Part 4

Economic, legal and institutional factors for achieving water and food security

10

WATER EFFICIENCY: STATUS AND TRENDS

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Highlights

- Latin America may well be water rich, but economic and urban growth from the last two decades has polluted freshwater resources of many countries.
- Several factors such as population growth, rapid urbanization, water contamination and pollution, and increased water demands due to increased economic growth are putting considerable pressure on available water resources. Decoupling economic growth from water use is at the core of innovation strategies for sustainable consumption and production and ultimately for resource efficiency.
- In LAC, as in other regions of the world, agriculture is the main user of freshwater. Within this sector about 90% of the water consumption is based on green water – rainwater stored in the soil as soil moisture.
- The greatest opportunity for improvement in water productivity and efficiency is in rain-fed agriculture through enhanced and known management practices.
- In general, irrigation efficiency of the existing systems in LAC countries is medium to low; the average irrigation efficiency for the region is reported at 39%, varying between 30 and 40%, whereas the world average is 56%.
- Urban water use in LAC also shows low technical water efficiency relative to developed countries; on average, water conveyance efficiency is reported to be 59%.
- Water efficiency in the electricity sector also shows significant room for improvement.
- Thus LAC countries must improve water use efficiencies in order to increase water and food security as well as protect aquatic ecosystems. LAC countries must consider water policy changes that provide adequate incentives to use water resources efficiently and ultimately achieve a more sustainable use of water in all sectors.

10.1 Introduction

10.1.1 Rationale for water efficiency in Latin America and the Caribbean

Latin America and the Caribbean (LAC) is graced with an abundance of fresh water, holding 31% of the world's freshwater resources (UNEP, 2010). However, several factors such as population growth, rapid urbanization, water contamination and pollution, and increased water demands due to increased economic growth are putting considerable pressure on available water resources.

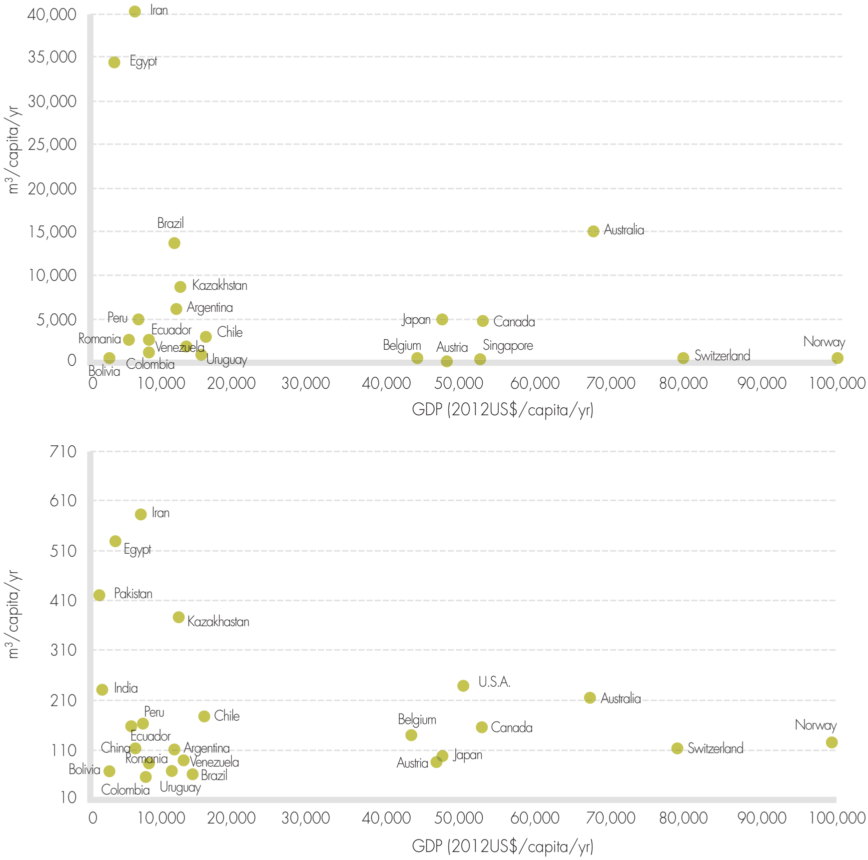

Figure 10.1 The relation between the blue water footprint of production (upper) and consumption (lower) and the level of economic development. *Source: own elaboration based on data from Mekonnen and Hoekstra (2011) and World Bank (2013).*

Available empirical evidence suggests a dubious relationship between the rates of water consumption and GDP growth in many countries (Figure 10.1).

Some developed countries (e.g. USA) and developing countries (e.g. India and China) have high water consumption rates per unit of GDP, i.e. a high water intensity ratio. Other developed countries (e.g. Singapore, Switzerland, Norway) and many developing countries have a low water consumption rate per unit of GDP (e.g. Uruguay) (Figure 10.1).

These examples suggest that relative decoupling of economic growth from water use is already happening in some countries. However, these assessments do not take into account the increases in burden shifting through virtual water flows (Gilmont, 2013). For example, OECD countries may have achieved the 'decoupling' by shifting water intensive production activities towards non-OECD countries (Figure 10.1). Decoupling should be assessed for Latin America and the Caribbean in light of the evidence that it is a net virtual water exporting region.

Empirical case studies of selected countries confirm that decoupling of economic growth from water uses and water pollution is not an automatic by-product of growth in national incomes but requires dedicated policies on improving water efficiency and water productivity at the required temporal and spatial scales.

Decoupling of economic growth from water use is critical for food security in LAC as water resource restrictions is one of the most important barriers to food production. The increase in irrigation activities has contributed to the substantial growth in agricultural production, enabling humanity to feed its growing population. However, more efficient use of green water (rainwater stored in the soil as soil moisture) and blue water (surface water and groundwater) has been stressed as one of the most important factors to achieve greater agricultural productivity (Pasha, 2002; Molden et al., 2003; Rosegrant et al., 2003).

Although improved methods and technologies have produced efficiency gains in all economic sectors, in some regions the need and potential exists for further improvements to ensure food security for a growing world population while minimizing the impacts on ecosystems and their goods and services.

Yet, the region is moving towards meeting the Millennium Development Goals (MDGs),but poor farming practices, unregulated human activity (or poorly implemented or -monitored existing regulations), including industrial development and urban poverty, have negatively affected LAC's water resources (UNEP, 2013). Additionally, given the region's rate of population growth, rapid urbanization and current patterns of water use, sustaining an adequate water supply for future generations is an increasingly important issue. There are many opportunities to enhance water efficiency and management in the region.

This chapter reviews the efficiency of water resources use in LAC. For this purpose, first of all, it provides the concepts and definitions together with the drivers for water efficiency. Second, it analyses the efficiency of water resources use in Latin America, looking at the water users in different sectors: urban and industry, agriculture, energy and the environment. Finally, it provides a summary of challenges and opportunities for enhanced water efficiency and management across the region.

10.1.2 Definitions and approaches

Achieving an efficient use of natural resources and other factors of production is a common goal of many current policies towards sustainability. Efficiency can be defined in general terms as the ratio between a desired output and an input, that is, the quantity of resource consumed in the process. Improving efficiency means creating more value with less resource consumption. However, depending on the scale and the disciplinary approach, the formulation of this indicator and the possibility of increasing it, imply different approaches (Jollands, 2006). Particularly in the case of water, three main interpretations for efficiency are usually recognized: technical efficiency, water productivity and economic or allocation efficiency (GWP, 2006).

- Technical efficiency considers the rate of physical application of water to its desired purpose. This factor can be defined for all the water uses in every sector. In agriculture, the value depends mainly on the technique (e.g. surface, drip irrigation) but also on the management system such as the mode of application of water linked to this technique (turns, on demand) and other factors (maintainability) allowing for the correct use of technology. Thus, factors other than the change of technique can lead to efficiency improvement.
- Water productivity is defined as the ratio between an output linked to a use and a water volume input. It provides a description of how well water resources are made productive (i.e. generating value) in their different uses.
- Economic or allocation efficiency deals with the objective of allocating the resource in order to maximize the net social benefits for society. It represents a general criterion characterizing the distribution of water between users (not a technical ratio attached to a specific use) (Wichelns, 2002). Possibilities to improve efficiency are linked to the economic instruments and governance arrangements, such as water markets, water rights reallocation, or the virtual water trade, leading to a higher benefit from the use of the available resources.

A comprehensive assessment of the relationship between green water (rainwater stored in the soil as soil moisture), blue water (surface water and groundwater) and grey water (volume of freshwater polluted) and economic efficiency should also consider the efficiency of the use of other resources, such as financial capital, labour or energy, in obtaining water services. Indeed, not only obtaining more benefit per unit of water is important but also more water per unit of other resources (GWP, 2006). For instance, this is also relevant in the debate on the efficiency between private and public sectors (Pierce, 2012).

It is also important to remember that these definitions are only valid within the broader economic context and other social objectives in order for efficiency not to be considered the final objective (Adger et al., 2003). For the most part, a higher efficiency does not mean that total consumption will be reduced as other incentives may govern resource use. Moreover, efficiency can make a resource cheaper, or increase its availability, incentivizing new uses (Pfeiffer and Lin, 2010; Dumont et al., 2013).

10.1.3 Determinants of the adoption of water conservation technologies

Theoretically speaking, the scarcer a resource becomes, the more likely it is that technologies will be adopted to save this resource. Empirical studies demonstrate that the scarcity of water resources is an important driver of water-saving technology adoption (see e.g. Schuck et al., 2005). However, water-saving technology adoption will increase in response to augmented water shortage only if users perceive that adoption will lead to water savings or generate other benefits.

In agriculture, the most important determinant of technology adoption is ultimately the farmer's perception of the incremental benefits and costs to his own farm income (Sharma and Sharma, 2004; Blanke et al., 2007). Hence farm-level perceptions of the water-saving properties and the impacts on income of each water-saving technology are critical determinants of the successful adoption of water conservation technologies.

Perry et al. (2009) state that farmers invest in improved irrigation technology for a variety of reasons, including increased income, risk aversion/food security, convenience and reduced costs. Varying prices for market goods, land, labour, water, electricity, energy, inputs, technology and soil management change farmers' perceptions on the value of water relative to these inputs. The farmers respond to market rules searching for the highest return per unit of land or water, depending on the relative scarcity of both resources (Ali and Talukder, 2008).

Studies demonstrate that public, government-supported extension of water-saving technologies has a positive effect on adoption of water conservation technologies (Schuck et al., 2005). Generally speaking, government policies promote the adoption of water-saving to incentivize water users to increase their technical and economic efficiency (Sharma and Sharma, 2004; Blanke et al., 2007).

