Chapter 5
Brazil: The Evolution of the Law and Politics of Water

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Absract Brazil's natural beauties were exploited during and after Portuguese colonization as if they were infinite. Red dyewood deforestation gave a name to the country ('pau brasil'). Non-sustainable economic activities of the colonial era, including sugar cane production, cattle ranching and mining, overused the land and water resources. After independence, deforestation continued, justified by narrow economic perspectives, resulting in increasing destruction of Brazilian ecosystems. More recently, this destruction stimulated contemporary preservationist impulses such as expressed in the National Water Act of 1997. Today, institutions aim to balance the economic and ecological values of water in a developing country that relies heavily on hydropower and irrigation. Water is now treated as a finite natural resource that must be managed through river basin committees to develop a balance between human consumption and ecosystem needs.

Keywords Brazil • ecocentric view • ecological flow • environment • hydropower institutions • water basin management

5.1 Introduction

This chapter analyses the social, economic, cultural, and political processes that have evolved in Brazil from an anthropocentric view (with emphasis on irrigation, navigation, and hydropower) to an ecocentric view that aims to integrate water use with environmental protection. The colonial period emphasized navigation, the republican period emphasized energy, with water categorized as public, private, or common according to their use by humans. An ecological view of water management emerged in the 1981 National Environmental Policy Act, the 1988 Federal

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Constitution, and the 1992 Earth Summit in Rio de Janeiro. This shift embodies a complex value conflict between economic and ecological goals, especially sensitive within a developing country context. The challenge to balance the economic and the ecological value of water in a developing country are great. This chapter provides a historical background, discusses the evolving ecocentric view and addresses the challenges in regulating hydropower projects, before drawing some conclusions.

5.2 The Background of Brazilian Water Law

The roots of Brazilian water policy can be traced back to the contrasting views of Native Brazilians to whom nature was connected with their existence and the Portuguese colonizers for whom nature was just a raw material with economic value.

5.2.1 Native Brazilians and Harmony with the Land Before Colonization

When Brazil was discovered by the Portuguese navigator Pedro Alvarez Cabral, around one million Tupinambas (Tupi-speaking people) lived along the Brazilian coast in villages of between 300 and 1,000 residents (Wagley 1963: 15). Each village was economically self-sufficient and lived within the rhythm of tradition and fidelity to the land (Gomes 2000: 29). They used wild plants sustainably, experimenting with wild species and bringing many (e.g., palms, nuts and fruits) under partial domestication (Steward & Faron 1959: 47). These developments still influence current production (Wagley 1963: 56). The Native Brazilian cultures contributed to today's growing conservation movement, both as a model and because of the conservation and protection of Indian lands, which constitute around 12% of the country (Valenta 2003: 643–44). The Tupinambas lived in communities of a single lineage largely concentrated along the rivers because of the abundant fish. They also hunted and grew crops (Steward & Faron 1959: 294). The rivers also allowed easy transportation (Steward & Faron 1959: 292). These patterns still influence current production (Wagley 1963: 62).

5.2.2 Colonization Introduces the Roman Law Tradition

The Portuguese arrived in 1500 and exploited the land, wood, and people for economic gain (Gomes 2000: 36). Gradually local and imported labour was organized to allow for the production of sugarcane, cattle, gold, and coffee (Williamson 1992: 183). Native Americans largely disappeared from the coast and were soon replaced by African slaves (Fausto 1999: 17). After some experiments, the

Portuguese government settled on mercantilist policies to strengthen its national economy through monopolizing the purchase of spices and raw materials from the colony and the import of products exclusively on the colonizers ships (Dewitt 2002: 71; Lockhart & Schwartz 1983: 184–91).

The Portuguese brought the civil law tradition with them. This tradition traces back to Emperor Justinian's compilation of Roman law in the sixth century—the *Corpus Iuris Civilis* (Farias 2005: 367). Justinian's Code consolidates Roman water law principles: water is variously characterized as a public commodity (*res publicae*), a thing common to everyone (*res communis omnium*), or a private commodity (*res singulorum*), depending on the circumstances of its flow (Pompeu 1972: 160–62). Because the civil law tradition emphasizes legislation, to study the evolution of water law in a civil law country is to study the changes in the constitutions, codes and statutes related with water and environment in Brazil. The idea of rivers as streams for all (water as *res communis omnium*), therefore, evolves from the civil law tradition. Water in large streams belongs to the public for use by fishermen and for navigation, while riparian landowners are allowed to make a reasonable use of water in the stream as long as navigation and fishery are not injured. Water in smaller streams was held in common by the riparian owners, while water that was confined to a single owner's land was the private property of the landowner.

