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**Water as a strategic global resource:  
economic and political implications  
for Latin America and Brazil**

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# Water as a strategic global resource: economic and political implications for Latin America and Brazil

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## Introduction

Just as water underpins life it is also the precondition for most economic activity. For the greater part of the last century, however, both of these functions were largely taken for granted in the industrial world and any major challenges or shortfalls seen as amenable to human engineering in the form of dams and fluvial transposition. The Rio '92 Summit and the adoption of the global objectives of the Millennium Goals marked a turning point in attitudes to water and have now placed the human right to water at the centre of the global political agenda. In a similar way, the surge in demand for primary commodities which has accompanied the continuous and rapid growth of the emerging economies, has highlighted the central role of water as an economic good. Growing evidence of the effects of climate change in the form of more frequent and serious floods and droughts has further confirmed the importance of access to and control over water.

Water, however is a singular product and is not interchangeable in the way that all other commodities, in principle, are. And if, like other commodities, it has a fixed and finite supply, water exists in a variety of inter-related forms subject to a reproduction cycle which makes its availability temporarily and geographically variable. Water's pervasive role in economic activities and its centrality for human reproduction mean that more than any other good it is subject to multiple and often

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conflicting claims. As a basic necessity of human existence, efforts to condition its availability on market criteria have met with sustained opposition. Above all, it is the perceived scarcity of water as an economic and human resource which has now placed hydro-politics at the centre of the global agenda.

In this paper, we first provide a brief characterization of the distinctiveness of water. We then examine how water is being discussed in global debates focusing on three issues: new ways of understanding and measuring water's role in the economy; water and the issue of economic and human rights to access and use; and appropriate forms of water governance given a plurality of often conflicting claims. In the next section we focus on Latin America, both to investigate the way in which its water resources influence the continent's insertion in global markets and to examine the policy responses and conflicts which have emerged on water issues. We discuss the principal ways in which the issue of water is becoming a central source of concern and conflict in Latin America. Of note here are the tensions over the management and supply of water services to the urban population. Sub-regional coordination, agreements and conflicts over water use will also be examined. Latin America and particularly the Southern Cone countries are occupying an equally central position in the global market for agricultural commodities which depend as much on water as on land for their competitive advantages. We identify the principal ways in which water availability and access influence Latin America's role as a global commodity player in agriculture, forestry and mining. The final section is concerned specifically with the economic and political dimension of water in Brazil. We discuss the degree to which an understanding of water as a strategic resource is influencing the formulation of policies both in terms of the domestic and the international agendas. We will be concerned here with policies for water services and those which address the strategic role of water in maintaining Brazil's long term competitiveness in agricultural commodity markets.

## Water and its many functions

Over a longer time perspective, the taken-for-granted status of water in much of the recent period can be seen as an exception. Whatever the qualifications that can be addressed to Wittfogel's thesis (1957) on hydraulic societies, control over water, in the form of large-scale irrigation works and water transport systems, has been the lynchpin of empires ranging from Egypt, Mesopotamia, the Indus and China to Mexico and the Andes. The extensive network of aqueducts was equally decisive to the success of the Roman Empire. It is not surprising, therefore, that conflicts over river water access are equally ancient. The Water Conflict Chronology Map ([www.worldwater.org/conflict/map](http://www.worldwater.org/conflict/map)) records border disputes over water as far back as 2.500 BC. Its importance is also enshrined in the Water Laws included in the Hammurabi Code.

These early civilizations combined a wealth of flood river water with a dearth of rain water (Solomon, 2010), a situation which would change dramatically as northern Europe assumed economic and political dominance. The rise of the US and its push to occupy and develop the Southern and Western desert and semi-desert States led to a resurgence of water-politics (Reisner, 1986). Huge hydraulic projects such as the Hoover Dam in the '30s and the new model of water management established by the Tennessee Valley Authority, which was to serve as an example for many other countries including Brazil, can be seen as a historical transition in which water once again becomes a central issue for State Politics. With the return of Asian and Middle Eastern countries as dominant economic players, it is perhaps to be expected that water should reappear centre stage in global politics.

Concern over water has led to a renewed reflection on its availability and distribution. Seventy per cent of the earth is made up of water but only 2.5% is constituted in fresh form, with oceans making up 97.5%. Of this, two-thirds are ice and almost one third is deep underground in huge aquifers. Only 0.3% of

total fresh water is readily available on the surface (Chartres & Varma, 2010). A complex interaction involving oceans, rivers, rains and ice, the hydrological cycle, has ensured a constant supply of fresh water. Variations in heat, however, associated with climate change clearly modify this balance and their implications are at the heart of concerns over future availability of water.