Dagnino and Ward (2012) found that water conservation subsidies that promote a change from surface to drip irrigation can increase the demand for water despite the absence of new depletable supplies. Findings show that where water rights exist, water rights administrators will need to safeguard against increased depletion of the water source with increased subsidies that reward reduced water applications. There is a need for good water accounting as discussed by Molden et al. (2010), to take into account these environmental impacts of the adoption of water conservation technologies.

10.2 Methodology and data for evaluating water use efficiency and its socio-economic implications

The methodology follows the different approaches to efficiency as presented in the introduction: technical efficiency, water productivity, economic efficiency and efficiency in the provision of water.

10.2.1 Methodology and data to evaluate technical efficiency

10.2.1.1 Specific uses/local scale

Technical efficiency considers the rate of physical application of water to its desired purpose (eq. 1). Therefore, it is a percentage indicating how well a technique or mode of distribution delivers water.

Thus, the technical efficiency (eff) can be defined as:

$$\text{eff} = \frac{\text{water delivered for the intented use}}{\text{water withdrawals}} \tag{1}$$

This expression is valid for all water uses. For instance, in the urban sector, efficiency of water delivery characterizes how much water is lost during its distribution to the final user. However, a priori this ratio must be considered as a partial indicator only. Particularly low efficiencies calculated according to this indicator do not mean that excess water is wasted or lost as return flows can generate value once they go back to the river basin.

A more detailed characterization of water use and reuse potentialities can be obtained based on the quantification of fractions (Perry, 2007). Water use is divided into:

- Consumed fraction (evaporation and transpiration) comprising beneficial consumption (water evaporated or transpired for the intended purpose) and non-beneficial consumption (water evaporated or transpired for purposes other than the intended use);
- Non-consumed fraction, comprising the recoverable fraction (water that can be captured and reused) and non-recoverable fraction (water that is lost to further use).

This allows for the differentiation between uses that remove the water from further use (evaporation, transpiration, flows to sinks) and those uses that have little quantitative impact on water availability (e.g. navigation, most domestic uses).

An alternative expression of efficiency could be the ratio between water delivered for the intended use and total water evaporated (eq. 2). It is particularly meaningful in the case of irrigation, as it would indicate the distribution between evaporation and plant transpiration.

$$\text{eff} = \frac{\text{water delivered for the intended use}}{\text{total evaporated water}} \qquad (2)$$

10.2.1.2 At the basin scale

The principal consequence of not identifying the potential reusability of return flows is that an increase in efficiency (first definition) may lead to downstream users being deprived from resources they were receiving. Other unintended effects should also be taken into account. For instance, switching from surface irrigation to sprinkler or drip irrigation implies that farmers will potentially have greater flexibility in their water use (on demand instead of turns), allowing the improvement of yields or growing crops that are more sensitive to water shortage (Dumont et al., 2013). This will increase water productivity but also water consumption.

The traditional approach of technical efficiency applied at the catchment or river basin level implies the consideration of the ratio between water consumption (total evapotranspiration, ET) and the basin's total resources. For a closed basin (i.e. where all the resources are allocated) this ratio is close to 100%. This result has sometimes been interpreted as efficiency and cannot be improved in this situation. However, this refers to technical efficiency and not economic efficiency (see section 10.2.3). In a closed basin, therefore, there exists the possibility of improving the total value of water use, even though 100% technical efficiency is achieved.

10.2.2 Methodology and data to evaluate water productivity of specific uses

Water productivity (WP), defined as WP = product/water consumed [mass/volume] (i.e. the inverse of the sum of the green and blue water footprint), is used at plant, field and farm scale. Many times total withdrawal is considered in the expression of WP. It should be observed, however, that this would lead to technical efficiency ratios (as described in the previous section).

Looking at the biophysical level first, WP is an efficiency parameter of the crop production process, where water (as well as other inputs) is subject to a transformation process of crop or biomass production, owned and managed by the farmer. We define green water productivity WP_{green}=yield/ET_{green} as the water productivity in rain-fed agriculture. For irrigated agriculture, blue water productivity is the difference between total water productivity and green water productivity ($WP_{blue}=WP_{total}-WP_{green}$).

In the industrial sector, water use efficiency is commonly determined as the ratio of production and water withdrawal. Here we use consumption in the denominator, not withdrawal.

The notion of WP can also be applied in a wider sense, by attributing different values to the numerator. This is commonly done in water valuation approaches, where economic attributes can be given in monetary terms (e.g. US$), social attributes (e.g. jobs, food security), or environmental attributes (e.g. carbon sequestration, biodiversity).

Pollution is not formally included in water efficiency or productivity measures, yet polluted water may reduce yield and hence enters the equation for crop WP indirectly. However, it ought not to be neglected, especially when considering urban environments, industry and other sectors. In the end, water pollution is also a form of water use that subtracts from other uses (e.g. due to pollution of return flows or salinization). It is therefore worth pursuing efficiency increases in those areas, which means: lowering the pollution per unit of production.

10.2.3 Economic efficiency: characterizing the allocation of water resources at the basin scale or amongst other geographical areas

Indeed, at this scale allocative efficiency considers re-allocating and co-managing water among uses by re-allocating water from lower value to higher value uses within and between sectors, thereby mitigating adverse impacts (Wichelns, 2002; Molden et al., 2003). At the same time environmental flow requirements need to be identified and managed (Richter et al., 2011). The total amount of water allocated in a river basin needs to be based on the maximum sustainable water footprint level of that basin (Hoekstra, 2013).

Value can be expressed in monetary terms (e.g. $/litre), food calorie terms (e.g. kcal/litre), energy terms (e.g. MJ/litre). Evaluation of water productivity should be carried out both in a physical sense (more crop per drop), and in an economic sense (more value per drop), in order to obtain the greatest benefit.

Economic water productivity (as defined in the previous section) provides a tool to attribute value and productivity to all water uses and users within a hydrological domain, and not only those pertaining to irrigated agriculture. When based on hydrological accounting of actual water consumption, a value (whether economic, social, ecological or agronomic) can be attributed to all water uses and reuses, including those that tend to be left unaccounted for in irrigation efficiency approaches as 'wasted fractions' non-utilized by irrigation (van Halsema and Vincent, 2012).

The water available within a catchment or river basin for allocation purposes is determined by the water balance equation:

$$P=ET+R+D\pm\Delta S \qquad (3)$$

where P is precipitation, ET is evapotranspiration, (evaporation, E and transpiration T), D is drainage and ΔS is the change in soil moisture. In order to assess whether or not a new technology that is available to farmers is beneficial to society, one needs to calculate net social returns instead of net private returns. The two concepts are identical, except that net social returns value all inputs and outputs at social prices, not market prices. Social prices are identical to market prices when well-functioning markets exist. When well-functioning markets do not exist, as is almost always the case with water, then one must attach a social value to water, which is defined as the value of the water in the best alternative use (at the margin) (Barker et al., 2003).

10.3 Technical efficiency in the use of water resources in Latin America from the production perspective

10.3.1 Urban and industrial uses

According to UN data for the year 2011, 78% of the population in the LAC region is concentrated in cities and this figure is increasing. Indeed it is expected to reach 86% by 2050. This trend carries with it the difficult task of satisfying the needs of existing megacities and balancing the environmental impacts that derive from them such as increased direct and indirect water consumption. Efficiency increases in the use of water in this context represents a way of limiting water stress and thus reducing the impacts of population growth and urbanization.

In LAC, technical efficiency in urban water supply is rather low. In Brazil, 37.57% of the water is lost (ANA, 2013). In Nicaragua, this figure reaches 25% in urban areas (GWP, 2011), and in the case of Colombia it was 20.5% in 2004 (ICC, 2007). The Inter-American Development Bank reported that 56% and 60% of the water was either lost or irregularly consumed in the water sector in Ecuador and Venezuela respectively (CAF, 2013). Approximately 36% of the water is lost in Mexico (Aguilar and Castro, 2010).

The Americas Association of water regulators surveyed water utilities in 2011. They obtained responses from twenty-three utilities in seven countries. On average, water conveyance efficiency is reported to be 58.81%, but ranges from 30.88% in Paraíba to 92.5% in Ceará, both states of Brazil. However, only ten out of twenty-three companies reported any data.

Nonetheless these figures do not reflect the complete picture. The quality of the services needs to be improved (CEPAL, 2010), not only the quality of the service as such (pressure, hours of service, reliance) but also the quality of the water for consumption (GWP, 2011).

Many problems for urban water management are rooted outside the urban scope. A recent report (GWP, 2011) mentions that unsustainable land management (soil and forest management), as well as industrial and agricultural pollution affect urban water availability and quality. Solutions for water provision and degradation are more feasible if a more systemic view of water resources, considering ecosystem services, is taken, which would require the adoption of integrated water management (GWP, 2012). Under this framework, water planners link basin level water management to the cities' water management and also consider the combined management of surface and groundwater resources (GWP, 2012).

10.3.2 Agricultural use

In LAC, as in many other regions of the world, agriculture is the main user of freshwater. However, the large and growing proportion of the population living in urban areas as well as the increased water demand from a growing industry and mining sector in LAC, in addition to reduced water supplies due to increased water pollution and climate change will put considerable pressure for continued transfers of water away from agriculture.

Trends in individual country's economies in LAC, the contribution and importance of agriculture to each of these national economies, trends in agricultural exports and the share of people employed in agriculture are all important factors underlying the development of irrigation and other water uses in the region. Since LAC's GDP growth for 2012 is projected to be 3.2% and 4.0% in 2013, compared to 1.6% and 2.2% in the OECD countries (see Chapter 4) and given that the decoupling of economic growth from water uses and water pollution is not yet generalized in the LAC region, increasing water efficiency in agriculture is a major challenge. However, there has been a decrease in the investment in irrigation in LAC in the last years (Molden, 1997; CAWMA, 2007; Ringler et al., 2010).

Focusing on South America and the Caribbean, the total irrigated area is around 18.6 millions of hectares; corresponding to only 7% of the world's total estimated irrigated area (CAWMA, 2007). Brazil has 3.5 million irrigated hectares, followed by Chile, Argentina and Bolivia. In general, irrigation in South American countries has been inefficient; a major weakness is the failure to provide adequately for the operation and maintenance of irrigation systems once construction or installation is completed (Garces-Restrepo et al., 2007).

Thus, in general irrigation efficiency of the existing systems in LAC countries falls below expectations. However, some efficient irrigation systems exist in the region, such as the case of banana production in Ecuador and fruit and vineyards in Chile (Ringler et al., 2010). With few exceptions, agricultural water use in general has been inefficient in LAC due to the predominance of traditional surface irrigation technologies; FAO (2003) reports that 95.6% of irrigated lands in LAC are surface irrigated; 2.7% use sprinklers and just 1.7% use localized irrigation (drip and micro-sprinkler). These percentages indicate that there is considerable potential to increase water productivity in the region by switching to more efficient water application methods (de Oliveira et al., 2009).

