliver. They sent me a bill for water they never supplied. (…) That is why many people steel water from the pipelines here. (…) But you go and check if the wealthy neighbourhoods in Rio don't have good and constant water. Why is it like that?" (see Figure 3)

"It is really chaotic here, but the population understands very little of public policies. (…) The water meter is here to steal us; some people pay, others don't pay, but they are afraid that when they go to sell their property the debt will be charged, with interest and all of that. (…) I don't like paternalism, paternalistic policies, some are now paying for the mistake of others".

Figure 3. Resident receiving water bills, but no water supply.

There are cases when the population appealed to the judicial system to see a normalisation of water supply, as happened in the neighbourhood 'K-11' in Nova Iguaçu, an area that has suffered from lack of adequate water for more than 50 years. With the support of a local NGO, various neighbourhoods associations brought the case to the public attorney in 2003, which forced CEDAE to provide a formal explanation and promised specific investments to address the problem (still inconclusive in 2008). However, there have also been situations where the tough cost recovery policy of CEDAE led to intimidation and sudden cancellation of water supply. It has happened, for example, in various communities in the municipality of S.J. Meriti, where the local residents formed a commission and requested assistance from a public defender lawyer [*Defensor Público*], who stated that:

"This is a problem created by the water company itself. For years, CEDAE failed to charge for the water supply and then decides to recover the entire debt at once. In many cases, because of the low value of the

properties, the debt is equivalent to half of the market value of the house. That creates a lot of anxiety among people about losing the family house. (…) Our work is to treat each case individually and according to the specific circumstances, but I am aware of cases where the company acted illegally, beyond the law, in terms of notification and deadlines. There are also areas where the residents demanded the installation of water meters, because the volumetric payment is likely to be lower than the 'social tariff', but CEDAE refuses to do it. (…) In other cases the company discriminates between residents with legal land tenure and those in illegal settlements. However, we understand that, according to the new national Sanitation Law [passed in 2007] the water services have to be universalised, all should be served, and the company cannot discriminate. In comparison, the electricity and the telephone companies don't make any distinction in terms of land tenure" (interviewer with public defender lawyer, 31 Jul 2008). Observation: the matter is debatable, because the state legislation, apparently contradicting the federal law, determines that the debt should be related to the property not the customer.

Although the water problems – pollution, flooding and deficient water services – are well known and repeatedly mentioned in plans and official reports [39], the solution seems to be continually beyond the possibilities of the public authorities. This persistent dilemma and, crucially, the related political exploitation of the water-related problems, lie at the heart of water management in the Baixada. Limited financial resources are not enough to explain the precariousness of the water services, high rates of insalubrity and recurrent flooding, particularly considering that between 1975 and 2000, around US$ 1.5 billion was invested in water infra-structure in the area [40,41]. It suggests that the underlying question is not one of lack of funds or technical capacity, but the selective allocation of resources combined with deficient urban planning and use of the public funds according to political priorities. Summarised by the expression 'pipelines against votes' this paradigm is typical of the many public initiatives so far a phenomenon that Porto describes as 'pipelinism' [*manilhamento*] [40]. The discriminatory distribution of public funds is directly related to the ambiguities of local political disputes, which unfold through a volatile combination of violence and populism. Politicians are known for both expressing their concern for the suffering of the population and making use of public anguish for their electoral benefit [42]. Furthermore, the instability of political alliances in the municipal administrations has led to an emphasis on short-term goals and widespread evidences of corruption, which all affect the formulation of technical responses to water problems. It will be shown below that the truncated channels of communication with population, as well as the irregular and ill-conceived interventions of public agencies and the absence of public accountability, have been common features of the recent history of water management in the Baixada Fluminense. Unfortunately, those distortions continue to prevent the achievement of higher levels of water sustainability.

2.4. Government Interventions and Persistent Problems

Because of the need to reclaim land to accommodate the accelerated process of urban expansion, there has been a constant endeavour to drain the wetland system and improve the salubriousness of the Baixada Fluminense. Initial land reclamation studies were conducted as early as in 1833 and the contamination of standing and running waters has always represented a serious public health issue

[43]. For instance, in 1855, there was a cholera epidemic with significant death of slaves and, therefore, loss of capital (slavery was only abolished in 1888). In 1870 the provincial government took the initiative to clean and canalise some river stretches and laws were passed in 1888 to expand the drainage of the Iguaçu catchment [44]. After the proclamation of the republic in 1889, the Province Commission of Studies and Sanitation (1894) and the Federal Sanitation Commission of Baixada Fluminense (1909) were created to carry out drainage studies and localised works [43]. The 1930s and 1940s – the first phase of the state-led industrialisation of Brazil – was a period of renewed efforts to drain and sanitise the area, but the rate of urban growth constantly overcame the response capacity of the federal and state governments. The situation was turned worse as the simple announcement of some form of infra-structure expansion triggered the occupation of new areas by more incoming migrants. During the military dictatorship (1964-1985) a national water supply and sanitation plan was launched in 1971 (PLANASA), but in the Baixada its implementation was turbulent and only led to some isolated pipeline and water distribution systems.

With the return of democracy in the 1980s, there was a resurgence of popular mobilisation in the Baixada, particularly around the creation of neighbourhood associations and municipal federations of associations. The Political Committee of Sanitation of the Baixada Fluminense was established in 1984 as a non-governmental forum for the dialogue between government authorities and representatives of local communities. Although this Political Committee is still operational today, its influence has declined dramatically due to both stakeholder demobilisation and repeated attempts from the state government to manipulate its members, often by catapulting them to paid jobs in the administration [40,45]. In 1984, the state government launched the Global Sanitation Plan (PEB), which included, among other innovations, the 'condominial sewage', a cooperativised model of low-cost sanitation that relies on a close coordination between members of the community. Unfortunately, a constant tension between the state and federal administration impaired the implementation of the PEB: out of 576 km of pipelines planned, only 70 km were effectively installed. The overlapping of responsibilities between the three levels of administration was, and continues to be, a major obstacle to the resolution of water management problems. According to the national constitution, the responsibility for water supply and sanitation belongs to the municipal authorities, but in metropolitan areas, because of the interconnection of pipelines across neighbouring towns, the state administration becomes the main operator; although the legality of the state responsibility for metropolitan systems is, after many years of deliberation, still unresolved by the supreme court of Brazil. Despite the fact that legal responsibility is disputed between local and state authorities, the main source of investment is from the federal government, which obviously interferes in the final destination of resources, or from multilateral development agencies, which also requires federal approval. In practice, the cooperation between the different levels of public administration is never taken for granted, but depends on party affiliation and the convergence of political interests. That means a serious institutional instability and, in many cases, waste of public funds.