The distribution of fresh water sources is also a decisive factor governing the emerging politics of water. Latin America, with 8% of the world's population has 31% of fresh water supplies, although within the region these are very unequally distributed. The world's semi-arid lands, on the other hand, with a third of the globe's population have access to only 8%. In addition, future population growth, projected to increase by 50% up to 2050, will be largely concentrated in these regions (Solomon, 2010). Direct trade in water can only marginally mitigate these distributional inequalities. Water is heavier than petroleum making costs prohibitive. In addition, the required scale of bulk water trade largely precludes such an option. Nevertheless there have been and continue to be experiments and pressures for the liberalization of bulk water trade although these have also met with opposition and bans based on criteria of water security. Pipeline supply has also been mooted and can be important in specific contexts such as the Middle East. In addition to cost and logistical problems, political opposition has also diminished the attractiveness of this option. As will be seen below, however, a more nuanced understanding of water captured in the notion of "virtual water", the amount of water used to produce different goods, allows for strategies of indirect water trade which are now becoming a key plank in many countries facing fresh water constraints. Rome's resort to Egyptian grain would perhaps be the first large-scale application of this strategy.

Fresh water exists in three forms – river, rain and ground water – with their spatial and temporal distribution and availability varying widely, although they are, at the same time, intensely inter-connected. While rain is still largely an act of God, in spite of efforts at cloud seeding, access to rivers and ground water are subject to a range of property rights, which influence forms of cooperation and conflict.

Vandana Shiva has identified four justifications of water rights: "the territorial sovereignty theory, the natural water flow theory, the equitable apportionment theory and the community of interest theory" (Shiva, 2002, p77). In fact in Shiva's account the last two are elided, but a fourth emerges in her discussion in the subsequent introduction of ecological considerations for the determination of what is equitable. The first two justifications are radically opposed since the former defends the sovereign right to dispose of river water within a nation's, or a person's, territory while the latter argues that the river must be allowed to follow its natural course, which clearly has downstream interests at heart. Each gives rise to specific forms of conflict and provides a different framework for the formulation and implementation of policies.

Cooperation and more critically conflicts arise most obviously among the same types of users, as in the case of farmers up and downstream of river waters. Increasingly, however, in a context of both greater scarcity and increasing social and economic differentiation, the potential for conflicts and the need for cooperation arise from the demands of different users. Six types (at least) of water use can be identified: 1) agriculture, especially irrigation, 2) industry, 3) human, especially urban, consumption, 4) production of energy, 5) means of transport, and 6) leisure activities. To this we should add the function of river run off water into the sea in the renovation of ecosystems. On a global average, some 70% of fresh water is appropriated by agriculture in the form of irrigation, industry is responsible for 14%, with domestic consumption absorbing the remainder. Clearly these averages vary sharply both between and within countries. In a global context characterized by rapid industrial /urban growth and water scarcity it is not surprising that water has become a key arena of conflict, at local, national, regional and global levels.

## Global debates on water

We will focus here on three types of debates which have emerged in response to the challenges of water scarcity. The first of these is concerned with quantifying and qualifying the use of fresh water in economic activities. The second focuses on the conditions of access to water and the rights involved in such access. The third addresses the problems of water governance and management given the multiple claims on its use.

In the effort to make visible the role of water in economic activities a range of neologisms have emerged: blue/green/grey water, virtual water, embedded water, water footprint. These studies have focused increasingly on the different qualities of water, reflecting the more pervasive concern with the quality attributes of products and services, and creating operational criteria to measure the use of water in economic activities. The distinction established between blue, green and grey water makes it possible to distinguish the different sources of fresh water involved in economic activities and the impact on water quality as a result of use. Blue water refers to surface and ground water prior to use; green water is that stored in the soil as moisture and subject to evaporation, and grey water is that which is polluted in the course of production operations, measured in the light of the resources required to return the water to its original state.

The virtual water concept was created by Allan (1998) and defines the amount of water required in the overall production cycle of goods and services. The results are often quite startling. As much as 2.500 gallons of water may be required to produce one pound of beef. Bottled water requires twice its volume in water to produce, and filtering can require from three to nine times the amount of water finally filtered (Glennon, 2009). This concept has thrown light on trade, particularly agricultural trade which can now be seen as often primarily trade in water. Water scarce countries now take into account calculations on virtual water requirements when defining their domestic production versus trade strategies. The

concept has, however, met criticism, particularly from the Australian National Water Commission which has argued that not all water is of equal value – rain water cannot be equated with irrigation water. The concept, furthermore, assumes that water used in one activity would have better alternative uses, which is not necessarily the case. Nor, it is argued, can conclusions on sustainable use be derived from the concept of virtual water. In spite of these limitations, the concept of virtual water would seem to be highly relevant when examining current commodity export tendencies in Latin America.