In the LAC region, the levels of technical irrigation efficiency are medium to low, in the range between 30% and 40% (Figure 10.2). In its country database, FAO (2013) includes average irrigation efficiencies for LAC countries (referred to as water requirement ratios) ranging from 18% (Costa Rica) up to 48%, 51% and 65% (Brazil, Paraguay and Puerto Rico respectively). The average for the region is reported at 39%, whereas the world average is 56%. Field estimates in various irrigation projects in Brazil, for example, resulted in average actual and potential water application efficiencies of 40 % and 60%, respectively, for conventional and improved irrigation systems (Ringler et al., 2010). The introduction of efficient irrigation systems in Chile during the past fifteen years has led to a significant increase in the proportion of irrigated land with efficient irrigation technology; at present, 30% of Chile's total irrigated surface is equipped with efficient irrigation technologies such as drip and sprinkler systems. This trend has led to an overall irrigation efficiency of 58% in the last ten years. Brazil shows progress towards a better application of water with 59% of irrigated lands being under surface irrigation, 35% with sprinkler irrigation, and 6% with localized irrigation; here water scarcity and farm characteristics have encouraged the use of more efficient irrigation methods. Thus, in order to ensure water and food security in LAC, there is a need to improve water efficiency, both in humid and arid regions.

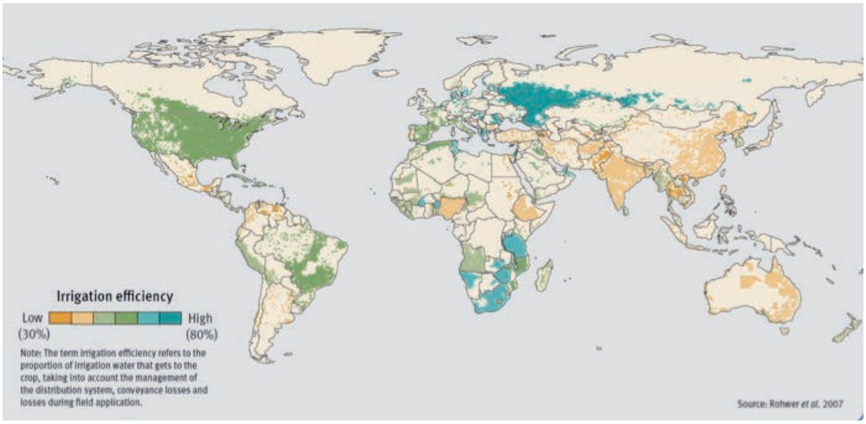

Figure 10.2 Global irrigation efficiencies, year 2000. *Source: UNEP (2012).*

In a comprehensive evaluation of 144 projects that adopted sustainable agricultural technologies and practices, including several studies in LAC, Pretty et al. (2006) demonstrate that the greatest opportunity for improvement in water productivity, i.e. marketable yield divided by crop water consumption, is in rain-fed agriculture. Water-related risks due to high rainfall variability can successfully be reduced by improved farm management, thereby avoiding low productivity or crop failure. Adequate measures include (supple-mental) irrigation, soil, and nutrient and crop management.

However, inadequate agricultural water use in LAC is salinizing, waterlogging, and eroding agricultural lands and polluting water for agricultural use. Most salinization problems originate from the inefficient use of water. Argentina and Chile have about 35% of their irrigated lands affected by salinity whereas 30%, equivalent to 250,000ha, of the coastal region of Peru under irrigation is also impacted by this problem. In Brazil 40% of the irrigated land in the northeast is affected by salinity as a result of improper irrigation (Ringler et al., 2010).

10.4 Water productivity in the use of water resources in Latin America from the production perspective

In the LAC region as a whole, the largest water user is the agricultural sector, amounting to 99% of the green and blue water consumption and 46% of the nitrogen-related pollution (Figure 10.3). Urban water supply represents as much as 0.5% of the total water consumed and 37% of the total nitrogen pollution. Meanwhile the industrial sector represents just 0.1% of the total water consumed and 17% of the total nitrogen pollution.

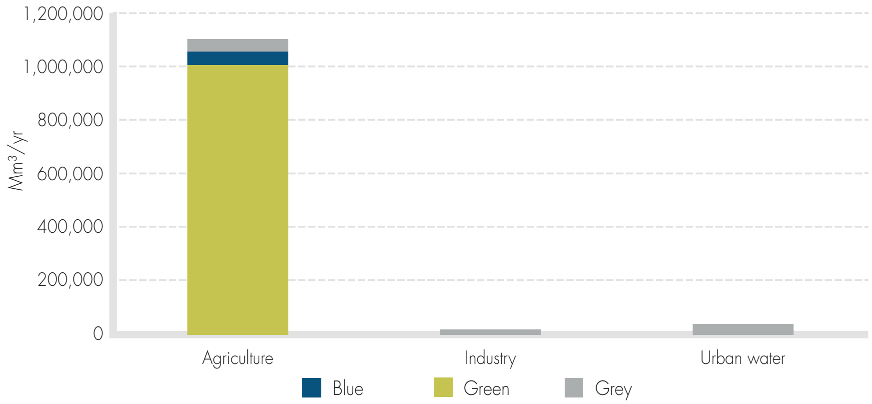

Figure 10.3 The annual water footprint of national production in LAC (in million cubic metres, Mm³), average for the period 1996–2005. *Source: Mekonnen and Hoekstra (2011)*

10.4.1 Urban and industrial uses

Figures 10.4 and 10.5 show the water footprint for domestic water supply and for industrial production for several countries of the LAC region. These values are inversely related to water productivity as was defined in section 10.2.2.

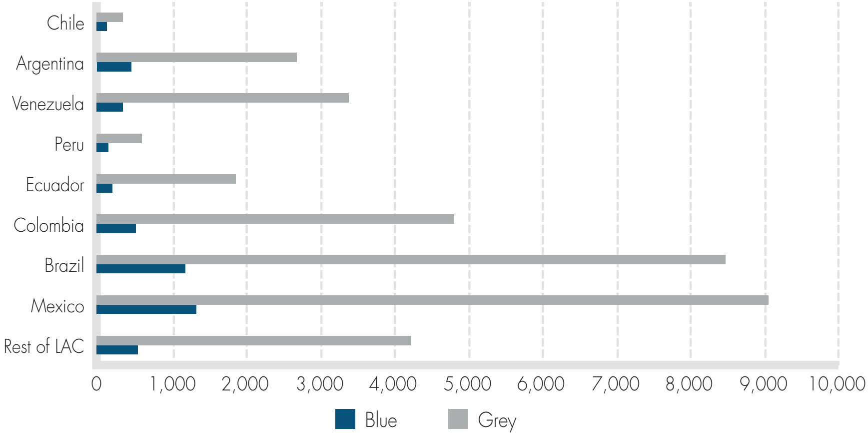

Figure 10.4 Annual water footprint of domestic water supply (in million cubic metres, Mm³), average for the period 1996–2005. *Source: Mekonnen and Hoekstra (2011)*

The water footprint of domestic water supply is determined by the grey water footprint; the grey footprint represents close to 88% of LAC's total water footprint for domestic water supply. Mexico has the highest value for its grey water footprint of domestic water supply and sanitation, followed by Brazil, Colombia, Venezuela and Argentina, in decreasing order. These five countries represent approximately 80% of LAC's domestic water supply grey water footprint. On the other hand, Chile has one of the lowest grey water footprints for domestic water supply for the southern sub-region. This is a reflection of the significant increase in the coverage of water treatment in the past decade, which has changed from 10% in 1990 to 80% in 2010.

Chile and Peru have the lowest blue water footprints for domestic water supply, accounting for 6% of LAC's total domestic supply blue water footprint. In contrast, Brazil and Mexico have the highest blue water footprints; theirs being eight times that of Chile and Peru.

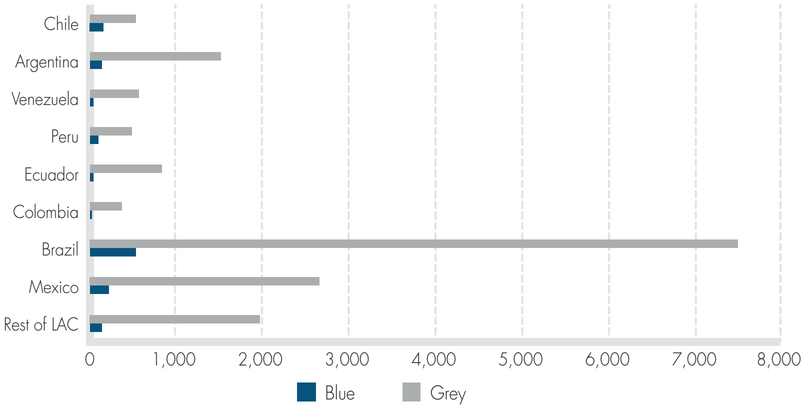

Figure 10.5 Annual water footprint of industrial production (in million cubic metres, Mm³), average for the period 1996–2005. *Source: Mekonnen and Hoekstra (2011)*

As was the case with the domestic water supply water footprint, the industrial production water footprint is mainly composed of the grey water footprint. The industrial production grey water footprint accounts for over 90% of its total water footprint. However, it is important to note that the industrial grey water footprint is less than half the value of the domestic water supply grey footprint. Brazil is by far the country with the highest industrial production grey water footprint. Mexico, the country with the second highest grey water footprint related to industrial production has a grey water footprint 65% lower than that of Brazil. Chile and Peru have the lowest figures, while Argentina has a medium-level industrial production grey footprint.

Mexico and Brazil also have the highest industrial production blue water footprint, thus these countries have the lowest industrial water productivities. The highest blue water productivities for industrial production are found in Colombia, Ecuador, and Venezuela; their industrial blue water footprints range from 20 to 45Mm^3/yr. Medium industrial blue water productivity countries are Argentina, Chile, and Peru, with industrial blue water footprints from 102 to 158Mm^3/yr.

10.4.2 Agricultural use

It is evident from Figure 10.6 that the LAC region relies extensively on rain-fed production systems, as the green water footprint is the most important component of the total crop production water footprint in LAC. Crop production in Argentina and Brazil has the highest crop production water footprint (Figure 10.6) whilst Mexico has a crop water footprint close to the average for the rest of LAC.