The next state administration (i.e. after 1986) dropped the condominial technology and reduced the overall targets of PEB to 251 km, but even this objective was not achieved. In 1988, the project called 'Reconstruction Rio' was launched in response to the major floods that affected the Baixada two years earlier and had a total budget of U$ 288 millions, mostly funded by the World Bank, to deal with

sanitation, urban drainage and solid waste. However, only half of the budget was actually spent due to bureaucratic delays, transition to a new state government and limited integration between state and municipal administrations. Significant to note is the fact that project emphasis shifted in the early 1990s with water problems of the Baixada starting to be described in more 'scientific' terms, instead of simply responding to community mobilisation. A comprehensive hydrological study of the flooding problem was published in 1996, the Iguaçu Project, which called for investments of US$ 400 millions [34]. Because of its heavy budget, the Iguaçu Project was never implemented and only a subset of its targets was recently repackaged under a different name (PAC-SERLA, discussed next). In 1994, the most ambitious initiative was launched, the Guanabara Pollution Control Programme (PDBG), with total funds of US$ 860.5 millions (financed by the IADB and JBIC). PDBG included investments in sanitation and drainage in the whole metropolitan area of Rio de Janeiro and for the Baixada it included seven new reservoirs (to serve a population of 575,000), two sewage treatment works (to serve an equivalent population), and drainage, planning, environmental restoration and education projects [46]. Despite the availability of funds, PDBG was marred by constant delays and was still not concluded in 2008. It was characterised by ill-conceived infra-structure projects that could not be easily connected to the existing pipeline system [47], as well as by an authoritarian relation with civil society and local authorities [48].

From the above examples – just handful of a much longer list of projects and programmes – it should be easy to realise that the Baixada Fluminense has been at the receiving end of many water management initiatives related in the last 25 years. Even so, the trend of problems and conflicts around water management continues to intensify due to the arrival of additional migrants, the natural growth of the population and the lack of maintenance to existing water infra-structure. The irrationality of many projects, together with technocratic and centralised interventions, created a situation of low efficiency, wasted resources and large-scale informality (i.e. illegal connections to public mains). In our interviews, members of the public complained that their household problems were only remembered at the election campaigns and, in an emergency, all they can do is to plea to some local politicians, in exchange for votes in the next election:

"You see, water has always been a very serious problem here. The population has to do whatever they can to overcome the problems, for example, in my street there is [public] supply only on Tuesdays and on Saturdays, for a few ours early in the morning. You have to wake up early and fill up the tank, if you miss it, you are left without water for many days. (…) Some people installed pumps and take water from boreholes or even from the pipeline, illegally… well, if you wait for CEDAE, you know… Another option, that has increased in the last few years with the demobilisation of the community, is to ask for a local councillor to send a water tank, in exchange for votes, of course. I can't prove, but everybody knows that they have a kind of parallel service to provide water. This operates using the very structure of the state, I mean, they control the water services and order to reconnect the supply [when it was cut] or to send a water tank… if you agree with their [political] demands…" (interview with a local school teacher, 06 July 2008).

See Figure 4 for a queue of water tank lorries (trucks) waiting to be filled in the city of Duque de Caxias. In different opportunities we tried to interview the lorry drivers but they vehemently declined;

various informants mentioned that most water tanks are paid by the water utility, which has to provide emergency supply when there are failures in their service (but obviously only to those legally connected to the pipelines) and that are also paid by politicians in exchange for votes (probably making unlawful use of public funds to pay for the service).

Figure 4. Water tanks: where water supply and votes meet.

Considering the sequence of projects and initiatives, it can be argued that the underlying trend is one of regular investments not in the resolution, but in the maintenance of water problems. The apparent contradiction between significant sums of money being invested and the widespread lack of care for the local communities can only be explained by considering the centralised and authoritarian formulation of investment programmes and, more importantly, because it is in the interest of hegemonic political groups. It is not technical incompetence or lack of resources that have perpetuated the water problem, but instead, that the continuation of poor water services creates favourable conditions for political patronage. The manipulation of public despair (such as by sending an emergency water tank) is a profitable electoral machine. At the same time, the constant formulation of new investment programmes reinforces the mandate of elected politicians and legitimises existing structures of power. Every four years a new governor takes seat, but the approach to water management problems in the Baixada remains remarkably unchanged.