The basic rules for the Portuguese nation and its colonies were established through the Ordinances of the Kingdom, named after the King that promulgated them: the Afonsine Ordinance (King Afonso Henrique); the Manueline Ordinance (King Manuel); and the Filipine Ordinance (King Felipe II). Under the *Ordenações Filipinas* (Filipine Ordinance), the navigable rivers belonged to the Portuguese Crown, and thus the use of water streams depended on royal permits (Livro II, Título 26, ¶8). A reaction against this Portuguese rule brought exceptions in a new statute, the *Alvará* of 1804, in which the Brazilian colony granted rights of free use (without permit) for riparian owners and cities (*Alvará de* 27/11/1804, ¶¶11, 12). With independence, the royal rights were transferred to the Government on behalf of the people; the current permission requirement for water use (*Lei do Plano Nacional de Recursos Hídricos* [National Water Act] (1997): arts. 12, 13) has its roots in the feudal Portuguese Ordinances. Thus, in the Brazilian Civil Code of 1916, water was classified as a public good belonging to the Federal, State, or Local Government when used for all people or as private if it did not belong to the Government (*Código Civil* 1916: art. 81).

5.2.3 Regional Diversity and Economic Activity During the Colonial Period

Different regions developed differently and made different demands on water resources. The north-eastern coast concentrated on sugarcane production (Normano 1935: 19; Prado Júnior 1967: 4). For the production of sugar, water-mills were very important. While water-driven mills were more efficient than animal-driven mills, they were

expensive and difficult to establish. Because of the rapid deterioration of land under sugarcane cultivation and the high cost (slaves, oxen, and oxcarts) of transportation, any *engenho* (sugar estate) would have had a limited radius from which it could have profitably received cane. Gradually, animal and water driven mills were replaced by steam-powered mills. The first steam mill was installed in Bahia in 1815, and another in Pernambuco in 1819, but steam mills were expensive. In 1857, only 18 of the 1,106 sugar mills in Pernambuco were steam-driven, while 346 were water-driven, and the others were powered by animals. Production increases were due to the installation of steam mills and central sugar factories (*usinas*), rather than to extension of the cane fields. *Usinas* first appeared in Pernambuco in the 1880s; they depended as much on railroads as on advanced sugar-processing technology (Prado Júnior 1967: 29).

The export-oriented sugar industry helped to implement inefficient land use in Brazil. Colonial land policy (donatary captaincy) and sugar monoculture favoured large grants to a few well-placed families, leaving the overwhelming majority of lands idle, badly utilized, and underutilized, or simply held for speculation and reserve wealth. The north-eastern sugar economy from 1570 to 1810 undergirded the strong interest in the economic value of water as a source of energy (hydraulic power) in current Brazilian water law. In modern times, lack of water has stalked the Brazilian north-east, a region often described in terms of persistent poverty and resistance to change. North-easterners see their aridity as a cause and symbol of their region's relative underdevelopment and claim that this reflects a long-standing pattern of government favouritism towards the south (Greenfield 1999).

The priority use of water for watering animals in current Brazilian water law (*Política Nacional de Recursos Hídricos* [National Water Act] 1994), has its historical roots in the economic activity of cattle raising—the initial focus of activity along the south-eastern coast. Rivers contained freshwater for cattle ranches and for small farms producing subsistence crops, primarily maize and manioc (Levine & Crocitti 1999: 4). Moreover, in Brazil (especially the centre-west), for generations, the river was the easiest way to go into the interior of the country, and therefore, the route of settlers (Morse 1958: 13).

In Brazil, gold and cattle lured the frontiersmen on to seek new lands. In the seventeenth century, Brazil was the largest supplier of sugar in the world before losing out to the West Indies. In the eighteenth century, gold from the south-western region became the mainstay of the Brazilian economy (Normano 1935: 18). Gold led to the overnight development of villages and towns along rivers in remote regions of Minas Gerais and from these primitive mining camps arose the opulent cities of Marianna, Villa Rica de Ouro Preto, and São João d'El Rei (Normano 1935: 29).

The activities of the first English Company in Brazilian gold production, the St. John D'El Rey Mining Company, demonstrate, beginning in 1824, a good picture of the importance of water to the gold rush. Lack of coal and the expense of burning wood for steam power ruled out steam engines, while the abundance of water made possible the hydraulic and hydroelectric power that enabled the mine to exist and expand, not to mention providing a cheap industrial solvent. By the 1930s, the St. John used about two million gallons of water per day. Low rainfall slowed production. 'Water [truly] became the lifeblood of gold operations' (Eakin 1989: 122).

