ESSAY

The Troubled Waters of Brazil: Nature Commodification and Social Exclusion*

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Introduction

Since the beginning of the 20th century, control over water resources and transformation of the waterscape have been integral to the expansion of industrial and commercial activities in Brazil. Through the construction of many and varied engineering schemes, the provision of electricity, supply of freshwater, and introduction of irrigation, water was progressively transformed into a commodity that could be labeled, quantified, transported, priced and, ultimately, traded.

However, commodification has created some fundamental social and environmental inequities, which reflect some of the broader dilemmas of economic development in Brazil. For instance, water supply and electricity are more available in the industrialized south and southeast than in the poorer states of the north and northeast. This discriminatory pattern of unequal water service provision is replicated across the neighborhoods of most towns and cities. Throughout the country, conflicts are common between upstream and downstream users due to humanly produced water scarcities. Moreover, many rivers are now seriously polluted due to lack of sewage treatment and the use of agricultural pesticides.

This essay attempts to demonstrate that, as with other industrializing countries, the task of advancing water management in Brazil is hampered by exclusionary political and economic practices. The imperative of development has dictated that rivers, coastal waters and groundwater be fully explored—but primarily for the benefit of the economic elite. Efforts to control and manipulate water have been part of an overall process of capital circulation that does not happen automatically but occurs as a result of political struggles and conflicts at many levels. The circulation of money has ultimately shaped the circulation of water, which has dramatically changed water's political meaning and social value.

In Brazil, the impact of water management practices generally goes unchecked due to timid enforcement of environmental regulations, which in turn, holds nature hostage to national and international economic pressures. In fact, environmental degradation occurs both when the economy grows and more resources are exploited, and during periods of economic stagnation when environmental protection is further relaxed to help boost economic activity.

In order to address the detrimental consequences of the country's past water management practices, new water regulations were implemented in 1997. Despite the fact that the current water policy framework states that integrated management and public participation are key objectives, the negative social and environmental effects of development remain unaddressed. The central tenet of the new legislation emphasizes the economic value of water, and consequently has provided a legal and political basis for further marginalizing stakeholders as well as encouraging the privatization of public utilities. Indeed, there is growing empirical evidence that the new system of water

management is controlled and manipulated by strong political groups. As in the past, water management continues to pave the way for the commodification of water resources and, inevitably, the reproduction of uneven and unfair socioeconomic outcomes.

The present water management regime in Brazil reflects the current worldwide dominance of neoliberal economic policies. But alternatives do exist. They would, however, depend on profound reassessments of economic priorities, democratic governance, and the role of the state.

Development and Water Control in Brazil

According to Swyngedouw, the world is "a process of perpetual metabolism in which social and natural processes combine in a historical-geographical production process of socionature," which is never-ending, highly politicized, contested and contestable. Water development is one element of that complex metabolism between society and nature; it also involves the manipulation of the water cycle to satisfy human demands and express social values. For water resources to be sustainable, catchment systems must remain resilient, and critical ecological functions must be maintained. There must also be fair and equitable distribution of opportunities across groups and generations without barriers erected against any class, race or gender.

The Brazilian experience of water development has significantly departed from this idealized notion of sustainability. As in many places, development has meant that the waterscape has been dramatically transformed by structural interventions that modified not only the physical and chemical features of water resources but also the morphology of watercourses and the patterns of biodiversity. As a result, a large proportion of Brazil's water bodies have suffered appalling pollution, induced sedimentation, alteration of water flow, destruction of habitats, reduction of plant and animal communities, in addition to flooding and various forms of water shortage. This has also created a hierarchy of social opportunities with the best provision of services available to those with higher incomes, while the negative consequences of water development have systematically affected the country's poorer groups, particularly residents of floodplain areas, landless peasants, indigenous tribes and peoples affected by dam construction.

At the beginning of the 20th century, Brazil had a population of 17.5 million, approximately 80 percent of whom lived in the countryside. The economy was based on the export of primary goods, particularly coffee, rubber and cocoa. A domestic market was emerging and benefited from the abolition of slavery in 1888 and by the constant flow of immigrants. In this phase, engineered water projects were in their infancy, and the few water companies that existed were basically confined to major urban centers. Public water supply was mainly in the hands of private investors (many of whom were foreigners), who obtained concessions to operate in wealthy neighborhoods where people could afford to pay for water service. Power companies were few and isolated, and they depended on foreign investment for electricity generation, transmission and distribution. Two electricity companies, Light and Power (Canadian) and AMFORP (USA), were established in the main cities, Rio de Janeiro and São Paulo. Gradually, those two companies controlled most of the electric sector in the rest of the country, which in the 1920s comprised 343 municipal utilities.