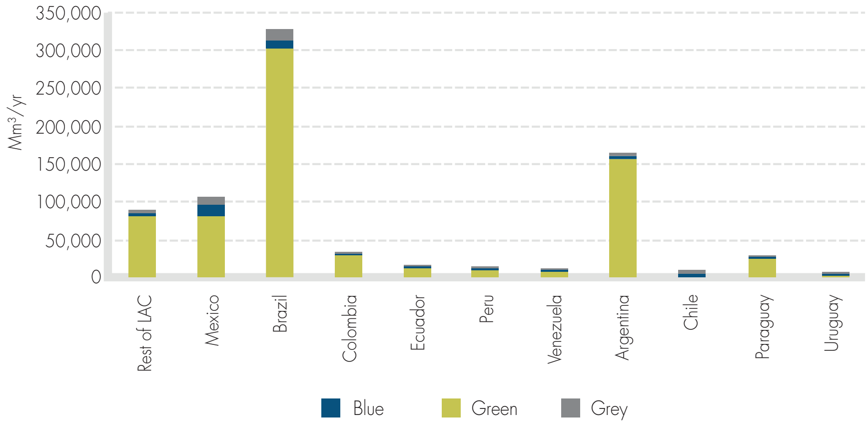

Figure 10.6 Total water footprint of agricultural crop production for the LAC region (average 1996–2005). *Source: Mekonnen and Hoekstra (2011).*

Mexico and Brazil have the highest blue water footprint for crop production, ranging from 9,000 to 14,000Mm^3/yr. Medium-range crop production blue water productivities can be found in Peru, Argentina, Chile and Colombia; the average blue water footprint of these countries ranges between 2,500 and 4,000Mm^3/yr.

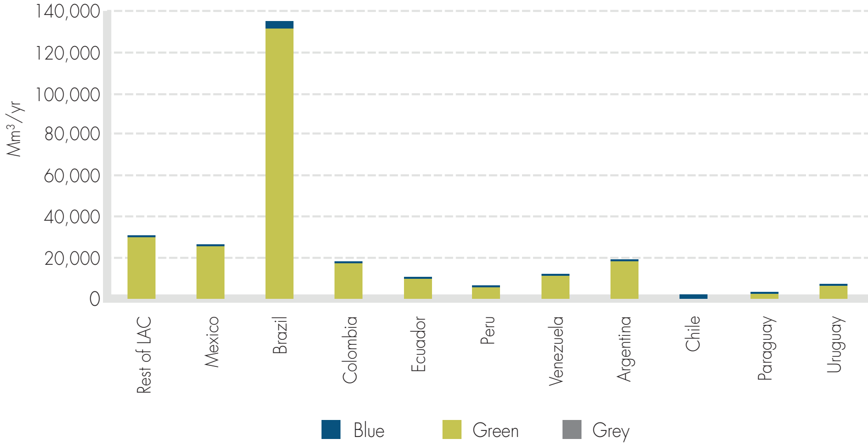

Figure 10.7 Water footprint of livestock production (Mm³/yr), period 1996–2005. *Source: Mekonnen and Hoekstra (2011).*

As in the case of crop production, the most significant component of livestock's water footprint in LAC is the green water footprint (Figure 10.7). Brazil stands out as the country with the highest water footprint of LAC countries although livestock's blue water footprint only represents 4% of the total water footprint in this country.

10.4.3 Energy production

The relationship between water and energy is mainly characterized by hydropower generation. The main hydropower producing countries in the world belong to the OECD and are responsible for 42% of the entire hydroelectric output. Asian countries are responsible for 26%, where China is the main contributor. LAC has a hydropower production share of 20%, mostly contributed by Brazil, which produces almost 12% of the world's total. In Brazil, 75% of the electric power is provided by hydropower.

Hydropower generation is generally associated with a reservoir, which accumulates water in order to maintain a regular flow regime. The evaporation rates in these reservoirs drive water losses in watersheds with hydroelectric dams or reservoirs. This factor gives hydropower dams a consumptive profile in terms of water use, an important fact which is in general overlooked in national or regional water plans.

An interesting indicator of water efficiency in the case of hydropower reservoirs is the ratio between the amount of water evaporated and the capacity for electricity generation. Mekonnen and Hoekstra (2011), exploring this indicator, have presented a preliminary study on hydroelectricity water efficiency. The authors used an evaporation database of thirty-five hydropower reservoirs throughout the world, eight of them in Brazil. The authors' results indicate that hydropower's blue water footprint averages from 140 and 244L/kWh for potential capacity and real charges, respectively.

In Brazil there are more than a hundred hydropower reservoirs with nominal capacities over 30MW. Sousa and Reid (2010) presented a blue water footprint assessment of the main Brazilian hydropower reservoirs, based on their estimated evaporation rates. They have found values ranging from 0.47 to 399.84L/kWh, for sixty-six studied reservoirs. The average blue water footprint was 35.46 L/kWh. The results are not directly comparable to Mekonnen and Hoekstra's range due to methodological differences with respect to real evaporation estimates. For the case of Chile, the average blue water footprint of hydroelectric reservoirs was 45L/kWh.

A similar study conducted by Torcellini et al. (2003) has estimated an average blue water footprint of 68L/kWh for the US's hydropower reservoirs. Blue water footprints of hydropower reservoirs are generally much higher than those of other energy sources. For example, Torcellini's values for hydropower reservoirs are thirty times higher than those found for thermoelectric plants.

10.5 Economic efficiency in the use of water resources in Latin America from the production perspective

As mentioned in section 10.4, in the LAC region as a whole, the largest water user is the agricultural sector, accounting for 99% of the green and blue water consumption and 46% of the nitrogen-related pollution (Figure 10.3), while it accounts for between 1 and 23% of the total Gross Domestic Product (GDP) and employs from 1 to 36% of the economically active population. Urban water supply represents as much as 0.5% of the total water consumed and 37% of the total nitrogen pollution. Meanwhile the industrial sector represents just 0.1% of the total water consumed and 17% of the total nitrogen pollution, while it contributes from 15 to 68% to the GDP that it generates and employs from 13 to 32% of the economically active population.

Economic efficiency of water use for the industrial sector in LAC is on average US\$ 155/m^3 (see Figure 10.8). Agriculture's water efficiency in LAC is significantly lower, with an average value of US\$ 5/m^3.

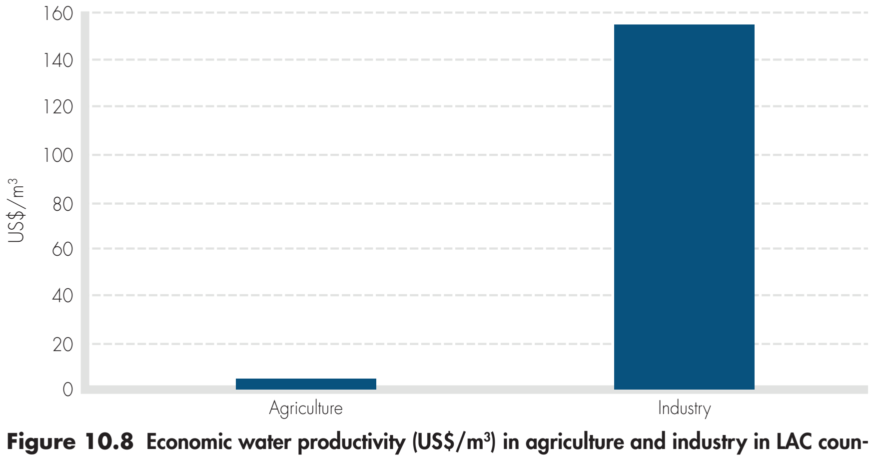

Figure 10.8 Economic water productivity (US\$/m^3) in agriculture and industry in LAC countries (2011). *Source: Mekonnen and Hoekstra (2011).*

10.5.1 Industrial use

As Figure 10.9 indicates, Colombia, Venezuela, and Uruguay are LAC countries with the highest economic water efficiencies in the industrial sector. These countries present economic water efficiencies from US\$ 280/m³ to US\$ 300/m³.

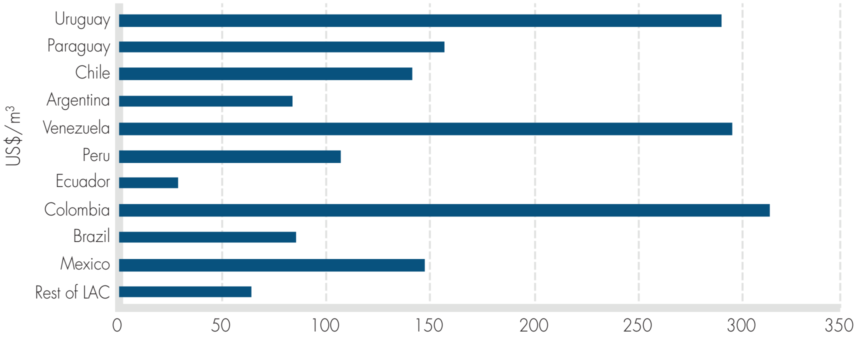

Figure 10.9 Economic water efficiency of industrial production for the LAC region (average 1996-2005) (US\$/m³). *Source: Mekonnen and Hoekstra (2011).*

Paraguay, Mexico, Chile and Peru show medium figures for the economic water efficiency indicator for their industrial sector (US\$ 140/m³ to US\$ 155/m³). The countries with the lowest economic water efficiency in their industrial sectors are Ecuador, Argentina, and Brazil, with an economic efficiency indicator which varies between US\$ 27/m³and US\$ 80/m³.

10.5.2 Agricultural use

As pointed out previously, agriculture is the productive sector with the lowest economic water efficiency, with values between US\$ 0.15/m³ and US\$ 35/m³ (see Figure 10.10). The highest economic water efficiencies can be found in Venezuela and Uruguay. All other LAC countries have low economic water efficiencies for their agricultural sectors which are all less than US\$ 1/m³.