5.2.4 Modernization in Brazil

Establishment of the Republic and the abolition of slavery in 1889 launched the modernization process in Brazil. Unlimited horizons and inadequate attention to environmental costs resulted in policy disasters such as the expansion of subsidized cattle raising (Andersen et al. 2002: 72), Amazonian hydroelectric generation, with immense reservoirs necessary to compensate for the relatively flat terrain, flooded out indigenous groups and diverse tropical biomes, destroying tropical forests and biodiversity (Jepson 2005). Native Brazilians continue to resist violently incursions by prospectors and other intruders into recent times (Rabben 2002). The Northeastern Brazil Integration Development Program (*POLONOROESTE*) launched a land settlement scheme in Rondonia and Mato Grosso that also prompted international debate over deforestation and soil degradation from farming, subsidized cattle ranching, mining, and lumber mills (May 1999).

Seven historical trade cycles have prompted deforestation (Brazil wood, sugarcane, livestock, gold, coffee, rubber and steel) and urban expansion from the early nineteenth century developed its own deforestation dynamic (Costa 2003: 75). In Rio de Janeiro, for instance, where sugar had caused the deforestation of tropical flatlands, urban sprawl shifted pressures to the cooler hills. The growing urban population, with its demand for food crops and for wood products (firewood for cooking and factories, charcoal, construction poles, ship-building, mangrove bark for hide tanning, etc.) pressured the surrounding Atlantic forest. Today, more than 92 cities have a population greater than 100,000, putting enormous burdens on urban water services (Meade 2004: 232).

5.2.5 The Water Code of 1934

Water law in Republican Brazil can be organized into the Economic Period, ushered in with the Water Code of 1934, and the Ecological Period, with adoption of the National Environmental Policy Act in 1981, the new Federal Constitution in 1988, the Rio Earth Summit of 1992, and the National Water Act of 1997. The Water Code of 1934 (*Código de Águas* [Water Code] 1934) was the first of a set of natural resources codes that viewed nature as a commodity. The Water Code regulated water use for agricultural and industrial purposes, including hydroelectric power.

A gradual industrialization had begun in Brazil in 1914 with the beginning of World War I, spurred on by the undemocratic government of Getúlio Vargas (President, 1930–1954) (Loewenstein 1942). Some regulations from this period lasted until the 1967 reforms, others until the 1988 Constitution. The Water Code was designed to promote the hydroelectric power sector and the role of the public and private sectors in providing energy, as well as to regulate agriculture and industry generally (Water Code 1934: Livro III). The Code classified water resources as public, common, and private (arts. 1–8).

Waters were public except when they were entirely inside a private property. Springs and waters found entirely within a private property were private if they did not give rise to common waters or public waters. Smaller streams were deemed common waters to be shared by the riparian owners. For most waters, water was disassociated from land and treated as 'national patrimony' to be exploited through specific concessions' (Drummond & Barros-Platiau 2006: 87). Public rivers were the property of the Federal and State governments according to the rivers' extent and state frontiers. The Code did allow usufructuary rights in public waters in conformity with administrative regulations (arts. 36, 46).

5.3 Democracy, Decentralization, Sustainability

Although the Water Code was innovative at the time, including the 'polluter-pays' principle (arts. 110–116), it ignored the ecological perspective. Growing water pollution in urban and industrialized regions with serious health impacts led to the development of new ecocentric laws and institutions (Meade 2004: 232).

5.3.1 The Ecological Era of Water Policy

The first state pollution agency was created in the state of São Paulo to deal with water scarcity, thermal inversions, and the absence of industrial control in a region characterized by industrial concentration. At the federal level, a national institution to protect the environment was created partly as an answer to the 1972 United Nations Conference on the Human Environment. A special agency was created, attached to the Presidential Office, the *Secretaria Especial de Meio Ambiente*—SEMA (Drummond & Barros-Platiau 2006: 91–92).

The current National Environmental Policy Act (*Lei Federal da Política Nacional do Meio Ambiente*) was enacted in 1981. This Act recognized for the first time the ecological value of water (art. 2(II)). It was drafted mostly by the SEMA staff and became Brazil's 'cornerstone environmental regulation' (Drummond & Barros-Platiau 2006: 91–92). The 1981 statute created environmental institutions at the beginning of the Brazilian democratization process. They are, therefore, not as authoritarian and centralized as most of the former Brazilian agencies. The National Environmental System, an encompassing management network, was conceived to share responsibilities among the three spheres of government: federal, state, and local. Nationally, the system is managed by a national agency, with its staff, regional offices, and a Council. The federal model was adopted in several states. The Councils have a democratic structure, differentiating the Council from the rest of Brazilian public administration. The National Environmental Council, for example, is composed of 47 members representing government agencies, environmental groups, and industry associations (CONAMA 2006).