In 1930, a political insurrection led by a populist alliance using the coercive power of the military replaced the old agrocommercial bourgeoisie with a new industrial elite as

the country's ruling class. As agricultural profits continued to decline, capital accumulated from coffee exports was invested into the nascent industrial sector with considerable success. For many decades the economy grew extremely rapidly by means of the "import substitution" model.

During this phase, the publication of the Water Code in 1934 represented a milestone in the regulation of water development. The Code provided a legal basis for the construction of heavy civil engineering schemes required to supply water and electricity to the industry.

By the end of the 1950s, all private electricity generation was nationalized, and hydropower construction proceeded rapidly under the leadership of the national government. Within a few years, using increasing sums of money lent by international financial organizations, rivers were interconnected and large impoundments were built. The rapid rate of hydropower expansion in the 20th century can be seen in Table 1. (Note the high percentage of total electricity provided by hydropower in Brazil).

Table 1. Evolution of Hydropower Generation in Brazil (1920-1999)

Year	Installed Power (MW)	Annual Rate of Growt (%)	Percentage of total electricity provided by hydropower (%)
1920	370.1	—	77.8
1930	615.2	5.21	80.8
1940	1,009.4	5.08	81.1
1950	1,535.7	4.29	81.6
1960	3,642.0	9.02	75.9
1970	9,088.0	9.58	79.3
1980	25,584.0	10.90	81.6
1990	44,900.0	3.93	91.6
[1999]	59,548.0	6.24	89.4

As a result of decades of investment in water control, there are now 573 large hydropower schemes operating in Brazil. Most of the existing schemes were established during the period of military dictatorships (1964-1985), when the control of natural resources was viewed as a matter of national security. However, energy shortage problems commonly persist, and the average rate of supply per capita is still only 200 kWh/year (merely 80th in the world).

Despite their limited energy use, low-income families (around 30 percent of the population) normally spend 10 percent of their salary on the electricity bill and pay higher tariffs per unit of energy consumed than large industrial consumers. Furthermore, 12 percent of the population, most of whom live in states with high rural populations, still lack access to a supply of public electricity.

Only about a quarter of the total hydroelectricity potential in Brazil has been developed so far. According to official estimates, another 260,000 MW could be generated by 4,120 potential schemes. Yet hydropower cannot easily be expanded, because most of the remaining sites are located in the Amazon basin, where the normal drawbacks of large-scale dams—displacement of people, parasitic infectious diseases, sediment erosion, declining water quality, dramatic loss of biodiversity and habitat destruction—would be greatly exacerbated.

The most ambitious project carried out by the ruling military dictators in the region was the Carajás mining complex—the largest in the world—located in the states of Pará and Maranhão on the eastern edge of the Amazon rainforest. The exploration of iron and other minerals depended heavily on the construction of a massive hydroelectric dam. In the 1970s, construction began on the Tucuruí Dam on the Tocantins River, 300 kilometers south of the city of Belém. Completed in 1984, the dam is the largest in the world in a tropical rainforest environment. The artificial reservoir has 215 km of extension and a flooded total of 2,850 $km^{2.}$ Its electricity generating capacity is 4,240 MW, which is intended to increase to 8,000 MW when new turbines are installed.

The main difficulty with hydropower schemes in the Amazon is the relative flatness of the terrain, which leaves vast areas of forest permanently inundated. In the case of Tucuruí, enormous areas were deforested, river flows were significantly altered, and large numbers of towns and indigenous reserves along the Tocantins River Basin were displaced.

Because contractors failed to clear the trees before flooding the huge reservoir more than 20 years ago, decaying trees now release substantial quantities of greenhouse gases, which negate any benefits from the carbon-free electricity generation of hydropower. The stagnant waters in the reservoir also brought an infestation of aggressive flies and mosquitoes, resulting in outbreaks of associated diseases such as malaria and leishmaniasis.

Furthermore, ill-conceived interventions like Tucuruí have deprived local communities of their traditional resources and produced a serious struggle for both space and survival, since most of those affected received no compensation from the state and were forced to move to the periphery of other cities. The main beneficiaries of the "aqua-military-industrial" complex in the Amazon have been Brazilian construction companies in conjunction with the government and multilateral lending agencies.

Amazonian deforestation and fires account for more than 75 percent of Brazil's greenhouse gas emissions and place the country among the world's top contributors to global climate change. There are growing indications that deforestation is causing a discernible change in rainfall rates and seasonality in the Amazon. Scientists project that forest clearance can reduce 8-10 percent of the region's annual precipitation as well as change the magnitude and frequency of extreme hydrological events, such as floods and droughts, which can disrupt ecosystems more severely than the gradual deviation from average climatic conditions. Human health and mortality rates are also likely to worsen due to heat waves, droughts, fires, and floods.