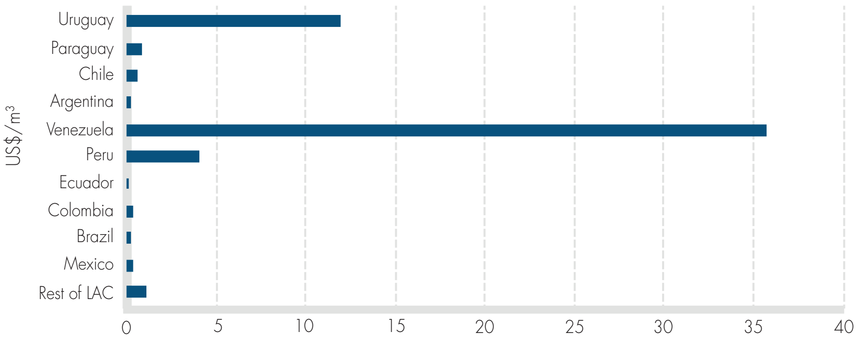

Figure 10.10 Economic water efficiency of agricultural production for the LAC region (average 1996–2005) (US\$/m³). *Source: Mekonnen and Hoekstra (2011).*

10.6 Environmental impacts of increased water efficiency

With reference to the environment, environmental efficiency is defined as the ratio of the minimum feasible use of an environmentally detrimental input to the observed use of said input, given the technology and the observed levels of outputs and conventional inputs (Reinhard et al., 2002). Whilst resilience is defined as the ability of a system to withstand perturbations or shocks (Gunderson and Light, 2006). In the case of water ecosystems, these perturbations could come from droughts or floods for example, or could be related to changes in water availability and water quality. Thus, improved efficiency in water use in an economic sector such as agriculture or urban water demand could increase the occurrence of environmental impacts in other ways (Box 10.1). However, it could also improve water availability in terms of both the quantity and the quality of the water. For example, the modernization of irrigation infrastructures is likely to increase energy demand, which in turn could increase water requirements to produce this energy. Thus, it is important to consider these environmental effects when projects that increase water efficiency are evaluated. The current challenge is to improve water efficiency whilst maintaining environmental sustainability (Ulanowicz et al., 2009).

Box 10.1 Environmental implications of irrigation modernization

[Adapted from Eugenio Gómez Reyes 'Inventario de recursos hídricos e implicaciones de la modernización del riego' in LA-Mexico (2012)]

Modernization of irrigation is widely viewed as a water-conservation strategy by policy makers who wish to increase water availability for human consumption and the environment. However, the adoption of more efficient irrigation technologies has not always achieved this desired result. There may be a rebound effect; water efficiency means the same production can be delivered with less water, but in fact more can be produced with the same amount of water. Furthermore, irrigation modernization reduces return flows, decreasing available water resources downstream. Additionally, reducing return flows leads to less leaching of pollutants; however, water available to absorb the contamination is also reduced. Ward and Pulido-Velázquez (2008) developed an integrated basin-scale analysis in the Upper Río Grande basin of North America (New Mexico) in order to study the effects of several water conservation policies on irrigation use and on water saved. They observed that incentive-based water conservation tools promote a change in the crop mix with more productive and water-intensive crops thus increasing the net farm income but also increasing the total water depleted. Subsequently, the adoption of water conservation technologies leads, in several cases, to an expansion of irrigated acreage (Pfeiffer and Lin, 2010).

During the last few decades, several irrigation programmes have been developed by Mexico's government in an attempt to improve water efficiency in irrigated agriculture. These water conservation programmes have often been developed without considering important factors in decision-making such as an integrated basin-scale analysis. Despite the large financial resources allocated in these projects, the main objective of water saving has not been achieved. Similarly, an analysis of Chile's agricultural census data of 1997 and 2007 indicates that irrigation efficiencies have increased significantly reaching 58% in 2007. However, during the same period, agriculture's water footprint increased. Thus it can be seen that policies focused on reducing water application do not necessarily always lead to water conservation.

As such Li and Yang (2011), conclude that a system's network must maintain a balance be-tween two essential but complementary attributes: efficiency and resilience. This is demonstrated in the current renewed interest of environmental water flows. In general it is an 'abstract water use' representing water quantities that ought to be maintained in streams and underground in order to sustain the system's functionality. According to Holling and Meffe (1997) the pathology of natural resource management arises when the range of natural variation in a system is reduced thereby producing resilience losses. In short, the balance to be struck be-tween the efficiency in the system (performance) and its resilience (reserve capacity) means en-suring more resource efficient systems: which use less land, water and inputs in order to pro-duce more food sustainably, while at the same time maintaining resilience to changes and shocks. Thus, this section introduces a certain note of caution in the pursuit of efficiency.

10.7 Conclusions and recommendations

The LAC region is fortunate enough to be endowed with an abundance of freshwater, possessing 31% of the world's freshwater resources (UNEP, 2010). This has contributed to the general perception that water is an abundant resource that is always available. This culture of abundance combined with a low educational level of farmers has resulted in the inefficient use of water. Moreover, several factors such as population growth, rapid urbanization, and increased water demands due to increased economic growth are putting considerable pressure on available water resources. Decoupling economic growth from water use is at the core of innovation strategies for sustainable consumption, production and ultimately resource efficiency.

In LAC, as in other regions of the world, agriculture is the main user of freshwater and more than 90% of the water consumed by this sector is green water. The greatest opportunity for an improvement in water productivity and efficiency is in rain-fed agriculture through enhanced and known water management practices. In general, irrigation efficiency of the existing systems in LAC countries also falls below expectations, due to the predominance of traditional surface irrigation technologies. In this region, irrigation effi-ciency ranges between 30 and 40% with the average reported at 39%; whereas the world average is 56%. These percentages indicate that there is a great potential of increasing water productivity in the region by switching to more efficient water application methods. However, future increases in irrigation efficiency in LAC countries must minimize unwanted consequences such as salinization, waterlogging, and increases in total water consumption (rebound effect).

Urban water use in LAC also has low technical water efficiency figures relative to developed countries; on average, water conveyance efficiency is reported to be 58.81%. Therefore increasing water demands due to a growing population and rapid urbanization requires increased technical efficiencies in the urban sector. There is also room for improvement with regard to the water efficiency in the electric sector.

Thus LAC countries must improve their water use efficiencies by addressing the following three major challenges (UNEP, 2011; 2013). First, the development of a water accounting system that considers the environment. This is essential in order to achieve the goals of increased water efficiency in a sustainable manner. That is, minimizing undesired environmental impacts such as salinization, decreased water availability for downstream users and increased total water consumption. Second, the implementation of transparent and comprehensive accounting systems will serve as an incentive to adopt best water management practices in agriculture so as to reduce environmental impacts. Third, the development of effective coordination mechanisms between authorities from different sectors and policies, at both national and river basin level, could ensure that their policies and objectives are mutually consistent and do not undermine each other.

In addition, appropriate policy instruments must be considered that provide adequate incentives to use water resources efficiently and ultimately achieve a more sustainable use of water in all sectors. This means that water users must consider water as a valuable resource; that is, water should be considered an economic good, as was originally recognized at the Dublin conference on Water and the Environment (ICWE, 1996). There are several policy instruments available that internalize the value of water resources when making water-use decisions; examples of these are water tariffs, water pricing, and water rights markets, among others. Chapter 13 gives an in-depth analysis of the use of these policy instruments in LAC countries.

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11

REFORMING WATER GOVERNANCE STRUCTURES

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Highlights

- Achieving long-lasting water and food security needs to be based on a solid foundation, represented by governance institutions that are able to ensure a fair framework for development. During the past three decades Latin America and Caribbean (LAC) has undergone significant institutional water reforms triggered by a number of factors, among which are the demands from civil society for more inclusive, sustainable, efficient and effective water governance, as well as the influence of international organizations promoting the introduction of Integrated Water Resources (IWRM) and other paradigms in LAC water governance structures.
- Some common trends in those reforms include: a shift towards decentralization, often complemented with the creation of coordination and supervising bodies at a higher level; the formulation of new water laws and policies that include a number of IWRM principles (environmental sustainability, integration, participation, accountability, transparency, cost recovery, etc.); the legal support of the right to water and sanitation; and the creation of water use levies and tariffs for cost recovery.
- In some countries the focus is now on adjusting and implementing those reforms, while others are still in the process of debating and formulating them. The main challenges for the implementation of ongoing reforms are related to the lack of integrated planning of water use, the poor coordination of the main stakeholders (both governmental and non-governmental), and the need for management instruments that may fit local conditions better.
- In its search for improved water security, LAC has pioneered the recognition of the access to safe water and sanitation as a human right. The countries' attention is now on the implementation of that right. The inclusion of the right to water and sanitation in most of the constitutional texts or laws is a first important step, which, however, has to be followed by clear financial and regulatory efforts.
- During the past three decades, private and public domestic operators have participated in the provision of water and sanitation. The analysis of past experiences suggests that the focus of reforms should be on creating favourable conditions for a quality and equitable service, which can be achieved only through ensuring strong governance, in general and specific for water.

- Funding of the water sector remains a challenge; governments struggle and usually fail to meet financial requirements. Despite the gradual introduction of tariffs and charges, revenues from the water sector are still insufficient to cover its financial needs. International public and private investors play a key role in filling that gap, with a clear emphasis on the development of infrastructure for domestic supply provision.

11.1 Introduction

A constant challenge worldwide is set by the need to count on adaptive institutions that strengthen democracy and promote growth and social development. In Latin American and Caribbean (LAC) countries there is a clear need to improve access to water, guarantee the quality of water for all uses, and enhance ecosystem services (Akhmouch, 2012). This makes the challenge of improved water governance particularly present and pressing in LAC countries, which often lack adequate institutional water systems (Crase and Gandhi, 2009; Akhmouch, 2012; Jiménez-Cisneros & Galizia-Tundisi, 2012). This chapter focuses on 'blue' water governance, which is a key instrument to achieving water security, while it does not deal *explicitly* with food security. Indeed, although well-performing water institutions do contribute to water security and therefore to food security (Chapter 1), the governance structures framing food security lie outside the water sector. As for green water, in other chapters it is pointed out that key inputs to agriculture and food production are water (blue and green) and land, whose use and management are strongly intertwined in practice but normally managed by different institutions. While this chapter focuses on the governance of the blue part of the land-water system, the institutional framework dealing with land and ecosystem management is discussed in Chapter 14.

Water governance can be defined as a system that makes water management more effective, accountable and participatory, thus strengthening the role of multiple stakeholders in institutional capacity building, improving coordination, broadening participation and consolidating partnerships (Jacobi, 2009). Water governance structures in some LAC have undergone reforms that implied not only re-orientation of policy priorities and approaches, but also the restructuring of institutional frameworks. This has led to the need for new intermediate institutions that enable a negotiated approach to water governance. Two issues hamper the capacity of institutions to improve and adjust to constantly changing conditions: the lack of proper evaluation of the quality of policies – often a consequence of lack of transparency and accountability that may favour some actors and their private interests over others; and the lack of adequate control over bureaucratic systems. Institutional reforms involved changes in the 'rules of the game', expressed by the coexistence of formal laws, informal norms and practices, and organizational structures, as well as strengthening institutional capacity.

The analysis of institutional experiences in the past two decades indicates a wide range of water governance approaches in LAC, which is telling that water management is a social and political issue as well as a technical one. The need to reform institutions has been mainly driven by the fact that the State had to respond to growing demands from civil society and, in particular, from economic sectors to improve its actions. Institutions are also reformed in order to respond to the need to improve their transparency, stimulate social capital, strengthen accountability, promote public interest, reduce institutional obstacles, and improve policy implementation and performance of the public and private sectors.