In 1987, the democratically elected National Constitutional Assembly created a new constitution that symbolized the consolidation of the ecological period and the beginning of democracy and participatory environmental management. Thus, the 1988 Federal Constitution includes an 'environmental' chapter on the basis of which the federal government created the country's major executive environmental agency—the Institute of Environment and Renewable Natural Resources. The Council decides democratically on rules to protect the environment and to achieve sustainability.

The 1992 Earth Summit, which took place in Brazil, produced the *Rio Declaration on Environment and Development*. The declaration consists of 27 principles to guide nations towards greater environmental sustainability (Rio Declaration 1992). The same conference adopted Agenda 21, a comprehensive blue print for local, national, regional, and global actions to achieve sustainability. The conference also approved the Convention on Climate Change and the Convention on Biodiversity. At the end of the 1990s, a new set of statutes was enacted to enforce Brazil's international environmental commitments at the Rio Conference, including a new National Water Act (*Lei do Plano Nacional de Recursos Hídricos* [National Water Act] 1997), for whose implementation the National Water Agency was created in 2000. These laws signalled a departure from the 1934 Code's vision of water as an inexhaustible resource oriented for anthropocentric demand, instead adopting an ecological approach for managing water use. Today, under the Ministry of the Environment, the National System of Water Management consists of the National Water Agency, the State Water Councils, and Hydrographic Basin Committees, designed to implement the ecological era of Brazilian water policy.

5.3.2 Public Participation, Cooperative Federalism, and River Basin Management

Following the overthrow of democracy in 1964, the army and police used torture and imprisonment to suppress resistance against the military regime until 1976. This period of dictatorship impressed itself in the Brazilian people's conscience. In 1982, millions took to the streets to demand elections, leading to the restoration of democracy in 1985. During military rule, decision-making processes were centralized in the Federal government. The return to democracy led to a new model of cooperative federation in which states and local governments have responsibilities in the management of water basins. The current Brazilian Constitution and National Water Act define a democratic paradigm of integrated and decentralized management of water resources.

The crisis of the former military regime and the increase of disputes related to the allocation of water to different uses and growing concern with environmental quality caused a legal shift towards river basin management. During the 1990s, several Brazilian states and the federal government passed legislation mandating a reorganization of the country's water management system. The new framework created inclusive decision-making committees to oversee management of water resources at the river basin level. São Paulo was the first state to improve river

basin water resources management policy, promulgating state regulations to integrate management of water resources (*Lei Estadual de São Paulo* [São Paulo State Statute] 1991). Other states followed in the early 1990s.

Operational barriers remain. Population expansion has caused cities and their auxiliary services, as well as state sanitation companies, to try to cope by supplying water with no thought given to resource exhaustion. Who is responsible for such exhaustion in each state has not yet been resolved. This management model requires the participation of civil society (the social-democratic element) to address peacefully the ecological allocation of water (the ecological element) and cooperation among the different parts of the Brazilian Federation (the political-federation element) in order to find a more efficient political institutional arrangement.

5.3.3 The Ecocentric Aspects of Environmental and Water Law

The main objective of water management is optimum water allocation to uses, yet controversy continues over the criteria for allocation. For centuries, political theorists assumed that humans are the primary, if not the only, beings of value in the material world, with the surrounding, non-human world valuable only insofar as it serves human purposes. Recently, environmentalists have challenged this human-centred approach to promote an ecocentric approach (Eckersley 1992: 1–2; Farias 2005: 101–51). Under this approach, the managerial framework must be tailored to the situations and constraints facing particular regions with different biomes.

The ecocentric approach in the Brazilian water allocation system is embedded in the 1988 Constitution's National Water Resources Management System within flexible federal regulation of the environment. The Constitution defines water as a public good, ending the private water system of the 1934 Water Code. As a public good, the Federal or State government administers water, according to the geographic and ecological circumstances of the river basin. Rivers entirely within a state are administered by the state (*Constituição Federal* [Federal Constitution] 1988: art. 20(III)). Rivers flowing through several states, or those forming a border between states, are administered by the federal government, although tributaries may be administrated by the different states (*Constituição Federal* [Federal Constitution] 1988: art. 26(I)). Water management at the river basin scale therefore depends on the cooperation of the state and federal governments. Environmental protection is shared by the federal, state and local governments, requiring that local governments also share in the management of watercourses. And, with the adoption of the new constitution, participatory planning for a National System began throughout the country led by the Brazilian Water Resources Association (Porto & Kelman 2000: 251–52).