Those somber projections were empirically verified in 2005 when the worst drought ever recorded in the Amazon devastated ecosystems and communities on an unprecedented scale (it was possible to see boats stranded on dry riverbeds and cattle dying because of lack of drinking water). One of the greatest concerns is that if deforestation continues to expand and reaches 40 percent of the total area (17 percent is deforested now), it will trigger an irreversible process, making the largest tropical rainforest in the world into a savannah.

During the 20^{th} century, irrigation for agriculture also received strong governmental support in Brazil and reached a continuous expansion of 30 percent per decade (Figure 1). By the end of the 1990s, a total of around 3 million hectares were irrigated out of 16.1 million hectares with irrigation potential.

Irrigation has been one of the pillars of the Green Revolution, which turned Brazil into a world leader in agribusiness. For example, the country exported US$43.6 billion worth of agro-commodities in 2005. However, the economic incentives for expanding irrigation have regularly encouraged the cultivation of land in areas where there is not enough water in the catchment to cope with current irrigation demand. This is a common occurrence in water-scarce catchments close to Brasília where in the 1980s large agribusiness enterprises were given financial incentives to install inefficient and expensive center-pivot irrigation systems to produce beans, pastures and coffee.

To irrigate 100 hectares of land in Brazil typically requires a volume of water that equals the average demand of 50,000 people. Consequently, throughout the country serious conflicts have arisen over water extraction for irrigation and urban supply. Fights pitting irrigation against hydropower have also become common. The ecological and social problems stemming from irrigation are still more evident in Brazil's semi-arid northeast, a region in economic decline that is now the largest pocket of misery in the Americas.

During the 20th century, water insecurity was used as a political justification for promoting irrigation in the northeast, though it failed to improve the lives of the region's poorer groups. Instead of helping the more vulnerable sectors of the rural population, the expansion of irrigation merely maintained the historical association between land ownership and water provision, since water storage capacity remains concentrated in the hands of large landowners. Thus, more than 95 percent of the beneficiaries are political allies that have never been badly affected by droughts, while most of the people affected during dry periods continue to be small farmers, squatters and sharecroppers. During periods of water scarcity, the regional elite further consolidate their holdings by cheaply acquiring land and animals from small farmers. A confidential World Bank report shows that only 4 percent of aid actually reaches the drought victims themselves, illustrating that drought relief schemes have done nothing but fostered political corruption. Nevertheless, politicians generally prefer to launch new programs with electoral appeal instead of blaming those responsible for past mistakes.

Figure 1. The expansion of irrigated areas in Brazil.

Public water services (i.e., water supply and wastewater treatment) represent the third main sector responsible for water commodification in Brazil. As with the electricity sector, water supply and wastewater treatment providers had to expand in order to cope with rapid industrialization and population growth in the 20th century. Following legal reforms after 1930, the control of utility companies was gradually transferred to municipal administrations from the previous private owners. In addition, the federal government established the National Health Foundation (FNS) and the National Department of Public Works and Sanitation (DNOS) in the 1940s to support the work of the local authorities. However, it was only in the 1970s that the sector experienced a major shift with the launching of the National Sanitation Plan (PLANASA).

Between 1970 and 1990, the percentage of urban households served by water supply went from 60.5 percent to 86.3 percent, and the percentage served by sewage collection rose from 22.2 percent to 47.9 percent. Moreover, during this same period, growing political and administrative problems together with evidence of corruption and mismanagement led to declining rates of investment, with a decrease from 0.34 percent of GDP in the 1970s to 0.28 percent in the 1980s, and only 0.13 percent in the 1990s.

As with hydropower and irrigation expansion, PLANASA was a major source of billions of dollars worth of contracts for construction companies and consultancy firms. Funds for infrastructure investments were concentrated in the hands of the federal government and then transferred to the state companies for contracting projects. PLANASA removed the autonomy of municipal companies and forced them to transfer the operation of local services to state water utilities through 30-year concessions. The majority of these contracts will expire in the next few years, which sets the stage for dramatic changes in water supply and wastewater management in Brazil.

After PLANASA was formally terminated in 1992, the sector began to shift towards a more decentralized and flexible provision of services based on increasing competition between public and private companies. Under the conservative administration of President Cardoso (1995-2002), new legislation, Law 8979/1995, was passed to specifically stimulate the involvement of private companies. However, the neoliberal reform of the sector remains incomplete, since it has been impossible to reach sufficient political agreement to approve further legislation.

Of all the sectors of water management, the most serious social and environmental problems are related to the collection and treatment of wastewater. Public wastewater facilities only serve 18.6 percent of Brazil's municipalities. Barely 35 percent of the collected sewage receives treatment—mainly primary sewage treatment, which removes just 30 percent of total organic material.