This chapter deals with water governance and its institutional reaches in LAC, with a special focus on Brazil, Chile, Costa Rica, Mexico and Peru. It first revisits the circumstances that triggered reforms undertaken in the different countries, and presents some reflections about their implementation currently and in the future. Then, the chapter analyses some of the elements that characterize institutional changes promoted by those reforms, while it leaves to other chapters of this book the in-depth description of other aspects (e.g. participation, transparency and accountability, economic instruments, etc.). With that perspective in mind, the role and characteristics of the legal systems for water use that frame and enable water governance, the recognition of the right to water and sanitation as a human right and the conditions needed to ensure its implementation are analysed. Finally, the chapter deals with the challenge of funding reforms and with how countries tap into national and international sources in order to address this issue.

11.2 Institutional setup: past, present, future

In this section, the main characteristics and challenges of reforming water governance structures are considered. The legal and organizational systems presented here constitute the framework within which four different types of actors operate: the state (public) institutions; market (private sector) institutions; activist (NGO) institutions; and civil society in a broad sense (Allan, 2013). Most of the water is used by the private sector (farmers, agribusiness, mining companies, etc.) as one input to their production activity. For these actors the market is the main driver determining production choices and the associated water uses (*ibid.*). One of the main tasks of the water institutional setup presented in this chapter is framing the use of water as a production input and ensuring that it is compatible with long-term water security.

11.2.1 Water reforms in LAC: triggers and trends

Since the 1980s, virtually all countries in the LAC region underwent institutional reforms of their water sector (Jacobi et al., 2009; Hernández et al., 2012) or at least have engaged in a lively debate on how to adjust their water institutions to new challenges posed by the need to address water and food security both as a country and at the scale of urban and rural communities. These reforming processes have been triggered by a number of factors. First, countries need to adjust to new and unseen socio-economic dynamics and the alteration environmental processes brought about by globalization and a strong economic development largely based on the exploitation of natural resources (see Chapters 3 and 4). For instance, in Peru water policy reform was driven by the need to update the 1969 General Water Law, which presented limited cohesion between water quantity, water quality and environmental considerations and did not recognize the economic value of the resource (MINAG, 2009). Second, processes of democratization have spurred demands from society for more inclusive, effective and environmentally sustainable water governance, which had to be reflected in an upgrade of water institutions. Thus, in Brazil the main driver for reforms was the need to approach water management from a regional standpoint and the need to consider the multiple uses of water, as well as the effects of their interrelations (Jacobi et al, 2009). Third, in some cases, major political changes have triggered water reforms. For instance, in Chile the major Water Code reform was driven by the shift towards a more decentralized political context. Economic liberalization enacted during the military regime of 1973–1989 included the 1981 National Water Code, which established transferable water use rights and facilitated water markets (Hearne and Donoso, 2005). Last but not the least, multilateral players – mainly the World Bank and the Inter-American Development Bank – and different international cooperation agencies are often perceived as important drivers of reform and as providers of comprehensive technical and financial support, as well as pro-reform decision-makers (Castro, 2007; Wilder, 2010).

Reforms have taken place mainly through the modification of the legal system and often with the approval of a new Water Act (see Section 11.3); the definition of water resources policies and guiding principles for water management; and in some cases even through bottom-up, informal reforms that have tried to anticipate or adjust top-down mandates to the local contexts (Kauffman, 2011). As a result, LAC countries exhibit coexistence of different approaches to the right to water and water services (as a human right, as a commodity, as a public service); coexistence of a set of formal and informal rules and standards that define different institutional models of water management; and coexistence of multiple state, private and social actors involved in decision-making processes (Hernández et al., 2012). Indeed, different political systems, political-administrative structures and institutional arrangements for water governance define the dynamics of public, private and public capacities for management with different performance results, according to the history and background of each country.

Being aware of the difficulties of generalizing when considering a diverse region such as LAC, it is useful to point out some features of the institutional setting that can be observed in some of the countries. Several LAC countries have decentralized at least some water functions (Table 11.1). In those decentralized models, domestic water supply and sanitation is usually transferred to the local level, while higher-level sub-national governments are responsible for water resources management (Akhmouch, 2012). The decentralization process often has gone hand in hand with the definition of the river basin as a water management unit (see Chapter 2), and in Peru specifically the 2009 Water Act reinforces the need to decentralize water management (participation of users, national regional and local government in the decisions process). In Colombia, the reform of the constitution in

1991 and the subsequent approval of the 1994 water legislation aimed to strengthen private water management institutions, increase private participation in the operation and redefine the role of government in providing public services. In that context, the state's main role is to regulate, support, plan and control the provision of these services, thus driving a process of decentralization and privatization in water management, transferring the operation of water services to the private sector (Hernández et al., 2012).

Table 11.1 Allocation of responsibilities in water governance at sub-national level and the role of the central government in selected LAC countries

COUNTRY	ROLE OF CENTRAL GOVERNMENT (dominant actor or joint role with sub-national governments)	ALLOCATION OF ROLES AND RESPONSIBILITIES IN WATER POLICY DESIGN AND IMPLEMENTATION
ARGENTINA	Joint	Municipalities, inter-municipal bodies, Provinces, River basin organizations
BRAZIL	Joint	Municipalities, Water-specific bodies, States
CHILE	Dominant	Municipalities
COSTA RICA	Dominant	Municipalities, Inter-municipal bodies, Regions, River basin organizations
MEXICO	Dominant	Municipalities, Regions, Water-specific bodies, River basin organizations
CUBA	Dominant	Regions, Municipalities, River basin organizations
DOMINICAN R	Dominant	River basin organizations
EL SALVADOR	Dominant	Municipalities, Inter-municipal bodies, Water-specific bodies, River basin organizations
GUATEMALA	Joint	River basin organizations, Municipalities.
HONDURAS	Joint	Municipalities, Inter-municipal bodies, Water-specific bodies
NICARAGUA	Joint	Regions, Municipalities, Inter-municipal bodies, Water-specific bodies, River basin organizations.
PANAMA	Dominant	Municipalities, others (water committees)
PERU	Joint	Regions, Municipalities, Water-specific bodies, River basin organizations

Source: own elaboration based on Akhmouch (2012).

A second feature common to several LAC countries is the increase of participation of stakeholders in decision-making processes (see Chapter 12), with special emphasis on the role of water users, which in some cases have acquired large control over water use through their associations. For instance, in Mexico the 1992 National Water Law, modified in 2004, created watershed councils to promote and facilitate – at least on paper – the participation of civil society organizations in planning, decision-making, implementation and monitoring of the national water policy at a basin level (Wilder, 2010). In the new institutional design, however, the federal water management agency CONAGUA assumed a policy making and overseeing role and retained key strategic functions (*ibid.*). In Chile, the 1981 Water Code significantly reduced the State's intervention in water resources management to a minimum and increased the management powers of water use right holders, organized into water user associations (Hearne and Donoso, 2005). However, multiple central authorities (ministries, departments, public agencies) continue to be involved in water policy making and regulation at central government level (Donoso, 2014).

While decentralization of water management and participation of water user organizations have been common features in some countries (e.g. Brazil, Chile, Mexico, Peru and Costa Rica), differences arise when taking these guidelines into practice. Brazil and Mexico, for example, implemented decentralized management and established the watershed as the management unit. In Chile, users and water users associations play a central role in the administration of water rights and there have been only timid attempts to establish river basin master plans (Hearne and Donoso, 2005). In Peru, the institutional landscape is characterized by partial decentralization to manage water at a basin level and the establishment of the National Water Authority in charge of managing water resources by basin (Kuroiwa et al., 2014).

The strong demands for democratization and for well-functioning institutions – both in general and in the water sector – has caused vigorous claims for increased accountability of all those involved in determining, influencing or implementing public policies. This has promoted important advances, at least on paper, in terms of transparency and accountability in the LAC region. These advances have often originated from outside the water sector but undoubtedly their effects can be perceived also within it (see Chapter 12).

Another feature common to several LAC countries is the definition of national or regional water policies and strategies that recall principles of IWRM such as policy integration, coordination and cooperation, integrated management of different water sources, environmental sustainability, public participation, planning at a watershed level (Regional Process of the Americas, 2012). Brazil represents a good example of this. During the 1980s, the degradation of Brazil's water resources in areas of large urban–industrial concentration led to pressure from civil society in favour of the improvement of water sources. Thereby, consensus was reached around the need for: the creation of a national water resources system considering multiple water uses, the adoption of references for regional management, decentralized and participatory management, a national water resources information system and technological and capacity development in the area (ANA, 2002; Jacobi et al., 2009). The Water Law came into force in 1997 and consisted of the basic legal text that created the Water Resources National Policy and the National Management System of Water Resources. The resulting policy is based upon four basic principles: a) adoption of the water basin as the management unit; b) the consideration of multiple uses; c) water as an economic good, with an economic value, encouraging its rational use; and d) participatory and decentralized management, providing opportunities to users and the organized civil society to participate in decision-making processes (Barth, 1999; Pagnoccheschi, 2003; Jacobi, 2004). In a similar way, Costa Rican water policy establishes among its goals the achievement of a balance between the use of water resources for human development and the sustainability of ecosystems. The guiding principles for accomplishing this are: integrated water resources management, establishing the human right of access to drinking water and basic sanitation, considering water a public-domain good, using a comprehensive ecosystem approach, encouraging the participation of all stakeholders, and the polluter pays principle.

Other common features that can be identified in the evolution of water institutions in the region are discussed in other sections of this chapter: the legal recognition of the right to water and sanitation and its implications in terms of implementation (Section 11.4) and the early stages of the reinforcement of water tariffs and charges as a means to increase revenues for the water sector and to improve water use efficiency (Section 11.5).

11.2.2 Implementing water reforms: the way forward

In the LAC countries there are both external and internal variables that cause water institutions to operate below par despite the formulation of water reforms. External factors are related to the overall trends in governance and levels of economic and human development already analysed in other parts of this book (Chapters 4 and 6), which constitute crucial enabling conditions for the success of any substantial improvement of water governance. When looking specifically at the water sector, the as yet limited citizen participation, the mismatch between hydrological and administrative boundaries and the insufficient capacity of local and regional governments in relation to their responsibilities have been identified among the most important challenges when designing water policy in several LAC countries (Akhmouch, 2012; Table 11.2).