The notion of the water footprint is similar to the above but has wider applications and can be applied equally to the water consumption of individuals, firms, economic sectors or even whole countries. It can become, therefore, both a guide to individual behavior and the basis for the elaboration of economic strategies and public policies. It was elaborated by Arjen Hoekstra (2003) at UNESCO and has been further developed by the University of Twente, Netherlands. From this has merged a Global Water Footprint Network with some 130 partners from business, NGOs, academia and government. The goal is to establish and adopt a universal standard for defining and measuring the water footprint which will then enable individual, firms and nations both to calculate their respective footprint and formulate strategies and public policies for their reduction. According to this standard the per capita water print in the USA stands at 2.500 cubic meters as against 700 cubic meters for China ([www.waterfootprint.org](http://www.waterfootprint.org)).

While water scarcity has led to a preoccupation with its measurement as a precondition for its better management, a parallel debate has emerged around the issue of water as a basic human right. Since the Universal Declaration of Human Rights water has been considered an implicit right, deriving from the right to adequate standards of health and well-being. Water has been on the agenda of the United Nations as a specific focus of concern since the 1977 UN Water Conference in Mar del Plata. At the 1992 International Conference on Water and the Environment in Dublin four principle were adopted: 1) fresh water is a finite and vulnerable resource essential to life; 2) water development and management

should be based on a participatory approach; 3) women play a central role in water provision; and 4) water has an economic value in all its competing uses and should be recognised as an economic good. The policy of privatizing water services had been widely adopted by Governments and international financing bodies since the '80s as a response to the challenges of water provision in the rapidly growing cities of the developing world. The fourth principle of the Dublin Conference could be seen to favor such an approach. Popular movements of opposition to these policies were accompanied by the proliferation of civil society campaigns in support of water as a basic human right. In this they were aided in the '80s by the international cooperation agencies' adoption of a rights perspective to development when it became clear that economic growth was being accompanied by widespread marginalization in developing countries. In this perspective, the ensuring of basic human rights provides the pre-conditions which release the individual and collective energies making development possible. In 2010 the United Nations General Assembly declared "the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights". The United States, Britain and Canada abstained on the vote, but this position was confirmed by consensus at a subsequent meeting of the UN Water Council later in the same year.

National States are therefore now obliged to make provision for universal access to safe and clean drinking water. But under what terms? For many the identification of water as a basic human right is equated with a rejection of its commodification. The assumption here is that water should be under the control of the public sector and made freely available. Popular opposition to privatization policies are interpreted in this light. Opponents, on the other hand, argue that if the "tragedy of the commons" is to be avoided the increasing scarcity of water should be accompanied by the attribution of value in the form of water pricing.

Academic debates, on the other hand, have highlighted the complexity of the issues involved (Bakker, 2009). Among those who defend access to water as a basic human right it is recognized that the availability of water depends on the

provision of a whole range of services, involving heavy investments which must be paid for. The recognition of water as a basic human right does not imply therefore that access is free. The defense of privatization, for its part, does not exclude differential prices for poor users. The poor are almost by definition, it is argued, efficient users and therefore a proper pricing of water to promote efficient usage would penalize those currently benefitting from low or subsidized prices for activities which would not otherwise be justified. Given the multiple uses of water, scarcity involves the negotiation of different and conflicting economic rights which becomes a pre-condition of ensuring access for all. The principle of sustainability also requires that current access not be at the cost of access for future generations. The affirmation by the UN of the principle of access to water as a human right does not therefore of itself define who should provide that access, or how it should be provided or under what conditions. Nor does it define what would constitute fulfillment of access.

Paralleling the measurement issues discussed earlier in relation to the definition of the water footprint, the affirmation of the right to water has led also to debates on the minimum water right (MWR). While specific quantities would depend on local circumstances of supply and patterns of water use, this debate has drawn attention to the multiple functions which constitute the right to water. In addition to drinking water, these would include personal hygiene and by extension basic washing activities. This debate has also opened up the intimate relation between the right to water and the right to sanitation, which has itself become incorporated as a basic human right.

The issue of the most appropriate forms of governance has been a key focus of debate in relation to water and depends very much on the scale at which the question of governance is posed. Although often purely local arrangements may be the most effective forms of governance, the indivisibility of freshwater river supply and the characteristics of the hydrological cycle have led to the adoption of the river basin as the basic unit of governance. In a similar fashion, aquifer systems as a whole are being recognized as the appropriate unit of governance in the case

of underground water. Major undertakings involving the transposition of water between river basins call for centralized State intervention. River basins traversing a number of countries require joint governance between States. The difficulties facing bulk trade in water, on the other hand, combined with the multiple claims on its use in any given locality, have led to the promotion of models of governance at river basin level involving all relevant actors within a participatory model of decision making and management. Such a participatory approach was enshrined in the second of the Dublin principles cited above. Adopting the river basin or the aquifer as the unit of governance imposes coordination arrangements which are often not convergent with the administrative and political organization of the country or region in question.