The Sinos River in the south provides a grim example of the environmental impacts of the lack of effluent treatment. Water quality was satisfactory until the 1940s, when expanding population and industry in the watershed began fouling the river's water. By 1970, industrialization had transformed the population of the region from one that was predominantly rural to an essentially urban population. The river basin has been the main producer and exporter of leather footwear to the United States and Europe. Apart from shoes, the local industrial sector includes metallurgy, textile, and chemical production. As a consequence, considerable water contamination by coliforms and heavy metals, particularly

chromium, has destroyed most forms of life along 190 kilometers—almost the entire length of the river.

Organic and inorganic water pollution are responsible for the great majority of water-related diseases that account for more than half of hospital visits in Brazil. Unsurprisingly, the impacts of the lack of drinking water and sewage treatment have mainly affected the poorer strata of Brazilian society. The more affluent social groups—defined as people whose monthly household income is equivalent to more than five minimal wages—are significantly better attended, especially in terms of sewage collection and treatment, than those who earn less (see Table 2).

Table 2. Provision of Public Water Services in Brazil (1981-1989)

Households per Income Group	Proportion of the Population with Water Services by Income Group (%)					
	Treated water		Sewage collection		Sewage treatment	
	1981	1989	1981	1989	1981	1989
0-2 MW	59.3	76.0	15.0	24.2	0.6	4.7
2-5 MW	76.3	87.8	29.7	39.7	1.3	8.2
> 5 MW	90.7	95.2	54.8	61.2	2.5	13.1
All	78.4	89.4	36.7	47.8	1.6	10.1

(MW = official minimum wage [approximately US$ 100 per month])

Water development in Brazil throughout the 20th century emphasized massive infrastructure expansion to support industrialization, irrigation, and urban growth. The expansionist style of water development converted the natural abundance of resources into scarcity through misuse and overuse without being able to cope with the demand for drinking water, sewage treatment, and electricity for the poorer social groups. Unfortunately, the improvement of the country's environmental legislation and institutional capacity—particularly the creation of the national environmental agency, SEMA, in 1973 (which is now the Ministry of the Environment, MMA) and equivalent agencies at the state level—coincided with the growth of negative environmental impacts and socio-environmental inequalities. However, the social and environmental contradictions of water development corresponded to the model of economic growth adopted in Brazil and are integral to the process of nature commodification required for the accumulation of capital. Thus it is not surprising that the allocation and use of water mostly benefited the small economic elite at the expense of the majority of the population.

The Privatization of Public Utilities in Brazil

The expansion of water infrastructure, led by the central government of Brazil, served the purposes of an elitist, disruptive model of economic development that prevailed for half a century. More recently, with the declining political legitimacy of the state, nature's commodification has shifted to more "liberal" alternatives of water allocation and control. The neoliberalization of the water sector is based on the premise that the market is more efficient and reliable than governments at providing services, because it eliminates political interference and imposes financial discipline on public utilities. Under neoliberal pressure, the specter of water scarcity, lack of public finance, and the "failed state" thesis combined to present powerful justifications to expand the market sphere and position it as the institution most naturally suited to allocate water resources. As is the case in many other countries, in Brazil market efficiency and private enterprise are now pervasively supported

by mainstream political parties, while government intervention to reduce social exclusion and environmental degradation is considered inefficient and therefore anachronistic.

Utility privatization is one of the main ordeals neoliberal globalization policies impose on countries in the global South, such as Brazil. In 2004, Brazil's economy, as measured by its gross domestic product (GDP), was ranked the fourteenth largest in the world. It follows then, that the Brazilian program of utility privatization is also among the world's largest.

From 1991 to 2001, the private sector spent US$67.9 billion and assumed US$18.1 billion worth of debts in order to acquire 119 state-owned firms and buy shares in a number of companies where the state had minority control. In addition, private investors offered another US$17.1 billion that was used to purchase shares in companies that still remain under state control, obtain concessions of public services, and acquire scattered, non-controlled stakes in various private companies owned by the development bank, BNDES.

Following the neoliberal game plan in the years before the sell-off, the government helped pave the way for privatization by reducing the investment capacity of public utilities, which led to declining levels of service. Government assistance to the newly privatized utilities continued with loans from public banks (US$15 billion between 1995-2001), agreements to contractual clauses that protect them against exchange rate fluctuations, and permission to increase consumer tariffs above the rate of inflation, while at the same time allowing the companies to remove subsidies that would have helped low-income families pay the higher utility bills. With such generous legal, operational, and financial gifts from the public sector, newly privatized companies improved their income and profits, while the value of the companies soared. Indeed, profitability continued to rise even as investment and tax contributions declined.