Moreover, the lack of coordination across administrative levels and sectors creates a duplication of some functions and activities, inefficiencies in the allocation of resources, insufficient and partial performance of certain functions, overlap between institutions, and conflicts of power between them. In this context, institutional problems have led to excessive delays in processing and management decisions; technical shortfalls in the implementation of tasks; and lack of the necessary financial and human resources to carry out the assigned functions (Hernández et al., 2012).

Mexico and Brazil represent two of the most advanced and modern water governance systems in Latin America due to the legislation and institutional reforms focused on watershed management and societal participation, but the implementation of their institutional reform is still under way. For instance, in Brazil there are significant differences between states and also between Water Basin Committees in relation to the consolidation of the current decentralized institutional model (Bechara Elabra and Magrini, 2013), which points to the complexity of the ongoing institutional restructuring. To complete institutional reforms, this restructuring needs to be fully implemented and the National Water Plan be approved. In addition to the modification of the territorial model, major changes are linked to an increased process of privatization of services through public–private partnerships so as to ensure investments that governments are not able to afford. Meanwhile in Mexico there is a need to coordinate the decision-making process and improve communication between different sectors, so as to reach agreement and allow for different stakeholders to participate in decisions. According to Serrano (2007), the consolidation of the reform is incomplete, and the lack of regulations is causing a bottleneck situation within the process.

Table 11.2 **Main challenges in water policy making and their relative importance in selected LAC countries**

MAIN CHALLENGES IN WATER POLICY MAKING	VERY IMPORTANT	SOMEHOW IMPORTANT	NOT IMPORTANT
Limited citizen participation	Argentina, Chile, Costa Rica, Guatemala, Mexico, Nicaragua, Panama	Brazil, Dominican Republic, Honduras, Peru	
Horizontal coordination across ministries	Argentina, Brazil, Costa Rica, Dominican Republic, Honduras, Nicaragua, Panama	Chile, Guatemala, Mexico, Peru	
Mismatch between hydrological and administrative boundaries	Brazil, Costa Rica, Dominican Republic, Guatemala, Nicaragua, Panama, Peru		Argentina, Honduras
Local and regional government capacity	Chile, Guatemala, Honduras, Mexico, Nicaragua, Panama	Argentina, Brazil, Costa Rica, Peru	
Vertical coordination between levels of government	Brazil, Dominican Republic, Guatemala, Honduras, Panama	Argentina, Chile, Mexico, Nicaragua, Peru	
Economic regulation	Chile, Guatemala, Mexico, Panama, Peru	Argentina, Costa Rica, Dominican Republic, Honduras, Nicaragua	
Managing geographically specific areas	Argentina, Chile, Costa Rica, Panama	Honduras, Nicaragua	Brazil, Dominican Republic, Guatemala, Peru
Allocation of water resources	Guatemala, Mexico, Nicaragua, Panama	Chile, Dominican Republic, Honduras	Argentina, Brazil, Costa Rica
Horizontal coordination among sub-national actors	Costa Rica, Honduras, Panama, Peru	Brazil, Chile, Dominican Republic, Mexico, Nicaragua	Guatemala
Managing the specificities of rural areas	Chile, Costa Rica, Panama	Argentina, Dominican Republic, Honduras, Mexico, Nicaragua, Peru	Guatemala
Managing the specificities of urban/ metropolitan areas	Argentina, Chile, Panama	Brazil, Costa Rica, Honduras, Mexico, Nicaragua, Peru	Dominican Republic, Guatemala
Enforcement of environmental norms	Costa Rica, Mexico, Panama	Chile, Dominican Republic, Honduras, Nicaragua, Peru	Argentina, Brazil, Guatemala

Source: own elaboration based on Akhmouch (2012).

Although operational principles (e.g. accountability, transparency, equity) are established, there are still complications related to the definition of responsibilities and functions.

In Chile, among the internal problems, the principal one is quite possibly the lack of a superior public authority that effectively coordinates all functions performed by public and private institutions in relation to water, supported by the enforcement of water user organizations (Hearne and Donoso, 2005).

In Costa Rica the approach to water resources management has been expressed through a Water Policy and a National Plan of Integrated Water Resources Management. However, these policy instruments are still not fully effective in changing water management practices, since administrative, operational and regulatory roles between government agencies and other water users have not yet been well defined (Astorga, 2010).

11.3 Legal nature of water and water rights

Whereas the general organizational setting and overall principles define the actual (or target) framework for water governance, the legal nature of water (who owns it, who can use it and how) represents the basic 'bricks' or, more precisely, the 'foundations' of the 'institutional building' in each country. Any change in the organizational system and any attempt to change the water policy orientation will have to take into account the water rights system and decide whether to adjust to it, make little amendments or engage in a far-reaching (and far more challenging) reform of those legal foundations.

When talking about water rights in a given country, as a starting point one ought to consider whether it has a Water Act or not. Most of the LAC countries do have one, which for the most part was passed or amended during the past decade. In many cases, the Water Act is complemented with legislation specific for domestic supply and in other cases there is only domestic water supply legislation (Figure 11.1). Having a Water Law, however, does not necessarily imply that this includes all the elements that are widely accepted to be considered good water management principles, especially in the case of Water Acts prior to the 1990s. Additionally, even in the most modern Water Acts, where these issues are included, their formulation or degree of implementation is often lacking (e.g. see Chapter 12 for public participation provisions; Chapter 15 for management at a river basin level).

11.3.1 Ownership of water resources

Unique features distinguish water from other natural resources: mobility, variability and uncertainty in supply, bulkiness, indivisibility, diversity of social, cultural and environmental functions, sequential and multiple use, interdependency among uses and users within a given river basin system, and conflicting cultural and social values. These characteristics can lead to multiple market failures, such as vulnerability to monopoly control and natural monopolies, imperfect competition, externalities, sub-optimal allocation of public-good attributes, risk, uncertainty, imperfect information, and potential for social and environmental inefficiencies and inequity. Institutions must address these failures in order to ensure efficient resource use and allocation. Thus, water is different from an ordinary commodity, although it can be traded using due caution. It is a free access and sometimes a common good, which, in absence of regulation is characterized by non-exclusion and rivalry and thus is prone to free riders. The characteristics of water have important consequences concerning its ownership, water rights systems, management institutions,

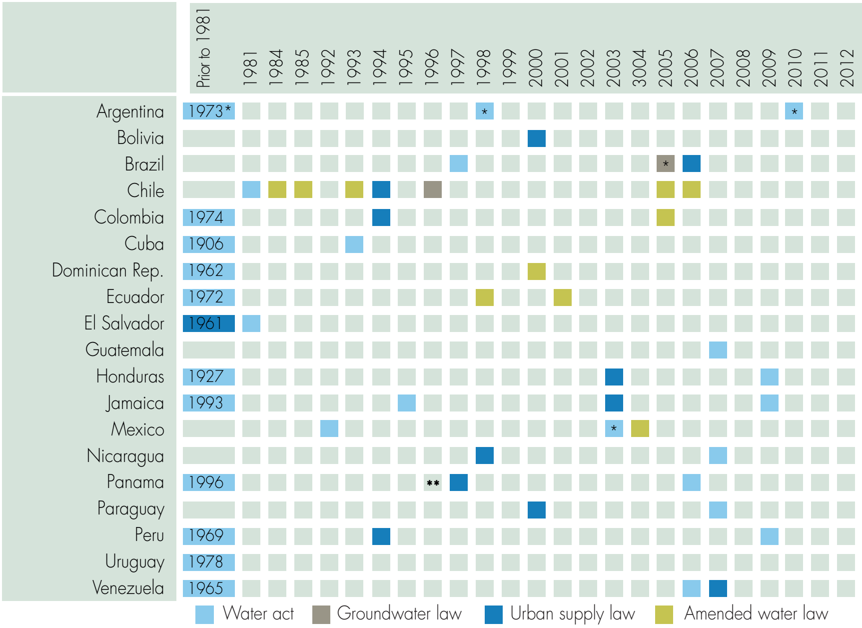

Figure 11.1 Timeline of the approval of the Water Act, domestic supply legislation and specific groundwater law in selected LAC countries. One asterisk indicates laws that apply only to part of the country's territory (province or state). Two asterisks: it is a law on natural resources with a specific section on water. *Source: own elaboration based on data from WaterLex and FAO Legal Office WaterLex.*

and conflict-solving mechanisms (Hanemann, 2006). Thus most regulatory schemes consider the establishment of exclusive access through the definitions of water use rights.

In most legal systems, water belongs to the public domain of the State. The principle of public ownership and control is a feature of both Western and Eastern water law (Bonfante, 1929; Wohlwend, 1975; Caponera, 1992; Ke, 1993). In general, legislation in the LAC region defines water as a 'public domain', 'national waters', 'national goods of public domain', 'property of the Nation' etc. Public ownership of water resources is the principle in force e.g. in Argentina, Brazil, Chile, Ecuador and Mexico, along with other LAC countries (see Table 11.3). However, similar terms do not mean the same thing in different countries. For example, the concept of public property in Chile has little to do with the features found in other countries.

11.3.2 Water rights

Although water belongs to the public domain, water use rights granted to economic agents are protected as private property. A system of secure and stable water rights is an incentive for investments in the development and conservation of water resources, and prevents the social unrest that would result from ignoring existing uses at times of change

Table 11.3 Ownership of water in selected LAC countries

COUNTRY	OWNERSHIP OF WATER [1]
ARGENTINA	The provinces have the original dominion over the natural resources existing in their territory.
BRAZIL	Ownership of water resources rests with the Union and, in some cases, with the states.
CHILE	With few exceptions, water is national property.
CUBA	Ownership of water resources is vested originally in the State.
DOMINICAN REP.	All waters in the country, without any exception, are the property of the State.
ECUADOR	Surface and underground water resources [...], including those which were previously privately owned, are deemed to be national property and for public use.
GUYANA	The State is the owner of all waters of the country and its rights of use.
MEXICO	The ownership of land and waters within the boundaries of the national territory corresponds to the Nation.
PANAMA	All waters within the national territory are public domain goods belonging to the State and belong to it.
PARAGUAY	Surface and ground waters are public domain property of the State.
PERU	Natural resources, renewable and non renewable, are patrimony of the Nation.
URUGUAY	Surface waters as well as subterranean waters, except for rainwater, integrated into the hydrological cycle constitute a unitary resource of public interest, which, as the public hydraulic domain, constitutes part of the public domain of the State.
VENEZUELA	All the waters are goods of public domain belonging to the Nation.

Source: own elaboration based on data from FAO Legal Office WaterLex, WaterLex Legal Database on the Human Right to Water and Sanitation, www.senado.gov.ar, www.congreso.gob.pe, and www.tsj.gov.ve.

in water legislation (Conac, 1991). A water right is usually a right to use (i.e. withdraw water or dispose polluting effluents). Ownership normally means a usufructuary power, and not ownership of the body of water itself (Getches, 1990; Tarlock et al., 2002). However, property rights to water use are conditioned.