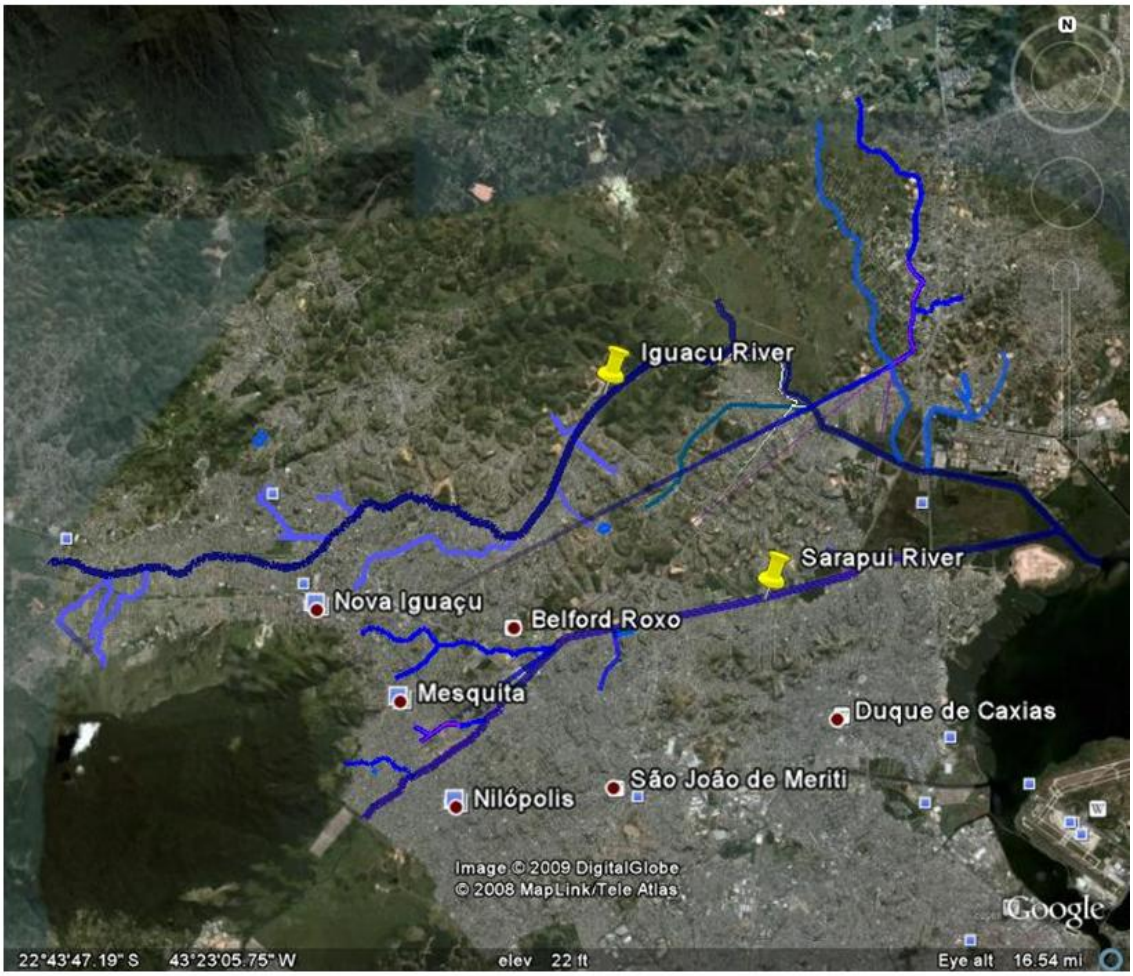
2.5. New Initiatives, the Same Unsustainable Trends

As mentioned above, government action has continuously focused on the formulation of new programmes, often apportioning additional resources to the same location or dealing with the same infra-structure work that was left unfinished in a previous project. Before an intervention is even completed, a new ‘generation’ of projects – normally launched by a different state administration to capitalise politically from the apparent novelty of the new project – is passed to occupy the water management agenda of the Baixada. For instance, since 2007, the latest round of water infra-structure

investments was announced with funds from the national Programme to Accelerate Growth (PAC). The overall programme included US$ 370 million for urban drainage projects (funds transferred to the municipal authorities), US$ 100 million for water supply (under the responsibility of CEDAE, the state owned water utility) and US$ 135 million to restore watercourses in the Iguaçu Catchment (under the responsibility of SERLA, which at the time of our research was the state water regulator and water resources management agency). We assumed here an exchange rate of R$ 2.00 = US$ 1.00. The latter is called 'PAC-SERLA' and corresponds to a reduced version of the aforementioned Iguaçu Project and its targets include river dredging, and revegetation and stabilisation of riverbanks (interventions worth US$ 97.5 million) and removal and resettlement of communities living along the river (US$ 37.5 million). Part of those investments will be used to conclude unfinished works initiated in previous projects, such as connecting water and sewage treatment plants that were built under PDBG and are still out of operation.

Because the goals of the PAC-SERLA project were focused on the Iguaçu catchment (i.e. the other projects funded by PAC don't have a similar spatial reference), its implementation received special attention during our fieldwork. See Figure 5 for an illustration of the location of the area of intervention of the PAC-SERLA project in Iguaçu River, in its tributary Sarapuí and in some other tributaries and sub-tributaries.

Figure 5. Location of the interventions included in the PAC-SERLA project.



The study of the PAC-SERLA project provided us with a unique opportunity to compare current practices with the past water projects from the perspective of water sustainability and public participation. For instance, the documentation of the project makes repeated reference to the 'sustainable use of water' and the achievement of 'environmental sustainability' [33], which confirms that these concepts that have been formally incorporated by local consultants and policy-makers. At its inauguration in July 2008 (just a few months before the local elections took place in October 2008, in which water was a critical electoral issue), governor Cabral declared it "an important work in the Baixada, which has the objective of saving [sic] people that live along the river and suffer from flooding" [49]. The governor claimed that 2.5 million people, the totality of the population living in the Iguaçu catchment, would benefit from the project, which was a gross exaggeration, later confirmed by civil servants (cf. interview with a coordinator of PAC-SERLA project, 07 Jul 2008), given that the interventions are restricted to selected river stretches.

In an attempt to respond to the growing demands for participation, two percent of the overall budget of PAC-SERLA was allocated to so-called 'social targets', which included services provided by a non-governmental organisation that was hired by the water regulator (SERLA) to mobilise the local population. The contract was for US$ 600,000 and the NGO service provider was selected by negotiation instead of open tender (i.e. even before the contract was signed, many of our informants were already aware of the winner). In confidential interviews, many professionals involved in this process expressed their inconformity and uneasiness with the overall direction of the service they were hired to deliver. On the personal level, some questioned the purpose of their work, given that they "live an incredible contradiction, all the time preparing projects and not having time to get engaged in the political movement" (interview with a think-tank activist, Jul. 2008). Interviews with the residents also confirmed the resentment of the local population with this rigid agenda of public mobilisation, as a lady put:

> "... They are making a lot of money and are trying hard to make our community accept and like the approaches used by SERLA; these guys come here with 'sophisticated' [a sense of irony in her voice] techniques to persuade the population. (…) But we are not stupid; this is the same technical staff of the New Baixada Programme that came here and made loads of promises. (…) We decided not to cooperate before they can show us a detailed programme of work and the engineering project" (interview with a resident of the Lote XV neighbourhood, Dec. 2008).

On of the most controversial aspects of the PAC-SERLA is the removal of more than 2,300 low-income families (around 10,000 persons) in order to make space for the machinery that will be needed to dredge the rivers. The aim is to resettle those directly affected in new flats (purportedly 'eco-friendly' units) still to be constructed, therefore requiring temporary accommodation in yet unknown locations [33]. Our fieldwork coincided with the organisation of open meetings with the population and the surveillance of those impacted by the removal. The inspection of households was done by social workers hired by a local NGO, which had been contracted by construction companies that provide service to the government. In all meetings, civil servants and consultants routinely arrived 1 or 2 hours later than the announced time and gave a standard PowerPoint presentation with only generic

information about the project. The activities followed a conference style, where the authorities were not prepared to answer specific questions about the impacts of the project on the community (Figure 6). The overall impression of the audience was that the meetings contributed little to improving awareness about the implementation of the project.