Electricity

Thirty-one percent of the overall sell-off of public assets in Brazil occurred in the hydroelectric sector, though 60 percent of the country's electricity generation capacity remains in government hands. Through the 1990s, private investors bid approximately US$23.5 billion to gain control of public electricity companies. The Brazilian government, primarily through BNDES, directly financed 48 percent of that money. The legislation covering such transactions was amended to remove differences in requirements for private domestic and private foreign firms, which made it possible for foreign groups to bid for concessions in the electric sector and build new hydropower schemes. The agreements included valuable incentives, such as non-controllable cost clauses, which sheltered the companies from a range of cost increases by allowing the companies to pass the increases on to the ratepaying public. For example, the contracts for these agreements were negotiated using U.S. dollars, so when the Brazilian currency was devalued in 1999, the companies were allowed to adjust prices to cover the exchange rate discrepancy, which resulted in enormous rate increases for customers.

More than a decade of experience has shown electricity privatization in Brazil to be technocratic, unpopular, and undemocratic. It has resulted in bad service to customers and growing unemployment, with 53,230 jobs lost in the sector between 1995 and 1999. It has also been plagued by suspicions of wrongdoings and corruption scandals.

More fundamentally, the market rationale introduced in the electricity sector has constrained the government's capacity to cope with basic social needs. The privatized companies, who are under constant pressure from shareholders to deliver profits in the immediate future, lack incentives to implement energy-saving measures, since such measures would lower their net income.

Nor does the government encourage the companies to pursue energy efficiency. The regulatory agency, ANEEL, lacks the necessary resources, data and staff to promote energy-efficient policies, which on the demand side require time-consuming dialogue with consumers and the general public as well as structural investments that tend not to boost short-term profits. So, instead of considering the public interest, the privatized utilities consistently pursued profits by charging higher tariffs and reducing investments whenever possible, which only aggravated inequity in the energy sector. For example, before privatization larger consumers used to subsidize small household economies. But after privatization, huge rate increases significantly above the rate of inflation were foisted on small customers, shifting the cross subsidy from large commercial customers to ordinary citizens and small businesses. As a result, in 2000, small consumers ended up paying R$150/MWh, while larger customers were paying only R$74/MWh.

Privatization also resulted in a less reliable public supply of electricity due to private companies' short-term perspective. Consequently, in 2001 when the southeast and northeast regions received less rainfall than expected, there was widespread risk of power disruptions and blackouts.

Water Supply and Wastewater

The problems in the electricity sector have not dampened government enthusiasm for privatization in the water sector. However, pending constitutional reforms have discouraged full-scale divestiture of public companies, and so far, most private sector participation in the water supply sector has been limited to concessions, carrying out specific tasks under contract, and joint private-public arrangements. Out of a total of 318 water supply and wastewater companies in Brazil, only 3 percent have been fully privatized. Nevertheless, the pressure to continue privatization in this sector remains high, particularly because of billion dollar investments in water supply and wastewater that are needed over the next two decades to improve the current precarious levels of service. To that end, the government announced an investment of 0.45 percent of GDP, approximately R$6 billion per year, is required.

The distortions created by the privatization of water services are similar to those of hydroelectricity, though they have not been as widespread. Recent assessments of the impacts of privatization in the water sector in Brazil demonstrate that it has neither improved the level of investment nor achieved higher indicators of efficiency. On the contrary, it has effectively increased the inequality between rich and poor, because private companies have chosen to serve industrial clients and operate in more affluent communities where customers can afford to pay for water—a process known as "cherry picking." Poorer customers now face serious difficulties in accessing water services, given that the initial charge to connect to the network system can be much higher than a worker's average monthly salary.

But even in these wealthier communities, the process has been riddled with problems. Decisions have been made with minimal public participation, resulting in

constant conflicts with local residents, steep increases in tariffs, allegations of corruption, disputes with the regulators and, inevitably, lengthy court battles.

Difficulties have been exacerbated in Brazil, because water supply and wastewater services currently operate in a legal vacuum. The debate about new legislation has dragged on for more than a decade in the national Congress, with various proposals being presented and later retracted for lack of support. (The most recent one was submitted by the federal government in 2005.) Resolving constitutional ambiguity about the responsibility of municipal and state governments remains particularly challenging, especially in metropolitan areas with complex water and sewage pipelines.

Private investors are using the absence of a clear legal framework in the water sector to advance privatization in a non-conventional way. As mentioned above, the contracts formalized between states and municipalities in the 1970s under the old PLANASA are about to expire, and hundreds of municipalities are having to deal with local water services without endorsement by new regulations. Furthermore, municipal administrations are now tempted to sign contracts with national or international private companies. Thus, a situation of chaotic decentralization and institutional uncertainly is becoming a catalyst for privatization "through the back door." Perhaps predictably, this "back door" privatization has resulted in instability, legal disputes and the breaking of contracts on both sides.