Managing water as an ecological good requires a normative system within an adequate institutional and legal framework. Powerful international actors have provided important political support to the institutional change and the new

normative system (Keck & Abers 2004: 32). The next subsections examine the resulting normative system.

5.3.4 *Water as a Public Property with Economic Value (the Substantive Norm)*

The National Water Act specified several guidelines for implementing the ecocentric view of water management: It treats water as public property and a limited natural resource, valuing its multiple uses and highlighting the use of water for human and animal consumption as an absolute priority in times of shortage (art. 1(III)). Water has characteristics that make involvement of the public sector in its management more essential than for other resources that can be handled efficiently in a market (Dellapenna 2000: 326–35). But there is no single objective to a public water allocation mechanism. Public allocation in Brazil promotes equity objectives, such as ensuring water supply to areas of scarcity (the north-east region), protecting the poor, and sustaining environmental needs.

Fundamental to the rationalization of water management is treating water as an economic good, for the use or harm of which its users should pay. Major water users—industries, sanitation companies, electric companies, irrigators—pay for both the quantity of water they use and their polluting discharges. This is not a commoditization or privatization of water. Brazil has resisted pressures to establish markets for water rights. Ownership of freshwater remains public; costs are a mechanism to regulate supply and demand within the jurisdiction of each river basin and to fund improvement projects within the basin.

5.3.5 *The Integrated Participatory Model (the Procedural Norm)*

As important as the substantive norms, the Brazilian procedural norm of full participation by local communities in water policy decision is even more important to implementing the ecocentric guidelines of the 1997 National Water Act. Public involvement at river basin level was seen as an indispensable condition for social, economic and ecological sustainability (Galloway 1997; McDonald & Kay 1988). The old paradigm of management solely by the government in the north-east had resulted in waste and unfair allocation of scarce water since the start of sugarcane production. Lobbying to meet the interests of few powerful politicians for the construction of new reservoirs with federal money is ‘drought political malpractice’ (Kelman 1994: 83). The new paradigm of participatory water management directly engages citizens to engage in self-rule. Each river basin committee is formed by representatives of water users (riparian and non-riparian) and representatives of federal and state governments. Members of Brazilian River Committees are

not legal professionals, but water users appointed by their fellows to solve local problems. A river basin agency serves as the executive office for the watershed, providing technical support to local management of water resources.

River basin management allows flexibility to adapt water use patterns to local needs. Because those directly involved in water use—either for agriculture, home consumption, or industry—have more information on local conditions than the agency staff, they do not need to rely on rigid formulas for allocation. User organizations can take into account local needs for watering animals, washing clothes, bathing, or small enterprises—needs that a sectoral agency has no mandate to meet—leading to improvements in output per unit water, or in equity, or both. Additionally, user-based management enhances political acceptability (Eckersley 2000; Farias 2005: 407–10).

The National Water Act specified tools to implement these principles, including water resources plans, water classification schemes, water use rates, and water resource information systems (art. 5). An ecologically sensitive approach recognizes that the multiple uses of water require a balance between the ecological and economic use of water at an appropriate scale—the river basin (Drummond & Barros-Platiau 2006: 98). The multiple use of water emphasizes treating water as a collective good, instead of something designed to appease individual and particular interests. Thus, the institution of the National System of Water Management classifies water bodies in order to establish the priorities for its use (art. 22). The Amazon River, for example, must be used more for ecological purposes than for economic purposes. Complementing the basin management approach, Brazil's enactment of an environmental impact statement requirement improves public participation in water management (*Lei Federal da Política Nacional do Meio Ambiente* [National Environmental Policy Act] 1981). It ensures access to information, the opportunity to be heard, transparency in decision-making, and mechanisms for implementation and enforcement. The environmental impact report that emerges from this process should describe the activity and the existing environment, explain the purpose and need for the proposed activity, consider reasonable alternatives (including doing nothing), and assess the environmental impacts of the project and its alternatives. The effectiveness of environmental impact assessment in Brazil, a developing country, is influenced by its political and economic philosophy, as well as the limited resources available for the process (Modak & Biswas 1999: 52).