Figure 6. Public meetings during the implementation of the PAC-SERLA project.

In any case, the lack of detail didn't seem to concern those in charge of the meetings: on the contrary, they emphasised that "in the dictatorship, people were removed without any consultation, but now it is totally different" (mentioned in a public meeting on 10 Nov 2008). However, most of our interviews with residents, especially in the day immediately after the meetings – when people still had a clear recollection of the events – demonstrated a growing uneasiness about the project and a high level of uncertainty. When confronted with our evidences of the shortcomings of the participatory strategy underpinning the project, civil servants argued that "the project deadlines must be met" and there was limited time for dialogue with the public. However, the technical details of the Iguaçu Project were still being developed and had only recently received the environmental licence from the environmental agency (FEEMA, responsible for nature conservation and protected areas, now incorporated into the new state environmental institute, INEA), which seems to undermine the claim for urgency.

It is fundamental to realise that members of the public not just resisted the river restoration project in the light of bad previous experiences in the last decades (which are vividly present in their memories), but its implementation seems to repeat, under a superficial discourse of public participation and sustainable water management, the vices of earlier approaches. The most common objection among the residents affected by the river restoration project (i.e. PAC-SERLA) was the fact that only some of the families will be compensated for damage to or destruction of their houses, but the allocation of compensation was not yet decided. Note that there is no compensation for the loss of land,

since these are irregular settlements. Nonetheless, managers and engineers continually complain about the 'bad' environmental behaviour of the local population and their unreasonable resistance to fully accepting the new water infra-structure project. As mentioned by a project manager:

"In the end of the day, we can't say that the project [PAC-SERLA] is really going to be different or better than the previous projects. (...) Our goal here is to initiate a process that leads to the solution; all we can do is to concentrate on the larger rivers and work on one riverbank only, because money is limited. (...) The resistance of the public [to house reallocation] is natural; we are not sailing on a sea of roses. Any change is not natural. Nature is cyclical and continuous, so if you change something, this is against nature. It is not that the human beings are apathetic, but it is their nature to want to keep things as before. The Moon moves round the Earth, and that doesn't change (...) The person has been living there for many years, so it is not easy to agree to move. But we need to intervene in order to reduce flooding. These people are living in an area along the river that it is supposed to be permanently protected. (...) It is not possible for the public agencies to enforce the legislation, it is very difficult in such large and overcrowded areas. That is why our project is going to remove the population and built roads along the river to avoid new invasions" (interview with a manager of PAC-SERLA project, 29 Jul 2008).

But the population seems to have a different view about the project, which is illustrated here:

"They are not dealing with numbers, but with human beings. The people are being ignored. (…) The Political Committee of Sanitation has simply not been involved in the debate and this is the main arena of debate [for water supply and sanitation]. They have to understand. They [the government] should come here, learn about our personal history, our problems, family, daily tragedy. (...) But that is never important for them" (interview with a local resident, 22 Jul 2008).

Despite the importance of addressing the flooding problem in the Baixada, the implementation of the new project seems to closely follow the same centralised, top-down approach of previous programmes. As a member of a neighbourhood association in Duque de Caxias complained in a meeting in September 2008, "the various interventions funded by PAC were thrown upon us in a finished, closed version, with no room for discussion". In particular, the open meetings organised to inform the population about the objectives of the PAC-SERLA project didn't seem to achieve a successful result and residents complained that "they were tired of listening" and "wanted to be listened to". With months of meetings that contributed little to clarify this situation, there was a clear deterioration in the quality of the dialogue between civil servants, consultants and the local residents impacted by the flood defence project. The initial uneasiness about the lack of clarity on the details of the river restoration project gradually turned into a widespread opposition. For example, during the surveillance, social workers put a sign on the houses supposed to be demolished, but some residents started to erase those marks on the front doors and replaced with the sentence: "we are not moving". It was possible to gauge a particular level of tension in a meeting in November 2008, when some members of the audience verbally attacked the civil servants conducting the activities and nearly reached physical aggression. At that point, it became evident that both sides were no longer

communicating to each other: on the one hand there were civil servants and consultants using their usual PowerPoint presentation to emphasise the 'wonders' of the project; on the other hand, the population repeatedly complaining about scanty information, the lack of involvement of local authorities and the uncertain compensation for the damage on their houses. The most recent responses to old water problems have not only failed to improve the understating of local socionatural conditions, but also deepened the level of distrust between catchment communities and government agencies.

2.6. The Timid Contribution of the River Basin Committee

Against the background of persistent institutional distortion and water management problems described above, the introduction of a new regulatory framework through the 1999 state water law (Law 3239) was received with great expectations. The state legislation follows the principles of the federal law (9,433/1997) and both were influenced by the doctrine of integrated water management and environmental sustainability. That is translated into various articles of state law that define water as a public and finite good with economic value; it also states that drinking water has the highest priority among multiple uses, that the watershed is the basic spatial unit for planning and management, and that social actors should participate actively in decentralised management. Essentially, the new legislation meant a shift from supply augmentation alone to the management of demand according to multiple uses and the economic value of water [50]. Water users are now expected to apply for a licence before they can abstract water or discharge effluent; these licences attract fees and charges equivalent to the level of impact (i.e. bulk water charges based on the 'polluter-pays' principle). Finally, under the new regulatory regime, river basin committees are supposed to approve long-term plans and resolve conflicts (based on the principle of subsidiarity).