Under pressure from economic development, the hydropower and water supply sectors have evolved from a condition of municipal control and private operation at the beginning of the 20th century to centralized control and government operation until the 1980s. Since the 1990s, those two sectors have come full circle, returning to decentralization and privatized operation. In those three phases of water development (i.e., privatization, nationalization, re-privatization), the key driving force was the conversion of water into a marketable commodity and its incorporation into the logic of capital accumulation.

During the industrialization phase, from the 1930s to the 1980s, the authoritarian state guaranteed the necessary conditions for water infrastructure expansion and private accumulation. Water stakeholders and the general population were excluded from the national project of water development, except for serving in engineering waterworks or paying their water and electricity bills.

After the neoliberal 1990s, the commodification of nature has moved the state back to a much smaller role in directly providing services, while it simultaneously benefits from emerging opportunities of incorporating water into market-like operations. New deceptive measures have been adopted to placate and mystify the public, such as the creation of "water plans" and the organization of catchment committees. In practice, the control over water and catchment space continues to be dominated by powerful economic and political interests. Nature commodification is found in its purest form when bulk water is quantified and priced on a volumetric basis.

Water User Charges as a New Form of Nature Commodification

The neoliberal reform of the state since the early 1990s coincided with the development of new water legislation and put Brazil on the same search for the "holy grail" of optimal environmental regulation that for decades has captured the imagination of

policymakers in Western countries. The milestone of regulatory reform in Brazil was the Water Act of 1997 (Law 9433/1997), which determined that water has economic value, and its usage should be charged accordingly. Bulk water charges were formally proposed to replace the "old paradigm of water management," which was based on the above-mentioned Water Code of 1934, with an "efficient" market approach. Under the new legislation, those wanting to extract water or discharge effluents must apply for prior permission from the state and pay an amount the state judges to be proportionate to the negative environmental impact.

The justification for this rests on the neo-classical notion that market incentives guarantee environmental improvements, because those who use or waste the most have to pay the most; therefore, water charges, together with the privatization of public services, are expected to result in more sustainable usage of natural resources. But this theory is based on the dubious assumption that the value of a life-sustaining element such as water is correctly determined by whatever the market will bear, regardless of the income level of the populations involved.

After the approval of the law in 1997, more negotiation was required to define the operational details and methodological approaches needed to implement bulk water charges. In March 2005, the National Water Resources Council passed regulations 48 and 49, which instituted a comprehensive pricing mechanism for water extraction and effluent discharges in all rivers under federal responsibility. The main political support for these critical regulations came from the two sectors that together have the majority of the Council's seats: water developers, who are interested in lucrative infrastructure contracts, and reformist environmental groups, who generally speaking, advocate that bulk water charges will lead to environmental improvements.

Proponents support the new market approach to water regulation for four main reasons: First, charges can be a significant contribution to catchment rehabilitation, which they acknowledge becomes important when ecological degradation starts to restrain economic activity. Second, those directly responsible for the environmental impacts—i.e., government agencies and business groups—escape blame, because the new system shares the costs of environmental degradation with the population at large, who, as consumers, have bulk water charges incorporated into their water and energy bills. In effect, stronger political sectors have advanced the ideological notion that everybody is responsible—and must pay!—for the environmental impacts of past economic development, despite the fact that the benefits of development were appropriated by a small elite, while the poor (mainly) were left with the negative impacts. Third, the payment of water rates, which contribute to catchment rehabilitation, allows large industrial customers the opportunity to "green" their image with slick advertising campaigns. This is despite the fact that ordinary citizens and small businesses are subsidizing the water charges of larger industrial customers and that the water charges are negligible in relation to these companies' income. Fourth, revenues from water charges are an attractive enticement for specialized private companies to become involved in operating water utilities.

The Paraíba do Sul River Basin

The best example of how charges benefit business interests is the experience of the Paraíba do Sul River Basin, located in the country's southeast. The river system has been intensively used by the steel industry and for agricultural irrigation, as well as to supply drinking water to the city of Rio de Janeiro. The Paraíba do Sul is also used to generate

hydroelectricity, with an installed capacity of 1,500 MW in the catchment and an additional 2,300 MW under study.

The catchment suffers from serious soil erosion, river degradation and water pollution, mainly from industrial effluents and untreated urban sewage. For example, under current conditions, daily discharges of domestic and industrial organic pollution create a suffocating 300 tons of biochemical oxygen demand (BOD), which measures the strength of the waste.

The intensive use of water in the Paraíba do Sul illustrates the serious conflicts between business appropriation of water and the needs of the population and the environment, which suffer the negative consequences of industrial water usage and practices. The list in Table 3 below represents only the tip of the iceberg, since most local events remain unreported, either because the competent authorities "can do nothing about it"—i.e., there is lack of political will—or the local population has limited organization and power to complain.