More recently, the issue of water scarcity in a context of climate change has led to arguments that the river basin/aquifer is no longer sufficient either as a unit of analysis or of governance. Here debates on governance connect up with those on the need to incorporate notions discussed above on virtual water and the water footprint. In a recent article, Hoekstra (2011) the author of the water footprint concept, has argued that efficiency, equity, sustainability and security of water in the context of globalization require new institutional arrangements. These would include an international protocol on full-cost water pricing. A pollution tax on products involving water pollution in their waste stage is also called for. Soil depletion and/or eutrophication resulting from international trade should be offset by a requirement for national nutrient trade balances. Further global measures should also include the promotion of a water-label for water intensive products. Initiatives in this direction are already underway in various water stewardship campaigns and the water footprint network has elaborated a standard for the assessment of water use. The United Nations affirmation of the human right to water requires the elaboration of enforcement mechanisms, which should also take into account minimum rights to water for the production of food. Hoekstra argues that we should also consider mechanisms for establishing maximum allowable levels of water use. The water footprint initiative could also lead to the implementation of a footprint quota, for which the Kyoto protocol may serve

as a guide. Similarly it is proposed that a water-neutral goal be adopted whereby water consumption is offset, as carbon is offset, by water conservation measures. A number of initiatives are already underway in this direction as in the effort by the Water Neutral Foundation in South Africa to make tourism water neutral (Hoekstra, 2011). Hoekstra argues that nothing less than a new global regime for freshwater use is required if water efficiency, sustainability and equity are to be achieved globally.

## Water in Latin America: source of conflicts and competitiveness

On aggregate Latin America is the most water favored continent in the developing world. This is expressed in the predominance of hydroelectricity in the composition of its energy generation. It is also evident in the profile of its principal, globally competitive economic activities, mining and agriculture, which are both heavily water intensive. Nevertheless, water availability is primarily concentrated in the South of the continent with water scarcity being most pronounced in Mexico and the Caribbean. Many regions in the South, however, also suffer from water shortage and 25% of the continent is now characterized as semi-arid or arid. Geographical problems affecting access are compounded by huge inequalities in income distribution which reduce per capita consumption from a hypothetical 110.500 cubic feet per annum to 1.010 for the average inhabitant, less than half the European average and a quarter that of the US (Barlow & Clarke, 2004).

Climate changes are already evident in the increasing droughts in the South of Brazil and Argentina, which led in the latter case to a loss of 1.5 million head of cattle and half the wheat crop in 2008. Droughts have also caused serious reductions in electricity supply in Brazil, Argentina, Chile, Peru, Venezuela and Ecuador. River flow depends heavily on the Andean glaciers which have shrunk 30% over the last thirty years and are threatened with disappearance by 2030. While Latin America, therefore, is highly favored in terms of aggregate water availability it is

proportionately more vulnerable economically to the effects of climate change as its major economic sectors and energy sources are heavily dependent on water.

Latin America's key economic export sectors are land-based rural activities but of the developing continents it is by far the most urban, with almost 80% of its population in cities. Urban water services, therefore, in a context of rapid urbanization and sharply polarized living standards, have become a central challenge and source of conflict. According to a recent FAO calculation, some 120 million urban poor in Latin America have no adequate access to water and a 150 million lack adequate sanitation facilities (<http://www.fao.org/nr/water/where.html>). In the '80s and '90s, international finance organizations, principally the World Bank and the Inter-American Development Bank in the case of Latin America, vigorously promoted the privatization of urban water services as the solution (BID, 2006). This policy was aligned with broader strategies for privatization and was often imposed, as a condition of loans, on debt-ridden countries and municipalities, involving in some cases the need for constitutional reforms. The leading water transnationals – Bechtel, Suez, Veolia, Agbar – were also keen to open up this developing country market calculated in the hundreds of billions of US dollars, attracted, in the case of Latin America, particularly by the growing urban middle classes.

The results have varied from country to country. Chile's water privatization has been considered the most far reaching and successful and this has been attributed to the nature of the contractual and institutional arrangements which included differential pricing for the urban poor and prior improvements in efficiency by the public sector. More recently Mexico in 2001 launched its Program for the Modernization of Water Management (Promagua) by which privatization agreements have been extended, with little opposition, to 28 of Mexico's 30 States encompassing 70% of the country's urban population. Privatizations in Argentina, on the other hand, which had been undertaken in the '90s, were revoked in 2006. Uruguay, in sharp contrast to the constitution reforms passed in other countries, saw the emergence of a social movement which imposed a plebiscite in which water privatization was rejected (Wilkinson, 2010).