Despite its ambitious goals, the implementation of the new legal framework in many parts of Brazil has been marked by delays and inconsistencies [4], but the situation in the Rio de Janeiro Metropolitan Area has been particularly problematic and more controversial than in other states. The controversy started with the formation of the local river basin committee: instead of establishing its own forum, the Baixada was incorporated into responsibilities of the Guanabara Bay Committee, which covers all river basins that drain to the Guanabara Bay and two independent lacustrian systems (the full name is "Committee of the Hydrographical Region of Guanabara Bay and Lake Systems of Maricá and Jacarepaguá"). Following the new legislation, the Guanabara Bay Committee received powers of deliberation, oversight, planning and establishment of a water tariff scheme, whilst the state government, through the state water regulator (SERLA), retains control over issuing water use permits and collecting water use charges. Collected charges are then transferred to the committee and used according to an operational plan approved the State Water Council (which is a branch of the state administration with representatives of water users and civil society). The Guanabara Bay Committee has 60 seats, 20 distributed between the public sector (17 are seats taken by municipal, 2 by state and 1 by federal authorities), 20 distributed between water users (12 taken by industry representatives) and 20 distributed between civil society representatives (7 taken by organisations of the Baixada Fluminense). However, the appointment and replacing of committee members has been ambiguous and open for dispute, particularly because only entities that are formally associated with environmental questions are

eligible to participate in the committee. Because of that, grassroots organisations, such as community associations and other entities with legitimate interest in taking part in the committee activities, have been prevented from being elected (interview with NOG activist, 05 Jul 2008). It should be noted that the Guanabara Bay Committee is part of the new water regulatory framework and, for that reason, it did not incorporate the aforementioned Political Committee of Sanitation of the Baixada Fluminense. Weak as it may be, the Political Committee remains an independent forum of popular representation that is focused on water supply and sanitation issues.

More important, the formation of the Guanabara Bay Committee was not the outcome of a bottom-up process, but was unilaterally imposed by the governor in 2005 (Decree 38,260/2005), which contradicted the fragile mobilisation that had started to emerge, since 2001, in the east and west sections of the Bay. There has been some limited reaction to this distortion, such as a meeting called by some activists in December 2008, but its outcome is still uncertain. At the same time the committee was forced upon the communities of the Guanabara Bay, the government commissioned a master plan that provided an overview of resources and management options [39]. The simultaneous constitution of the committee by gubernatorial decree and the imposition of a master plan, neither of which had been previously discussed with the water stakeholders, could only elicit serious resentment from them. The already questionable legitimacy of the new representative forum was further increased by the erratic agenda of meetings and the tone of the internal debates. For example, in a meeting the president of the committee complained that local water management problems were missed by the committee while local water users continue to act as if the committee didn't exist (cf. committee meeting, 08 Nov 2007). In another meeting, there was a strong complaint about the lack of interest among many governmental and non-governmental organisations, which never nominate representatives to take seat in the committee (cf. committee meeting, 13 Mar 2008). Growing tension and disagreement about its political direction led to the resignation of the president of the Guanabara Bay Committee (Mrs Negreiros), only a week after giving us an interview. Interestingly, the new president expressed a position that was clearly more amenable to government interventions and less concerned with the environmental impacts of current development plans, mentioned below (interview on 07 Jul 2008).

The maelstrom about the composition and activities of the Guanabara Bay Committee are related to the broader disputes regarding the introduction of bulk water charges in the state of Rio de Janeiro. The requirement to charge all water users was one of the pillars of the 1999 legislation, but it was only in 2003 that a specific law introduced a charging mechanism (Law 4247), surprisingly approved by the state assembly of deputies with minimal parliamentarian debate. The most controversial part of the 2003 legislation was its Article 24, which forbade the transference of bulk water charges to the customers of public utilities. Although the state water utility (CEDAE) is responsible for around 80% of the income from the bulk water charges, it refused to make any payment if that could not be transferred to its business and household clients. The bizarre rebellion of a state-owned utility against its own government persisted till the current state administration, who proposed an amendment to Article 24. That eventually became the state law 5234/2008, whose text allows the transference of bulk water charges to the utility customers and, therefore, preserves the interests of CEDAE. At the time of our fieldwork, CEDAE hadn't yet started to make the payments, because of the pending negotiation about the backlog of unpaid bills.

Despite all the controversy, the revenues from bulk water charges are unlikely to provide a significant contribution to the Baixada, given that most of the water used there is imported from another river system (the Guandu River Basin), where the abstraction charges should be paid and reverted to the respective river basin committee. Regardless of the level of income, the destination of the revenues of water charges is already a source of internal anxiety in the Guanabara Bay Committee, even before CEDAE starts making its payment. Several members of the committee mentioned in the interviews that the decisions about where and how to allocate the resources are non transparent. As mentioned by one interviewee:

"The discussion [about the destination of committee funds] is very confusing, with the simultaneous, but cumbersome, analysis of various items (…). There are no criteria. The executive managers present their decisions about where the money will be spent and that was it. Done. I try to open the debate, discuss the priorities before deciding where to put the money. But those in charge of the meeting never accept that. It is clear that they had a political agenda and want to impose it" (interview with a think-tank activist and member of the Guanabara Bay Committee, 22 Jul. 2008).

In reality, the activities of the Guanabara Bay committee have so far offered little contribution to improve the overall management of water and to restore the environmental condition of the rivers of Baixada. A decade after its introduction, the new institutional framework is still too feeble to intervene in the formulation of policies and implementation of projects, which makes the state system of water management little more than a 'figment' [51]. Maybe the fundamental cause of the institutional weakness of the new committee can be related to the observation of a former member of the committee, who mentioned that

"Our overall aim is the sustainability of the [water] resource, but it is not easy to keep distance between the government and the river basin committee, which often means an interference in the direction of the committee activities" (interview with industry representative, 01 Aug 2008).

That was corroborated by a current member of the committee, who thinks that at the same time that some senior members of the government have been responsible for strengthening the formal structure of the committee, there is limited delegation of responsibilities and power sharing (cf. interview with sanitation engineer, 15 Jul 2008). Other informant even mentioned that:

"The new committee is formally, according to the legislation, the best instrument to supervise, monitor all these projects, but it is failing terribly. I can mention a number of moments that the population protested here, but the committee is unable to incorporate, canalise that in an effective manner. Even when they take interest, there is no continuity (interview with political activist, 18 Jul 2008).

The failures of the new institutional framework, in particular the activities of the river basin committee, are not only circumstantial problems, but reflect the long legacy of power asymmetry, lack of public accountability and capture of public agency by the stronger groups. This is consistent with the

observation that participatory forums established to deal with water issues in Brazil have recreated the regional political context, acting as an extension of the party political game rather than areas of stakeholder negotiation [52]. The overall performance of the river committee was summarised by a NGO activist that regularly attend the meetings as an observer:

"No public debate is being promoted. I mean, there is limited consciousness of the need to have a democratic management of water; also the river basin perspective is very limited. The mentality has been something like 'let's form a committee that the municipal authorities and all the rest will follow suit'. But it didn't work like that. (…) We had already 'thousands' of elections and every time the problems are the same, but these are not limited to the lack of resources. There are many other issues involved: waste of resources (…), the rationality of massive projects, the control of public organisations, and so on" (interview on 23 Jul 2008).