Table 3. **Recent Examples of Environmental Conflicts in the Paraíba do Sul**

Water-related conflict	Municipality	Year	Offender	Consequences of legal action
Surface and Ground Water Pollution	Campos dos Goytacazes	1999	Usina Santa Cruz (alcohol distillery)	Company required to improve its environmental performance.
	Santo Antônio de Pádua	1999	Indústria Cataguazes de Papel	Company required improve its environmental performance (however, there is further evidence of persistent infractions).
	Volta Redonda	2000	Companhia Siderúrgica Nacional	Company required to reduce pollution, clear the water course and restore local habitats.
	Resende	2002	BASF	Company required to implement a restoration plan over seven years.
	Nova Friburgo	2002	YPU Artefato de Couro e Metal	Company was fined and subsequently closed three times due to repeated environmental offences.
	Cantagalo	2001	CERJ (hydroelectric)	Company required to carry out environmental assessments.
Lack of sewage collection or treatment	Petrópolis	1999	Lago do Nogueira settlement	Still under investigation.
	Cantagalo	2002	Quinta dos Lontras settlement	No solution as yet.

The Paraíba do Sul was the first river basin under the responsibility of the federal government to implement the administrative framework to adopt bulk water charges. In order to legitimize the introduction of water charges, government officials and business sectors manipulated the river basin committee (CEIVAP).

The official methodology for pricing bulk water was agreed upon in 2001 by the committee and received approval by the National Water Resources Council in 2002, three years before the Council passed the 2005 regulations. Charges were calculated by

considering the monthly profile of three factors: volume of diverted water, volume of effectively consumed water, and volume of water required to dilute effluents.

According to the National Water Agency (ANA), water charges in the Paraíba do Sul basin generated revenues of R$4.5 million in 2004 and R$9.5 million in 2005, with 67.45 percent coming from public water companies and 32.43 percent from industry. These revenues have the potential to expand considerably as more users start to contribute in the next few years.

The financing of water and sewerage systems by the revenues of water charges is an ingenious association between environmental management instruments, utility privatization, and the development of market-like transactions. It began in 2001 when the government launched the Hydrographic Basin Pollution Cleaning Program, known in Brazil by the acronym PRODES. PRODES offers payments to wastewater companies based on the volume of sewage they treat.

Because the Paraíba do Sul was the first river basin to implement bulk water charges, it quickly became eligible to join the program. Under PRODES, the local contract for bulk water charges for the Paraíba do Sul accounts for 25 percent of the payment to wastewater companies, while 75 percent comes from general taxation. PRODES supporters point to an investment of R$6.7 million in sewage treatment in 2005, which incorporated the contribution of water use charges, as evidence of the program's success and financial viability.

Yet, there is also evidence that PRODES works against the public good. For example, the water charges the private companies collect make it easier for them to take over public services or form public-private partnerships without having to use their own capital. Consequently, private firms can purchase or operate public utilities with very low risk and little capital investment. Large municipalities in the Paraíba do Sul, such as Petrópolis, Campos dos Goytacazes and Nova Friburgo, have already privatized their local water utilities. Furthermore, a plan commissioned by the government on the implementation of water charges in the catchment welcomed the involvement of the private sector and says "realistic" consumer tariffs are necessary to reduce the risks of private investments.

The implementation of charges on water extraction and effluent discharge in the Paraíba do Sul has reproduced the problems of past attempts at market-oriented water management. The new water policies in the catchment did not solve the old socio-environmental conflicts but rather created new and more difficult challenges. For instance, a recent survey of 488 industries found that water charges were well received by most big companies, because they did not incur significant financial burden. However, the same research identified higher resistance among smaller businesses that ended up having higher costs incorporated into their monthly water bills.

In addition, the experience in the Paraíba do Sul shows that the new approach cannot adequately deal with the threat of widespread environmental degradation, in part because it limits restoration measures to impacts that constrain economic activity. All in all, the discriminatory bases of the old paradigm of water development were carried forward unquestioningly. The government continues to serve the interests of the dominant economic sectors, but the negative impacts of development are disproportionately absorbed by excluded social groups and the environment.

Public Reaction against the Contradictions within Water Development

Local experiences, as in the Paraíba do Sul River Basin, demonstrate that economic development has inserted water into the maelstrom of business relations in Brazil. Water control became part of an overall system of political domination and exclusion that make Brazil one of the world's most inequitable countries and a champion of environmental destruction. Though pressures of the market have encouraged significant investments in infrastructure throughout the years, private and public water utilities remain unsuited to serving most low-income households. On the contrary, the transfer of public services into private hands has not only mainly assisted some privileged economic groups at the expense and social exclusion of others, it has also exacerbated environmental degradation.