In many countries local and broader social movements emerged against the privatization of urban water services – Honduras, El Salvador, Peru, Puerto Rico, Ecuador. The iconic example of opposition which led to the revocation of a privatization agreement was that of Cochabamba in Bolivia, and the Bechtel company. Here the imposition of full-costs for water created a popular uprising which also led to the termination of the contract and the withdrawal of Bechtel which then initiated a lawsuit for damages.

The politicization of access to water and the emergence of water markets are reflected in the campaigns and mobilizations which characterize both proponents and opponents of water markets. The World Bank created the Global Water Partnership and the leading water transnationals formed the World Water Council which together since 1997 have promoted a triennial World Water Forum. As against this, social movements have created an Alternative Water Forum organized around the theme "Another Water Management is Possible". RED VIDA, composed of 43 Latin American grassroots movements from 16 countries is a participant. In an attempt to defuse this polarization a Water Dialogues Movement was created at the 2001 Freshwater Conference in Bonn with support from the German Ministry for Economic Cooperation and Development to promote multi-stakeholder initiatives at national level, involving organizations from Brazil, Indonesia, the Philippines, Uganda and South Africa.

This movement, which finished its work in 2010, tried to promote a more analytical reflection on the experience of private sector participation. In its overview paper of recent trends it notes the decline of private investment in the first decade of the new millennium and the increasing recognition of the primary role of the public sector (Bakker, 2009). In particular, the identification of privatization with the model of concessions and the sale of assets has given way to a focus on different forms of private sector participation and to a recognition of the broad range of private actors involved in water utilities, not limited to the leading transnationals. While the privatization promoted in the '90s has proved not to be the solution, it has often been unjustly identified as the problem. In fact, with the withdrawal

of private firms, as in the case of Bechtel in Cochabamba, the basic problems of adequate and healthy urban water supply in Latin America's cities have been shown to persist.

One of the solutions to the lack of adequate public water in Latin American cities has been the emergence of a bottled water industry. This focused initially on urban districts and consumers not integrated into the utilities network. It was then extended to use in institutions given the unreliability of tap water for human consumption. More recently this has been complemented by the surge in bottled water for individual consumption, now the fastest growing segment of the soft water market. This water is of two kinds. When drawn from wells and bottled at source it is characterized as mineral water and can be the object of high-priced branding. More commonly, however, it is treated public utility water and known as mineralized water. This latter is meeting with increasing opposition, particularly in Europe, both given its ecological costs and the fact that it substitutes a public service which, it is widely thought, should provide drinkable tap water. In Latin America, mineral water has been the primary source of conflict to the extent that it has been identifying with the drying up of prime sources of water conflicting with established alternative uses such as spa resorts, and also local drinking sources.

While in no way comparing with the tensions and conflicts which transborder flows of water pose in other regions of the world, Latin America is not immune to the challenges of hydropolitics. The most dramatic of these is the recurrent conflict over Mexico's access to the water from the Colorado river. This water has been crucial to the irrigated agriculture of Mexico's northern region, which in turn is an important export earner for this country. Mexico has an international right to a proportion of the waters from the Colorado river but these have been recurrently threatened on two fronts. On the one hand, transposition of the Colorado River within the US has directly threatened water supplies to Mexico. A more insidious problem has been the increasing salinity of this water as the result of its use in the US for irrigation. Salinity has reached such proportions that this fresh river water has now to be desalinated on the US side prior to its use in Mexico (Solomon, 2010).

Mining activities, which require large quantities of water, particularly in the Andean countries are leading to the formalization of agreements on transborder flows. In 2001, Bolivia passed the Water Export Law sanctioning access by Chilean mining operations to the Potosi river (Barlow & Clarke, 2004). Transborder Treaties are already in place for the joint management of the Southern Cone's River Plate Basin and the rivers of the Amazon region. Brazil, Paraguay and Argentina also have a joint agreement for the use of the Guarani aquifer, the world's largest reserve of transborder underground freshwater, shared between Brazil, Argentina, Paraguay and Uruguay, which is currently being studied with a view to the development joint management institutions. The need for such an initiative has become particularly acute as major urban water supplies are increasingly drawing on these reserves.