Because of its institutional weaknesses, the Guanabara Bay Committee has been virtually absent from the controversies around infra-structure and development programmes that are likely to have major impacts in terms of water management in the Baixada. A new petrochemical complex (Comperj) is being constructed in the vicinities of Baixada, on the eastern section of the Guanabara Bay, which will represent a major increase in water demand in the Metropolitan Area of Rio de Janeiro. It is intriguing that the petrochemical project was approved by the federal government – in an area already suffering from water deficits – without any decision about water supply (five possible alternatives were under consideration at the time of our fieldwork). The intensification of road traffic associated with Comperj will also require the construction of a new road by-pass (called the Metropolitan Crescent) to connect the petrochemical plant with the Port of Sepetiba on the other side of the Metropolitan Area. One of the most negative impacts of the Metropolitan Crescent is the fact that it is likely to lead to additional housing expansion over the last remaining areas of natural vegetation, located in the headwaters of the Iguaçu River and have been so far preserved due to their being relatively difficult to access. These two examples of a poorly planned development reveal how the most recent public policies for the region have reproduced the same pattern of short-term gain and lasting environmental impacts, which form the essence of unsustainability and unsustainable development.

3. Discussion and Conclusions: Water Sustainability as a Work in Progress

The water management problems in the Baixada Fluminense are not uncommon in peripheral metropolitan areas, particularly in Southern countries, that in recent decades experienced fast rates of growth and limited investments in infra-structure. Nevertheless, the specific circumstances of the Baixada Fluminense reflect a combination of long-term social marginalisation, abandonment of the local river system and lack of proper regulatory measures. This gamut of problems is not simply a sign of incompetence or lack of commitment on the part of civil servants and engineers – who, in our opinion, demonstrate a sincere will to improve the local circumstances – but is an indication of stronger underlying distortions created by decades of authoritarianism, populism, inadequate urban policies and disregard for the daily suffering of the local population. In other words, the limited integration between public authorities and between spatial areas, the ever-growing need for additional

funds and the deficiency of urban planning and environmental regulation are ultimately manifestations of an entrenched legacy of social exclusion and environmental injustices. In similar circumstances, Gutberlet and Hunter identified a direct relation between political marginalisation and bad living conditions in the periphery of São Paulo [53]. As mentioned in the introduction, conflicts around water use and conservation are intrinsically related to issues of fairness and the democratisation of management strategies. The most important manifestation of water unsustainability in the Baixada is precisely the fact that problems are identified and responses are formulated, but impacts and inequalities are constantly reproduced through development policies and the authoritarian attitude of public agencies. It means that water unsustainability is not simply the trend of bad water quality and water scarcity, but is deeply embedded in the highly asymmetric balance of power between the local communities and the political and economic priorities of regional development.

It is also worth noting that the power mechanisms behind water problems operate not only through the control of the state apparatus by hegemonic private interests, but also through the very failures of the official plans and projects. Water problems in a highly populated area, such as the Baixada, serve as an appealing justification for new official initiatives and investment plans, although no programme is ever formulated in consultation with the local communities. On the contrary, the political machinery benefits from the manipulation of social despair with electoral promises and, between elections, the occasional provision of water tanks. In the last two decades, despite substantial amounts of money invested in water infra-structure (estimated between one and one and a half billion dollars), the level of pollution, flooding and water scarcity has only increased. Water management demands are identified in one project only to be replicated in the next, with waste of resources and frustration of expectations. Successive projects have been hampered by implementation delays and, since 1990, been characterised by an increasing 'scientificisation' of water management (which has also proven inadequate to deal with the political origins of water problems). The unresponsiveness of the official agencies and in particular the customer treatment provided by the water utility (CEDAE) demonstrate that the underlying challenge is not technical, but essentially political. Scarce resources and operational difficulties have been significantly exacerbated by the lack of commitment of public agencies to ameliorate the quality of public water services, whilst the local population lacks the political means to revert these long-established trends. Many residents mentioned a number of times when they organised protests and hired buses to take people down the CEDAE's headquarters in Rio de Janeiro, but the water utility have systematically refused to listen. In one occasion, they received an ominous recommendation from a utility manager: "pray to rain, that is the best you can do…" (interview with a resident of Duque de Caxias, 06 Jul 2008).

The institutionalised unsustainability of water management in the Baixada has re-emerged in recent attempts to respond to social and environmental demands through the implementation of the new water legislation (informed by the goals of integration and sustainability). To be sure, the new institutional framework is certainly an improvement in relation to the decision-making carried out during the dictatorial period or even the populism that characterised government action earlier in the 20th century. There is now a regulatory structure that includes consultations and open meetings, whilst the Guanabara Bay Committee is the formal arena of representation. However, a more qualitative assessment of these recent developments reveals a disturbing paradox: the adoption of key elements of

the agenda of water sustainability has not resulted in more democratic and inclusive water policies. As openly stated by the chief-director of the water regulation agency (SERLA), "it is not because the committee recommends something that the intervention of public agencies will have to follow it" (cf. minutes of the Guanabara Bay Committee meeting, 24 Apr 2008). If current policies and initiatives have broadened the agenda to formally include elements of public participation, these still operate within the limited space created by the technocratic rationality that conceals or denies the political dimension of water problems. As described by Cooke and Kothari, behind a discourse of participatory democracy, there are only rigid and centralised forms of decentralisation [16]. Although the new regulatory context encourages the formation of a 'multistakeholder dialogue' that is supposed to involve all social actors of the Guanabara Bay, it is normally the case that government agencies maintain a privileged position in the decision-making process, while most of the other stakeholders are not really considered as partners (as identified elsewhere [54]). Overall, the Guanabara River Committee quickly became another missed opportunity to join efforts for the resolution of long-standing water problems, especially because its activities have been systematically contained by government pressures and economic priorities (such as the petrochemical industry).