5.3.6 Water Conflicts on a River Basin Scale: The São Francisco River Basin Committee Case

The São Francisco river basin provides a good example of the basin management process. The basin covers an area of almost 634,000 km^2, draining areas of Minas Gerais, Goias, Bahia, Pernambuco, Alagoas, and Sergipe, as well as part of the Federal District. The river is nearly 2,900 km long, with an annual average flow of 3,000 m^3 per second, providing roughly two thirds of the freshwater available

in semi-arid north-eastern Brazil (Costa 2003: 16). The river basin is marked by socio-economic disparities and environmental vulnerabilities. With a population of approximately 13.3 million inhabitants (year 2000), about 7.5% of the Brazilian population, the basin has enormous potential for economic growth.

Intense economic activity exerts pressure on water resources, particularly with 340,000 ha irrigated (with a potential estimated at 800,000 ha) and areas affected by pollution. Another area of great concern is the impact of hydroelectric and other dams on the hydrological processes and geomorphology of the river—and the cascade of consequences these changes impose on the estuary, coastline, and the marine environment. The optimization and harmonization of various water uses—generation of electricity, shipping, irrigation, fishing, tourism and leisure, dilution of wastes, household and industrial water supply, mining, environmental needs, and others—has been a constant challenge. In weighing alternative courses of action, such as to improve river flows (the ecocentric option) or to increase the irrigated area for crop production (the anthropocentric option), the River Basin Committee must respect the National Water Act and what seems more important for the majority of the members. Hence, the selection of members for the River Basin Committee should cover the diverse social, political, economic and environmental characteristics of its stakeholders in order to handle these water conflicts.

5.4 Challenges in Balancing Economic and Ecological Values

Seeking to balance the economic and ecological value of water in a developing country is a hard task. This section illustrates the problem by considering the importance of water for the production of energy in Brazil, the negative effects for the river basin, the role of Native Brazilians and rubber tappers in the protection of the Amazon biome, and the case of dam construction inside the Amazon Basin.

5.4.1 Water, Energy and Development

Brazil definitely was not an environmentalist society for most of its industrialization period; it was a pro-development society (Drummond & Barros-Platiau 2006: 84). The importance of rivers for development has resulted in first-rate university programmes in engineering and related scientific fields, primarily focused on hydroelectric power (Keck & Abers 2004: 29). In the 1934 Water Code, hydraulic energy use was primary and other uses were secondary (Water Code 1934: art. 143). Today, electrical energy represents nearly 40% of the total energy consumption in Brazil and hydroelectricity provides 70% of its electric power. (Braga et al. 1998: 129–30). Until recently, thermal generation was utilized for isolated systems and in a complimentary way. The 1988 Brazilian Constitution vests the Federal Government

with authority over exploration, directly or by concession, authorization, or permission, of the hydropower potential of watercourses in cooperation with the states where those potential sites are located (Constitution 1988: art. 21(XII)(b)).

Drought in 2000 and 2001 led to acute power shortage as the nation's hydroelectric dams became unable to meet national demand. The result was a power rationing that included mandatory blackout of up to 4 h per day. The rationing was lifted after rains began refilling lakes, rivers, and reservoirs. The government announced a short-term plan to build 55 new thermoelectric plants by 2003 and a long-term plan for 8 new hydroelectric plants over 7 years (Buckman 2004: 83).

5.4.2 Hydropower and Ecological Impacts

The growing environmental awareness emphasizes the environmental costs of generating power. Hydropower traditionally has been considered a renewable way of generating energy that does not emit greenhouse gas emissions. Today, that view has changed. Reservoirs change the way significant amounts of vegetation rots and dramatically change the greenhouse effect of that rotting vegetation (Pearce 2006: 144). The reservoirs also have significant negative ecological impacts, including fundamental changes for the flooded land, evaporation rates, the morphology of the watercourse, the transport of sediment, levels of oxygenation, and the temperature of waters, all of which may affect riparian habitats and aquatic species, particularly during sensitive stages of the breeding cycle (Reid et al. 2005: 363–64).

Today, under the National Water Act, the use of water for the generation of electric power is subject to a government permit and must be described in the National Water Resources Plan (National Water Act 1997: art. 12). Another important mechanism to analyze the ecological impacts of hydropower plants in Brazil is the environmental impact statement (National Environmental Policy Act 1981: art. 9(III)). Procedures for environmental impact statement include public consultations and hearings in order to take into account the social, cultural, economic, and environmental concerns and values of the entities and citizens involved. Nevertheless, in general, the mechanism has not succeeded in resolving the complex social and political problems involved, especially in societies with a low level of organization and activism or a non-democratic government. Brazil has no historical tradition of public participation in the political/administrative decision-making processes on an institutional basis.