## Water in Brazil

Of all Latin American countries Brazil has the most favorable relation between overall water availability and population, with some 18% of the world's fresh water resources for less than 4% of the world's population. In addition to plentiful rivers most of Brazil receives regular rainfall. Nevertheless the principal fresh water supplies are in the least populated region of the North, and drought has been a constant feature of its populous semi-arid Northeastern region. Increasing droughts, associated with climate change, are also occurring in the rich farmland areas of the South. Brazil's generous fresh water supplies are reflected in the profile of its energy matrix. Globally hydroelectric sources of energy make up less than 3% of overall energy generation. In Brazil, on the other hand, hydroelectric power accounts for 15% of total energy supplies and over 80% of its electricity.

Waterways, however, have not been drawn on proportionately for the movement of goods. Whereas only some 7% of Brazil's grains reach the ports via barges, nearly a half of the US grain harvest is transported by river. In Brazil, the priority given to hydroelectricity has often been at the expense of river transport. On the other hand, new investments are now being directed to Brazil's (and Argentina's) waterways,

and are recognized as decisive for the competitive incorporation of the Brazilian agricultural frontier as it moves inwards and upwards through the Centre-West to the Northeast and the North. Whether for transport or energy, investment projects have to be negotiated with local populations and environmental social movements, which can considerably extend the time-scale for implementation, or even lead to plans being put on hold.

Brazil's first Water Code in 1934 gave priority to energy and industrial usage with the most spectacular result being the Itaipu dam on the Paraná River, a joint project between Paraguay and Brazil, involving agreements also with Argentina. Negotiations began in 1966, construction in 1971 with the dam entering into operation in 1984. Although Itaipu is the dam which generates the most electricity, many other dams in Brazil have been built on a larger scale. Given the impacts of these investments on river use and the scale of the areas inundated, conflicts have become an increasing feature of plans for dam construction. The shift from a military regime and the consolidation of democratic institutions as from the 1980s has given greater legitimacy to civil society participation in plans for dam construction.

A Movement of those Affected by the Dams (MAB) emerged when Itaipu was being constructed and subsequently assumed national proportions as huge dams in the Northeast (Sobradinho) and the North (Tucuruí) were undertaken. This movement was to become an important component of the forces in favor of agrarian reform, showing once again how land and water are inextricably connected. In the case of Tucuruí and more recently with the inclusion of the Belo Monte dam on the Xingu river in the Lula government's investment program (PAC) opposition has extended to the indigenous communities. The latter project provoked the First Encounter of the Indigenous Nations of the Xingu in 1989 and a Second Encounter in 2008. Internal opposition to the Belo Monte dam has been accompanied by the mobilization of international opinion, and the future of its construction in 2011 is uncertain.

An important criticism addressed to the policy of large-scale dams, in addition to their social and environmental impacts, was the priority given to industrial use

at the expense of local populations and agriculture. The growing conflicts over water use with very different claims on the same water sources were first reflected in Brazil's 1988 Constitution. Here water was defined as a multiple-use public good with priority in the context of scarcity to be given to humans and animals. The Federal Government was responsible for transborder State rivers and the State Governments for those beginning and ending within a State's boundaries. Inspired by the 1988 Constitution, the São Paulo State Government in 1991 was the first to draw up a Water Law. River basin committees were to provide the basic management unit, establishing a model which was to be adopted by other States and paving the way, also, for subsequent Federal legislation. In the Northeast, Ceará took the lead with a more centralized approach which informed the World Bank's Pro-Água Semi-Arid Program to be implemented in other Northeastern States (Abers & Kerk, 2006).

The Federal Water Law of 1997 reaffirmed the Constitution's priorities, but focused on the need for water management which would take into account its scarcity in the context of multiple use claims. Following the Dublin Conference of 1992, the Brazilian Law affirmed the economic value of water and the need for payment for use based on a permit system. This Law established a National Policy for Water Resources (PNRH) and a National System for the Management of Water Resources (SINGREH) which was to be based on stakeholder management committees at river basin level. In 2001, however, a more centralized approach was adopted with the creation of a National Regulating Agency (ANA) (Abers & Jorge, 2005).

The guiding principles of the 1997 Law were those of participation, given the need to negotiate multiple uses, and decentralization, given the different dynamics of the various river basin systems. Water management would be based on the river basin and the different actors involved. Sustainable, shared and integrated, management of water resources at the river basin level was the model. How all this would be implemented, however, was left undefined. How to establish prices for the right to draw on bulk water supplies, who should be responsible for such charges, and to what use the resources should be put were all unspecified issues, inhibiting

the development of the river basin committees. ANA was to play a leading role in the exploration and implementation of solutions to these problems through the promotion of a pilot project in the Paraíba do Sul river basin, involving the States of Minas Gerais, São Paulo and Rio de Janeiro, where all these issues and the conflicts to which they gave rise were successively negotiated. By 2010, some 150 river basin committees were in operation throughout Brazil.