The Guanabara Bay Committee was created by gubernatorial decree and in frontal disagreement with the bottom-up mobilisation that started to emerge in different river basins in the Metropolitan Area. At the same time, other organisations that historically served to express public opinion, such as the neighbourhood associations and the Political Committee of Sanitation, have been increasingly ignored by public authorities and even local communities. Because of the enduring and unresolved water problems, the public seems more predisposed to resort to populist politicians (that can at least answer to their urgent demands) rather than taking part in endless meetings and protest marches. In the last few years, environmental NGOs have become an increasingly important player in the water debate in the Baixada. However, most environmental NGOs adopt a more 'pragmatic' strategy, such as claims for eco-efficiency or better environmental regulation, instead of more directly addressing the political dimension of water management problems. The typical NGO activist in the Baixada is a low middle class individual with a university degree and strong views about the environment, but not necessarily a clear political affiliation. Tesh and Paes-Machado make reference to the experience in other parts of Brazil, where, despite the obvious agreement about the insalubrious condition facing the majority of the Brazilian population, environmental-movement organizations have paid scant attention to sanitation and limited their activities to the preservation of natural resources and the prevention of industrial pollution [55]. In that sense, environmental activists frequently ignore the politicised basis of water management problems and, as a result, may fail to offer a more substantive contribution to address unsustainable trends.

The search for water sustainability in the Baixada Fluminense should be seen as an element of the ongoing transition from 'old' to 'new' regulatory approaches in the state of Rio de Janeiro. That involves not only the improvement of technical and managerial systems, but more importantly the construction of participative forms of decision-making. It is clear that some progress has been made and, at least in the discourse, new policies and projects demonstrate a higher level of integration and environmental concern. However, there is still plenty of evidence that, despite changes in the rhetoric, water managers and policy-makers maintain a detached and highly structured dialogue with local

communities and their political leadership. It is not enough to call for 'public participation' and 'non structural measures' (to replace more rigid engineering interventions) when the problems of water management remain related to the asymmetric balance of power and democratic deficits. The engagement of the local public cannot be only a formal requirement of public guidelines or development programmes, but needs to be seem as part of a more radical process of change [56] and should necessarily include distributive and compensatory measures [25]. Finally, a genuine agenda of water sustainability for the Baixada cannot be dissociated from the reversal of highly discriminatory process of urban growth and socioeconomic development. Ultimately, water sustainability remains a sectoral issue, but with profound demands and repercussions for other areas of environmental management and public policy.

Acknowledgements

The authors would like to acknowledge the financial support from the Brazilian Research Council (CNPq) and warmly thank all the informants and organisations that agreed to take part in the research, as well as for the opportunity to attend numerous meetings and have access to internal data. Thanks to Dr. Paulo Carneiro for the images used in 'Figure 1' and to Diana L. Mcnamara for helping with the preparation of the text.

References

1. Gleick, P.H. Water in crisis: Paths to sustainable water use. *Ecol. Appl.* **1998**, *8*, 571-579.
2. Syme, G.J.; Nancarrow, B.E. Achieving sustainability and fairness in water reforms: a western Australian case study. *Water Int.* **2006**, *31*, 23-30.
3. Mollinga, P.P. Water, politics and development: Framing a political sociology of water resources management. *Water Alternatives* **2008**, *1*, 7-23.
4. Ioris, A.A.R. The limits of integrated water resources management: A case study of Brazil's Para ba do Sul River Basin. *Sustainability: Science, Practice, & Policy* **2008**, *4*, 4-11.
5. Barraqu é, B. Integrated and participative river basin management: A social science perspective. *IAHS-AISH Publication* **2008**, *323*, 111-123.
6. House, M.A. Citizen participation in water management. *Water Sci. Technol.* **1999**, *40*, 125-130.
7. Rouse, M.J. *Institutional Governance and Regulation of Water Services: The Essential Elements*; IWA Publishing: London, UK, 2007.
8. ACC. *The Dublin Statement and Report of the Conference. International Conference on Water and the Environment, 26–31 January 1992, Dublin, Ireland*; UN Administrative Committee on Co-ordination, Inter-Secretariat Group for Water Resources: Geneva, Switzerland, 1992.
9. Delli Priscolli, J. What is public participation in water resources management and why is it important? *Water Int.* **2004**, *29*, 221-227.
10. Loubier, S.; Rinaudo, J.-D.; Garin, P.; Boutet, A. Preparing public participation at the catchment level: Comparison of three methodologies applied to the H érault River Basin. *Water Sci. Technol.* **2005**, *52*, 33-41.

11. Mostert, E. The challenge of public participation. *Water Policy* **2003**, *5*, 179-197.
12. Warner, J. Multi-stakeholder platforms: Integrating society in water resource management. *Ambiente & Sociedade* **2005**, *8*, 1-20.
13. Scott, L. Participatory multi-criteria decision analysis: A new tool for integrated development planning. *Development Southern Africa* **2005**, *22*, 695-716.
14. Kenyon, W. A critical review of citizen's juries: How useful are they in facilitating public participation in the EU water framework directive? *Journal of Environmental Planning and Management* **2005**, *48*, 431-443.
15. Smith, J.L. A critical appreciation of the "bottom-up" approach to sustainable water management: Embracing complexity rather than desirability. *Local Environment* **2008**, *13*, 353-366.
16. *Participation: The New Tyranny?*; Cooke, B., Kothari, U., Eds; Zed Books: London, UK & New York, USA, 2001.
17. Ribot, J.C. *Democratic Decentralization of Natural Resources: Institutionalizing Popular Participation*; World Resources Institute: Washington, D.C., USA, 2002.
18. Alatout, S. State-ing natural resources through law: The codification and articulation of water scarcity and citizenship in Israel. *Arab World Geographer* **2007**, *10*, 16-37.
19. Zeitoun, M.; Allan, J.A. Applying hegemony and power theory to transboundary water analysis. *Water Policy* **2008**, *10*, 3-12.
20. Loftus, A.; Lumsden, F. Reworking hegemony in the urban landscape. *Trans. Inst. Brit. Geogr.* **2008**, *NS 33*, 109-126.
21. Anand, P.B. Capability, sustainability, and collective action: An examination of a river water dispute. *Journal of Human Development* **2007**, *8*, 109-132.
22. Özerol, G.; Newig, J. Evaluating the success of public participation in water resources management: Five key constituents. *Water Policy* **2008**, *10*, 639-655.
23. Larson, K.L.; Lach, D. Participants and non-participants of place-based groups: An assessment of attitudes and implications for public participation in water resource management. *J. Environ. Manage.* **2008**, *88*, 817-830.
24. Heyd, H.; Neef, A. Public participation in water management in Northern Thai Highlands. *Water Policy* **2006**, *8*, 395-413.
25. Schlosberg, D. Reconceiving environmental justice: Global movements and political theories. *Environ. Polit.* **2004**, *13*, 517-540.
26. O'Riordan, T. Environmental science, sustainability and politics. *Trans Inst. Brit. Geogr.* **2004**, *29*, 234-247.
27. Werlen, B. *Society, Action and Space: An Alternative Human Geography*; translated by G. Walls; Routledge: London, UK & New York, USA, 1993.
28. Sayer, A. *Method in Social Science: A Realist Approach*, 2nd Ed.; Routledge: London, UK & New York, USA, 1992.
29. Corbin, J.; Strauss, A. Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology* **1990**, *13*, 3-21.
30. Cloke, P.; Cook, I.; Goodwin, M.; Painter, J.; Philo, C. *Practicing Human Geography*. SAGE: Los Angeles, USA, 2004.