5.4.3 Forest Peoples and the Fight for Preservation in the Amazon Basin

The 1988 Constitution contains extensive definitions of 'Native Land,' requiring the demarcation of all indigenous territories by 1993 (Constitution 1988: art. 231(I)), yet by 1996 the Brazilian government issued a decree delaying the

demarcation of new reserves and impeding the indigenous rights guaranteed under the Constitution. The decree allows cities and non-Indians to challenge demarcation and suspend Indian property claims. The Yanomami are South America's largest unassimilated tribal group; the 20,000 remaining members of this group live in cleared sections of the rain forest, where they conduct their affairs according to long-standing communal principles (Early & Peters 2000; Meade 2004). Although the Yanomami secured some victories, by 2000 they had gained control of only a quarter of their original lands, which remain threatened by mining interests, politicians, and the military.

The current importance of Native Brazilians in the area of the Amazon Basin is unquestionable. Moreover, Indian customs and characteristics have penetrated deeply into Brazilian behaviour. Indian myths form a part of the Brazilian subconscious. In the Amazon, many names of places, rivers, animals, and popular expressions have been borrowed from Tupi-Guarani (Buarque de Holanda 1979: 88; da Silveira Bueno 1986: 509) and many Amazon peasants believe in Native American supernatural forces and call on medicine men (Wagley 1963: 59).

Besides, by the mid-1980s, rubber-tappers and native Brazilians, led by Chico Mendes, took the leadership in establishing a link between their struggle and ecological concerns, forming in late 1988, in the state of Acre, a coalition for the preservation of the Amazonian rain forest active under the name 'Forest Peoples Alliance', which was extended in early 1992 into the International Alliance of the Indigenous-Tribal Peoples of the Tropical Forests. Native Brazilians should be in charge of both the management and the control of the resources on which they depend. That same year, the Convention on Biological Diversity and Agenda 21 both expressly acknowledged the major role to be played by indigenous and local communities (da Cunha & de Almeida 2000: 315).

5.4.4 The Tucuruí and Xingu River Dams in the Rainforest

For some, the hypothesis of not using Amazonian hydropower implies the implementation of a significant thermoelectric programme for the country that would rely on oil, coal and, maybe, nuclear plants. This would certainly result in higher energy costs to the final consumers, severe air pollution at the local through to global scale, and the disposal of nuclear wastes. Thus the adequate planning of Amazonian hydropower plants, including economic, social and environmental variables, is considered the only feasible alternative for the long-term supply of electric energy in Brazil (Braga et al. 1998: 133). More than 50% of new hydropower potential is located in the Xingu River in the Amazon basin. Development of dams on the Xingu river basin is being given the highest priority (Braga et al. 1998: 131) and if this actually happens, the new hydropower will be installed in a highly environmentally sensitive region of the Amazon basin, a vast network of jungle, rivers, and trees, containing a yet unknown richness in biodiversity and

natural resources. Estimates vary, but most studies agree that this region contains at least one third of the world's biome of tropical moist forest and perhaps as much as two thirds of the world's freshwater is located in the Amazon basin (MaGee & Zimmerman 1990: 515).

The international environmental and political communities have heavily criticized the rapid deforestation of the Amazon basin. Traditionally, controversy surrounding the Amazon has stemmed from conflicting economic uses of the forest. Today the ecocentric approach motivates the critics. Brazil's policies in the past 30 years have been designed to stimulate economic growth, through adequate infrastructure (Klosek 1998: 126–27). The Brazilian government has spent billions of dollars building roads, hydroelectric dams, and other development projects designed to encourage settlement in the Amazon, including 'Operation Amazonia' in 1966 with special tax incentives encourage domestic and foreign investment in the Amazon region. This, aided by the World Bank, the Inter-American Development Bank, and the United States Agency for International Development, caused the clearing of the dense forest in what was perceived as the last great land grab on the planet.

Over the past 15 years, dams have come to define many elements of the landscape and power sources in the Amazon River. Large dams flood extensive tracts of forest and displace people and wildlife already living there. An example is the Tucuruí dam, which was built in the Brazilian Amazon region to serve the aluminium export industry, while the local population was deprived of its livelihood and suffered other negative effects of the project without compensation (La Rovere & Mendes 2000: xviii).