While the management of river basins has in Brazil and globally become the dominant policy this has not eliminated major interventions in water resources. In addition to its Three Gorges Dam, now the world's biggest, China is considering a plan for the integration of all its river basins into one system of national water supply (Solomon, 2010). Brazil, as we have seen, is also continuing with its policy of large dam construction in spite of growing opposition both domestic and international. New sources of bioelectricity are also calling in question the need for major hydroelectric investments. UNICA Presidente, Marcos Jank has argued that the sugar-cane sector can already produce the equivalent of one Itaipu in bioelectricity and the planned expansion of this sector will allow for the production of an equivalent of two Itaipus, making projects such as the Belo Monte unnecessary ([www.unica.com.br](http://www.unica.com.br)).

In addition to the proposed construction of dams, the Federal Government's investment program includes the transposition of the São Francisco River, Brazil's longest domestic river which begins in the State of Minas Gerais and traverses the States of Bahia, Pernambuco and Sergipe, in the Brazilian Northeast before flowing into the sea. While its principal motivation has been the importance of diverting water to attend the dispersed rural population of Brazil's semi-arid region, opponents argue that 70% of the water will be destined for irrigation projects, xx for urban centers and only 4% for the drought affected rural population. Displacement of indigenous populations has also provoked opposition, particularly from Church leaders in the region. Opposition has coalesced around an Alternative Project based on decentralized initiatives and ANA has itself put forward an alternative. Nevertheless, the project has been reconfirmed by the Dilma Government which

took office in 2011 and it is expected that the transposition will be in operation in 2012/13. Perhaps to offset the above criticism, the Dilma Government in 2011 launched the "Water for All" program to universalize access to water in this semi-arid region of the Northeast.

With the creation of a favorable regulatory regime through the Concession Act and the Public-Private-Participation Act passed in the '90s and support from the World Bank and the Inter-American Development Bank (IDB), it was expected that Brazil's water and sewage system would become the object of privatization. From the standpoint of public policy, the huge investments required to maintain and universalize these services, calculated as requiring US\$60 billions over a two decade period, were the principal justification for privatization, together with efficiency considerations. The equally huge size of the Brazilian market was the principal attraction for the water transnationals. The results, however, have been extremely modest with only 5% of the population receiving privatized services on the basis of some 65 concessions. In some regions, such as Rio Grande do Sul, a tradition of political opposition to privatizations and the promotion of alternative participatory models would explain the maintenance of public services. In other cases, privatization initiatives failed through disputes over contract fulfillments. More generally, a confused regulatory framework would seem to have been an inhibiting factor and the leading water transnationals have tended to withdraw, often accused of cherry picking and focusing on water rather than sanitation services. Tariff readjustments have been a further focus of tensions with evidence of a decline in water consumption particularly affecting low income consumers (Lobina & Hall, 2007).

A further explanation for the limited impact of privatization lies in the adoption of alternative capitalization strategies by the leading utilities – SABESP in São Paulo, and CEDAE in Rio de Janeiro. These companies have chosen to sell shares on the stock exchange and this model has now received the approval of previous supporters of the concessionary model such as the IDB which is also now financing these utilities. While privatization has not emerged as an overall

solution, it is likely to increase as institutional arrangements and best practices become established. Government estimates project that up to 30% of the urban population will be attended by private concessions by 2025.

The Water Dialogues Movement commissioned an evaluation of Brazil's privatization experience which was carried out by the INECON/Fundação Getulio Vargas Consortium (2008). Water coverage was analyzed before and after privatizations and also in comparison with typical pre-privatization situations. Of 30 cases studied, 27% increased coverage, 40% were neutral and for 23% coverage decreased using the former criteria, while 40% were positive, 30% neutral and 30% negative using the latter. The results for sewage on the basis of 28 cases were significantly worse; 32% positive, 7% neutral and 61% negative coverage using the former criteria and 18%, 21% and 61% respectively using the second criteria. Operational and commercial performance was generally evaluated to have improved. While charges increased significantly in some cases as a result of privatization, the study concludes that in general the design of the bidding process established clear limits to charging practices. Consumer well being, measured by the notion of consumer surplus, was judged to be positive although significantly less so for sewage treatment. Similar results were found in the case of consumer satisfaction, although a decline in the use of water for drinking was identified particularly in low income users. In the case of new users, responses also tended to be favorable, although the study detected evidence that low income users were less represented in new connections. The study also identified a tendency for foreign capital to withdraw from the consortia and concludes that in an uncertain regulatory context open to opportunism local capital may well be preferable.