31. Sarewitz, D. Public science and social responsibilities. *Development* **2006**, *49*, 68-72.
32. Kelman, J. Macrodrenagem do programa Reconstrução-Rio. In *Saneamento Ambiental na Baixada: Cidadania e Gestão Democrática*; Florêncio, J., Porto, H.R.L., Santos Júnior, O.A., Eds.; FASE: Rio de Janeiro, Brazil, 1995; pp. 63-78.
33. ECOLOGUS. *Relatório Ambiental Simplificado – Primeira Fase do Projeto de Controle de Inundações e Recuperação Ambiental das Bacias dos Rios Iguaçu/Botas e Sarapuí (Projeto Iguaçu)*; SERLA: Rio de Janeiro, Brazil, 2007.
34. Rio de Janeiro. *Plano Diretor de Recursos Hídricos da Bacia dos Rios Iguaçu-Sarapuí*; Fundação Superintendência Estadual de Rios e Lagoas (SERLA): Rio de Janeiro, Brazil, 1996.
35. Gramacho, A. A ponte da discórdia: Uma disputa entre os barqueiros do Rio Iguaçu e a Ferrovia no final do Século XIX. *Revista Eletrônica do Instituto Histórico* **2006** (not numbered); Available online: http://www.cmdc.rj.gov.br/base.asp?area=revista.
36. IPPUR. *Mapa dos Conflitos Ambientais no Estado do Rio de Janeiro*; IPPUR & FASE: Rio de Janeiro, Brazil, 2004.
37. Vasconcelos, V.O. A degradação dos rios na Baixada Fluminense: Uma análise sobre o Rio Botas no Bairro Itaipu – Belford Roxo. *Revista Pilares da História* **2005**, *5*, 35-47.
38. Cardoso, A.; Corrêa, L. Pobreza urbana no Rio de Janeiro. *Cadernos IPPUR* **1993**, *7*, 67-78.
39. Rio de Janeiro. *Plano Diretor de Recursos Hídricos da Região Hidrográfica da Baía de Guanabara*; Governo do Estado do Rio de Janeiro, Secretaria de Estado de Meio Ambiente e Desenvolvimento Urbano: Rio de Janeiro, Brazil, 2005.
40. Porto, H.R.L. *Saneamento e Cidadania: Trajetória e Efeitos das Políticas Públicas de Saneamento na Baixada Fluminense*; FASE: Rio de Janeiro, Brazil, 2003.
41. SERLA. *Projeto de Trabalho Técnico Social (Anexo II)*; SERLA: Rio de Janeiro, Brazil, 2008.
42. Barreto, A.S. *Cartografia Política: As Faces e as Fases da Política na Baixada* Fluminense, PhD Thesis; Museu Nacional/UFRJ: Rio de Janeiro, Brazil, 2008.
43. Souza, M.S. Os impactos das políticas agrárias e de saneamento na Baixada Fluminense. *Revista Pilares da História* **2006**, *4*, 17-25.
44. Tôrres, G. *Baixada Fluminense: A Construção de uma História*; IPAHB: São João do Meriti, Brazil, 2004.
45. *Sociedade em Movimentos: Trajetórias de Participação Social na Baixada Fluminense*; Macedo, M.E., Maia, J.G.V., Monteiro, M.G., Eds; Imprinta Express: Rio de Janeiro, Brazil, 2007.
46. Rio de Janeiro. *Programa de Despoluição da Baía de Guanabara*; Governo do Estado: Rio de Janeiro, Brazil, 1994.
47. Britto, A.L. Implantação de infra-estrutura de saneamento na região metropolitana do Rio de Janeiro. *Estudos Urbanos e Regionais* **2003**, *5*, 63-77.
48. Vargas, L.A. *O Programa de Despoluição da Baía de Guanabara: Uma Análise na Perspectiva de Saúde Coletiva*; PhD Thesis, IMS/UERJ: Rio de Janeiro, Brazil, 2001.
49. Rio de Janeiro. *Lindberg e Cabral Lançam as Obras de Construção de Casas no Cobrex*; Available online: www.governo.rj.gov.br/listaNoticias.asp (accessed on 7 January 2008).
50. Braga, B.P.F.; Flecha, R.; Pena, D.S.; Kelman, J. Pacto federativo e gestão de águas. *Estudos Avançados* **2008**, *22*, 17-42.

51. Dantas, E.S.R. *Impacto Financeiro da Cobrança Estadual pelo Uso dos Recursos Hídricos sobre o Setor de Saneamento e Vice-Versa*, MSc Dissertation; COPPE/UFRJ: Rio de Janeiro, Brazil, 2007.
52. Schattan P.; Coelho, V.; Favareto, A. Questioning the relationship between participation and development. A case study of the Vale do Ribeira, Brazil. *World Develop.* **2008**, *36*, 2937-2952.
53. Gutberlet, J.; Hunter, A. Social and environmental exclusion at the edge of São Paulo, Brazil. *Urban Design (international)* **2008**, *13*, 3-20.
54. Stewart, A.; Gray, T. The authenticity of 'type two' multistakeholder partnerships for water and sanitation in Africa: When is a stakeholder a partner? *Environ. Polit.* **2006**, *15*, 362-378.
55. Tesh, S.N.; Paes-Machado, E. Sewers, garbage, and environmentalism in Brazil. *Journal of Environment and Development* **2004**, *13*, 42-72.
56. *Participation: From Tyranny to Transformation?;* Hickey, S., Mohan, G., Eds; Zed Books: London, UK, 2004.