In 1975, Eletronorte, a state energy company, proposed the construction of several dams on the Xingu River. In 1980, Eletronorte carried out studies for the hydroelectric complex of Altamira, comprised of these two dams involving the flooding of 8,000 km^2 of land. The Conference of Indigenous Peoples of the Xingu, which met in 1988 in Altamira, united dozens of indigenous nations, who demanded that the Xingu River be freed of dams (de Castro 2005: 10). Since 1988, local activists (rubber-tappers, Indians and environmental NGOs) have paralyzed several attempts to construct dams in the Amazon region of Brazil due to their social, economic, and environmental impacts on local communities. Pressure from natives caused a temporary cancellation of loans from United States-based international development banks for projects in the Brazilian Amazon (Rich 1985: 734–35). The Altamira controversy, combined with other controversies over dams around the world, led the World Bank, for a time, to stop its financing of large dam projects. Belo Monte, on the Xingu River, was one of the projects in Brazil paralyzed by lack of funding. This process culminated in the Report of the World Commission on Dams in 2002 and the Johannesburg Summit in the same year, both of which opposed new large dams, although there have been some developments more favourable to large dams since.

Recently, the Altamira project was reformulated to include a complex of five hydroelectric dams with the potential to flood at least 100,000 people in three municipalities and 8,000 people in indigenous settlements. The proposed dam at the large turn of the Xingu would be Eletronorte's largest. The large turn is a mythical place filled with symbolism and significance to the peoples of the forest

(de Castro 2005: 10). The effects of the Xingu complex would be similar to those at the Tucuruí dam, the fourth largest hydroelectric dam in the world: changes in the water quality of the river and its tributaries, in the dynamics of waterfalls, and in the size of lakes, islands, and small waterways. The experience suggests that a state may not be the best protector of the interests of its residents when it comes to the construction of dams. All the interests need to be weighed, measures mitigating negative effects need to be developed, and where rights are violated these need to be compensated. When the World Bank or the like are involved, these organizations have a responsibility to hear the river basin committee to ensure the proper weighing of the interests affected by the project.

There is a gap between the legal and political system regarding the construction of dams in the Amazon River. The decision of hydropower plants must be made inside a river basin committee. It therefore is inconsistent with the National Water Act to make these decisions before the installation of the Amazon and Xingu River Basin Committees. The Brazilian institutions already have the know-how to create the Amazon Basin Committee; it will not be an institutional challenge as the São Francisco was.

5.5 Conclusions

In civil law countries such as Brazil, theory precedes practice. Despite the fact that Brazil has a rich and advanced water legislation, much remains to be done in terms of enforcement and compliance, especially in the case of development issues such as the construction of dams and the importance of the Amazon rainforest's preservation. Compliance remains a problem with so many still attached to the vision of nature as a raw material to be exploited for free, and thus not aware of the benefits of environmental conservation.

Since 1500 in Brazil, water resources have been allocated on the basis of economic exploitation. The Brazilian government has continued to elaborate statutes, such as the 1934 Water Code, that promote capital infrastructure and seek to maintain the allocation of water for the production of goods for the international market. The 1934 Water Code regulated the use of water in order to allow the expansion of hydropower. Only recently has increased understanding on how the environment affects the quality of life, led to environment-friendly policies for water allocation, such as in the 1988 Constitution and the 1997 National Water Act.

The sustainability of natural resources, and particularly of water, can evolve in Brazilian minds through the participatory model of water management. The important connection between substantive and procedural environmental rights was recognized in Principle 10 of the Rio Declaration on Environment and Development (1992), which stresses public participation as a precondition for sustainable development. Enhancing the capacity of institutions to promote participation, the National Water Act contributes to the public awareness of water and related environmental issues and enables these institutions to use these concerns for the decision-making process

of allocating water. The participation of river basin stakeholders in the conservation and management of natural resources seems to be increasing in Brazilian Water Policy Management. The example from the Forest Peoples in the Amazon Basin has shown the connection between public participation and water resources preservation.

Brazil will continue to depend on its hydropower resources for development. This situation requires careful decision-making in order to encompass economic, social, environmental and political concerns. There is no better place for this than in a river basin committee. River basin committees have provided an important mechanism for public involvement in water management, but conditions for its practical implementation are far from effective and meaningful. River basin decision-making is at a disadvantage because of the historical lack of public participation in Brazilian history. In order to improve ecocentric water management, it is important to invest more resources to raise the quality of environmental impact statements for hydropower dams and to improve the participation of non-governmental organizations in the committees, in order to increase the number of ecocentric, rather than anthropocentric, decisions.

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