Environmental injustice is unmistakable in heavily urbanized areas, such as Rio de Janeiro, where a large part of the population without water services lives in peri-urban areas and slums (*favelas*) often located on unstable hillsides or insalubrious mangrove swamps. These disparities in economic development demonstrate that the environmental and social problems of water-related activities in Brazil are, in fact, problems of development itself.

While economic development has profited from water use at the expense of the environment and the exclusion of the population, it is gradually provoking the reaction of the public against the exigencies of capital accumulation. By contesting the idea that water should be treated as an economic good, organized groups have defended the traditional rights of local communities and stymied the further advance of water commodification. Sectors of Brazilian civil society are standing up to powerful international agencies through a variety of channels and via the coordination of a constellation of social actors.

One example is the National Movement of People Affected by Dams (MAB), which coordinates resistance campaigns against 63 dams, while offering an elaborate attack on the model of economic development. There is also organized resistance against the privatization of water utility companies under the umbrella of the National Front for Environmental Sanitation (FNSA), which comprises 17 civil society organizations, including trade unions, consumer groups, water professionals, environmentalists, political groups, and community representatives.

Public mobilization in Brazil reflects the worldwide movement of local communities and grassroots activists against the uneven distribution of the results of economic development. This opposition is based on the premise that interaction between society and nature should produce both equitable water access for all social groups as well as the indefinite continuation of natural resources.

So far, the resistance to water commodification and privatization in Brazil has achieved mixed results. On one hand, it has helped to force international development banks to reconsider the rush towards rapid privatization of public utilities. For example, the World Bank is revisiting its infrastructure policy, conceding the limitations of privatization, and now offering a menu of options for service provision, which increasingly includes "corporatization." On the other hand, despite public mobilization, the powers of capital have forced previously left-wing politicians to adopt the neoliberal agenda of minimal government intervention while maximizing market liberties. The new administration, under President Lula de Silva's center-left Workers' Party (PT), fought privatization in Congress and the courts when it was in opposition. However, since taking power, it has adopted

conservative fiscal and monetary policies, avoided condemning privatization, and pushed legislation on public-private partnerships, the new face of utility privatization in Brazil.

Conclusion

Economic growth in Brazil historically depended on investments in water infrastructure, particularly for hydropower, water supply and irrigation. Gradually, the waterscape was incorporated into market-like transactions to boost industrial production and urbanization. Heavy investments were made by the state under authoritarian and technocratic management, which produced serious social and ecological problems, including the displacement of catchment populations, selective provision of public services that benefit wealthier groups, water pollution, river degradation, water scarcity, and increased sedimentation in waterways. Mainstream politicians, academics and bureaucrats have argued that these problems are the consequence of a still imperfect, partially developed framework of water management. However, this point of view ignores a condition of the internationally peripheral accumulation of capital in Brazil, which has crafted the model of water development through the transfer of foreign technologies, investment and machinery. In a more recent phase of water development, the neoliberal globalized reform of the state has promoted a privatization program worth billions, which includes the sell-off of hydroelectricity and water supply utilities.

The dismantling of government-owned water companies coincides with the implementation of a new regulatory framework to control the allocation and use of water. A crucial aspect of the current legislation is the emphasis on the economic value of water and the introduction of water user charges, which ultimately raises new opportunities for the circulation of capital and privatization with the support of governmental funds. The implementation of fees for water extraction and effluent discharge has reproduced the same contradictions as the initial paradigm of water management while serving to reinforce the commodification of water. Water charges represent a narrow and time-limited solution to environmental disruption, which leaves unresolved the serious question of the primacy of economic interests over social and environmental demands. It conceals the fact that the new water framework is highly functional for capitalist accumulation, not only because it reduces the cost to reverse environmental damage to those directly responsible, but also because it creates the preconditions for private interests to take over publicly owned utility companies.

The experience of water development in Brazil can be compared, metaphorically speaking, with a dam impounding water. The more the dam continues to operate and accumulate water, the more it undermines its own structure due to sedimentation upstream and erosion downstream. The concentration and storage of sediment upstream represents the accumulation of capital by the upper classes, and the inability of the sediment to be evenly distributed downstream represents the poverty of the population's majority. Eventually, the dam will either collapse under its own heavy weight, or it will have to be removed to allow the free passage of water and the restoration of the environment.

This metaphor illustrates the fact that the problems of water development in Brazil are less related to deficiencies in the technical management of water use ("sediment balance") and are more a consequence of a prevailing undemocratic and discriminatory model of economic development—i.e., the dam itself. Solutions to the problems of water development depend on understanding and dealing with these long-term bases of nature exploitation, which go beyond the water sector alone. Answers to water problems are

related to considering socioeconomic gains and historic responsibilities, which should pave the way for a more inclusive approach to water development. If successfully achieved, new approaches of environmental management should allow for the construction of a more equitable relationship between social groups and between society and the rest of nature.