The Sanitation Law of 2007 commits Brazil to universal access to water and sanitation services within two decades. In 2008, according to the 4th National Report Monitoring the Millennium Goals, 91.3% of households had access to the water network and 80.5% had access to sewage systems while 76% had integrated water and sewage systems. Sewage treatment is calculated as around 70%. Untreated sewage, industrial effluents and chemical run-off from agriculture threaten both

fresh water and increasingly ground water supplies. Urban water systems are calculated to leak between 40-60% of their water supplies. It is estimated that maintaining and expanding these services will demand at least R\$168 billion, whereas public expenditures are only R\$8 billion per year. Privatization was promoted principally with these investments requirements in mind. Now it is clear that there is no substitute for public investments although the 2007 Law is unclear whether responsibility is at the municipal, State or federal levels (Valor, 2011).

Over 60% of Brazil's water as we have seen is used for agriculture and Brazil has consolidated itself as the world's leading commodity exporter, with the Southern Cone increasingly substituting the historic role of the US mid-west. In addition to its predominance in traditional crops – coffee and sugar-cane, Brazil leads or is second in exports of orange-juice, soy, poultry, beef, tobacco and cellulose. Corn, a traditionally domestic market product is also beginning to be exported along with new categories such as fresh fruits. Irrigated agriculture currently accounts for only 4.5 million hectares but will increase substantially as Brazil positions itself to accompany projections of continued long term demand. Aspersions and central pivots are the main irrigation methods and are extremely inefficient with only 60% of the water reaching the roots of the plants. In addition, these methods are heavy energy users (Rebouças, 2003).

We discussed above the degree to which trade in agricultural commodities is increasingly calculated in terms of its water content, as virtual water. With the institution of charges for water and the practice of the negotiation of different claims on water in the river basin committees, we can expect a greater questioning of the use of water resources in agriculture once it is understood that agricultural exports are water exports. This is particularly the case since Brazil's agriculture has traditionally developed far from the Amazon region where most freshwater is concentrated, and today the legitimacy of Brazil as the world's "commodity basket" depends on it being seen not to encroach further onto this region. In many regions water is still used freely, while in others customary pricing practices have been established. It remains to be seen how farmers will adapt to the new

legislation. In the short term, there will likely be considerable opposition but the new legal framework for water use should stimulate the adoption of more efficient irrigation practices already on the market – ferti-irrigation and drip-irrigation which can be targeted to specific crop requirements through the adoption of precision agriculture. On the other hand, small scale irrigation practices are argued to be the most efficient which reinforces policies for strengthening the family farm sector.

Climate change will significantly affect the regional availability of water for Brazilian agriculture. EMBRAPA (2008) has elaborated projections for the impact of climate change on Brazil's principal crops. Over the medium to long term, soy is seen to be the crop which will most suffer from climate change. Sugar-cane, on the contrary, is the crop most favored by such changes. A range of other crops including beans and manioc also become more vulnerable, particularly in the Northeastern region.

## Conclusion

On the aggregate Latin America and more particularly Brazil are favorably endowed with hydrological resources. At the same time, Brazil has developed a legislative framework attuned to global concerns both with regard to water as a basic human right and to the economic value of water deriving from its increasing scarcity. In practice, however, water is very unequally located with only 6% of it availability in the Southeastern region which has to support 42% of Brazil's population. Brazil's legislative framework, on the other hand, is strong on principles but weak on detailed regulation and implementation which leaves great uncertainty with regard to governance and responsibility. Almost 80% of Brazil's fresh water is in the Northern Amazon region subject to increasing restrictions on its use by international opinion.

Currently Brazil's agriculture is overwhelmingly dependent on rainfall and/or inefficient systems of irrigation both of which are now called in question either

by climate change or the perspective of water charging. If Brazil is to maintain its position as the world's most competitive agricultural commodity exporter and ensure domestic food security, in addition to greater exploitation of its waterways for transport, efficiency in the management of water resources will become increasingly central.

Important advances have been made in the provision of water and sanitation services, particularly in the Southeast, but much remains to be done in the North and the Northeast. The correlation of water and sanitation services with indicators of public health has done much to reposition these services as investments rather than costs. The growing scarcity of water supplies for urban centers and the need to capture water at ever greater distances, or by greater resort to underwater sources, is leading to increased attention to sewage and water treatment and to the reuse of water. This is particularly noticeable in the private sector where many water intensive sectors are adopting strategies of water reuse.

A greater awareness of water scarcity is evident at the consumer level with the emergence of a range of water saving products and water measurement systems. The National Water Resources Plan for 2012 promises to firmly anchor policy within a perspective of confronting climate change through the development of water ecosystem zoning in combination with the adoption of water footprint criteria for decisions on the sustainability of economic activities. Nevertheless, the debates over the New Forest Code, which involves proposals for reducing areas of forest preservation near rivers and lakes, suggests that there is still a very wide gap between academic, public policy and citizen awareness and the immediate interests of powerful economic lobbies.

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