11.3.3 Conditions on water rights

In most countries water rights are complemented by a requirement of effective and beneficial use. In virtually all jurisdictions, the allocation and permanency of water rights are contingent upon allocating them to a socially recognized beneficial use (CEPAL, 1995). When water rights are not utilized they are lost under the forfeiture and abandonment provisions of water legislation. Other conditionalities on water rights include provisions concerning no harm to third parties and the environment. Furthermore, in some countries water rights have been adjusted as new knowledge developed or conditions change, since the government has a permanent duty to monitor the use of water, under public trust obligations. Rights not subject to conditionalities of effective and beneficial use facilitate monopolization and have other negative features in cases of water trade: they can be traded according to their nominal entitlements, and not on the basis of effectively consumed

1 Non-official translations.

water. Chile allows the trading of nominal water entitlements, just as Australia does. As a result, trade deprives the environment and users of export areas of water, available so far. Negative externalities to the environment and third parties are thus difficult to control (Young, 2010, 2011, 2012; Donoso, 2011).

11.3.4 Theory versus practice

It is worth mentioning the difference between written water law and its implementation in practice. It is possible to find Water Acts that are very elaborated and complete, but this does not necessarily mean that they are fully implemented and enforced on the ground. Shortcomings in this sense can be observed in the management of water resources by river basin, the limited role of water tariffs, the difficulties associated with the protection of water and water ecosystems or the achievement of true public participation. Pitfalls in the design and reliability of water rights registers are also common even in countries with a well-developed legal water system as is the case of Chile. This is particularly important in the case of groundwater, where the establishment and continuous updating of registers of water use rights is considered to be crucial in laying the foundations of groundwater management (GEF, 2012).

Even if in Argentina, Brazil, Colombia or Mexico the situation is notably better than in the remainder of the region, LAC still faces challenges in terms of designing and enforcing more advanced legal water systems. For instance, the poor application of environmental laws to protect water quality is a clear shortcoming in the region, where mining, industry and even urban areas can be non-compliant with the law without serious legal or economic consequences (see for instance Chapter 9). This also applies to the non-compliance in other sectors, as is the case of the Madre de Dios river (Peru). Here there is illegal exploitation of gold following intense deforestation and large amounts of mercury are used to separate gold from the metal ore. There is no control of the effluents, which are left untreated and cause severe water pollution (Kuroiwa et al., 2014). This suggests that water protection cannot be achieved only with water-related laws and that, in any case, their effectiveness is linked to a global improvement of the rule of law, poverty reduction and the building capacity of the local population.

Another notable gap – which is not unique to the region (De Stefano & Lopez-Gunn, 2012) – is the enforcement of groundwater water rights (GEF, 2012). Groundwater is a classic example of common pool resource and for this reason it is prone to overuse in the absence of sound management practices. An example of poor enforcement of legal regulation can be found in the Guanajuato State, where the economy and a fast-growing population have led to the drilling of around 17,000 wells since the early 1970s. Those wells ten years ago were abstracting approximately 4,000 Million m^3/yr (about 1,200 Million m^3/yr more than the renewable resource). Aquifer depletion was occurring at rates of 2–3m/yr, and had important effects on water security in the area (Foster et al., 2004).

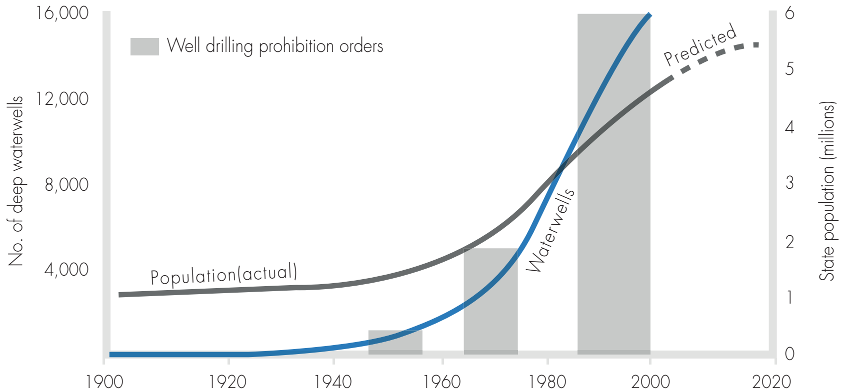

Figure 11.2 Growth of population and water well drilling in Guanajuato State, even during well drilling prohibition orders. *Source: Foster et al. (2004)*

In the 1990s the Mexican federal government made major efforts to register and control groundwater abstraction, including the issuing of three well-drilling bans, but the number of deep wells experienced a sharp increase despite the bans (Figure 11.2). Thus, the lack of capacity for field implementation and the clash of interests between the law and socio-economic trends favoured by groundwater use caused lack of consistent enforcement of the bans and pointed to the need for finding solutions to aquifer depletion not only based on command-and-control approaches (Foster et al., 2004).

11.4 The recognition of the human right to water and sanitation and the MDGs

In LAC the access to adequate water and sanitation is still a major challenge, both in terms of the share of population served and in terms of the need to address large spatial and social disparities in the service coverage (Chapter 6). There is no doubt that addressing this challenge is not just a matter of building water infrastructure but also a matter of counting on institutions that are able to create favourable conditions (regulatory, financial, social) that allow infrastructures to meet the goal they were designed for. For instance, if institutions fail in preserving the ecosystems that actually provide water, it will be increasingly more difficult (and expensive) to actually supply the pipeline network with good quality water. If institutions fail in setting up a sound and long-lasting system to finance the operation and maintenance of existing water distribution and sanitation systems, the quality and equity of the service will inevitably suffer. Thus, the broad recognition in LAC of the right to safe and clean drinking water and sanitation as a human right could act as a starter or a catalyst for institutional reforms.

In July 2010, the United Nations General Assembly (UNGA) formally recognized the right to water and sanitation as a human right (HRWS), essential for the full enjoyment of life and all human rights (UNGA 64/292). The human right to water and sanitation entitles everyone to sufficient, safe, acceptable, accessible, and affordable water and sanitation services for personal and domestic uses, which are delivered in a participatory, accountable and non-discriminatory manner (WASH, 2012). Two months later the Human Rights Council affirmed by consensus that access to water and sanitation was a legally binding human right (HRC 15/9)[2] (Figure 11.3). During the last decades, claims and international pressure mounted for the recognition of the HRWS, with a parallel claim, particularly rooted and strong in LAC, of a series of environmental rights (Chapter 14). The UNGA resolution has now shifted attention towards the implementation of the human right to water, towards adequate financing, 'capacity building' and technology transfer, as well as adequately allocating responsibilities at international and national levels.

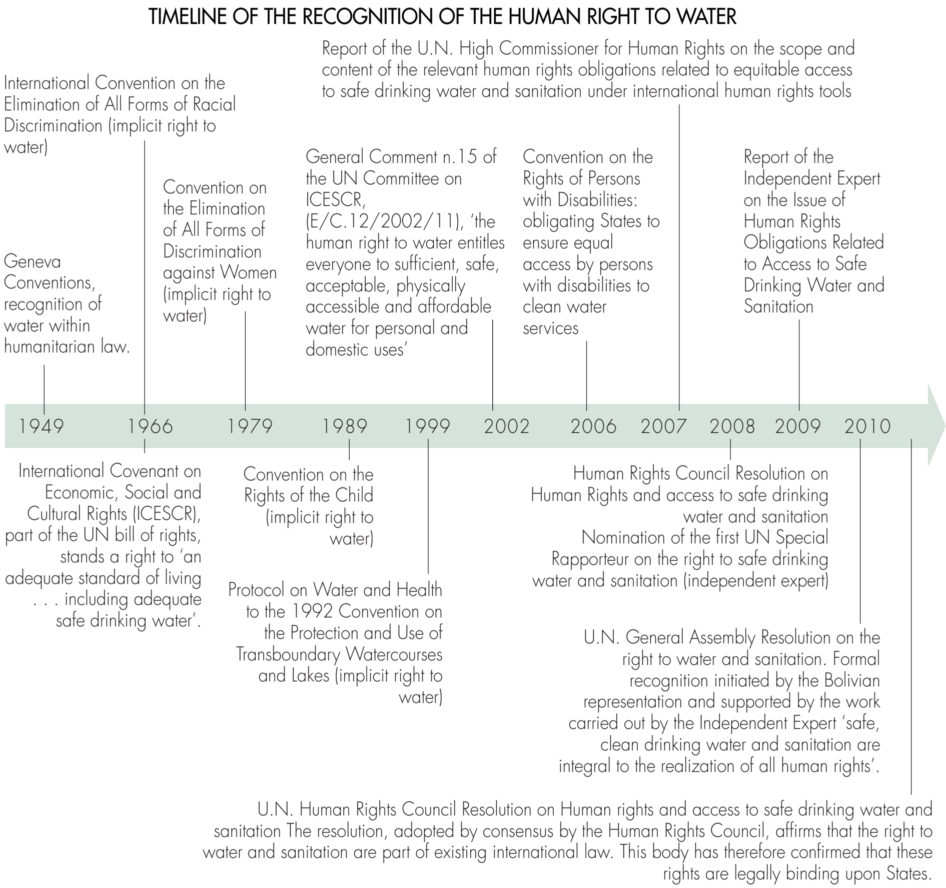

Figure 11.3 Timeline: international legal and political recognition of the human right to safe water and sanitation. *Source: modified and updated from Maganda (2011).*

2 The Human Rights Council confirmed that the human right to water and sanitation is derived from Articles 11 and 12 of the International Covenant on Economic, Social and Cultural Rights and is therefore legally binding on the 160 countries which have ratified the Treaty (status as of 18-02-2013).

The large majority of LAC countries voted in favour of the above-mentioned UN General Assembly resolution (Figure 11.4), reinforcing a new generation of solidarity and collective rights such as the right to environment. However, as often happens, the main stumbling block is in their implementation. At the interim evaluation of the Millennium Development Goals (MDGs) presented at Rio+20 in June 2012, statistics looked promising. According to the Joint Monitoring Programme[3] (WHO-UNICEF, 2012), 94% of the population have secure water access and 80% have access to sanitation, although these measures have been questioned by newer indicators (Flores et al., 2013). However, statistics hide great interregional disparity, differences between urban and rural, a marked diversity in the quality, sustainability and efficiency of water services, as well as notable differences between wealthy and poor areas in the same country (Chapters 4 and 6). As LAC is a region characterized by great income distribution inequality, it is essential to look beyond national coverage rates to understand the challenges ahead.

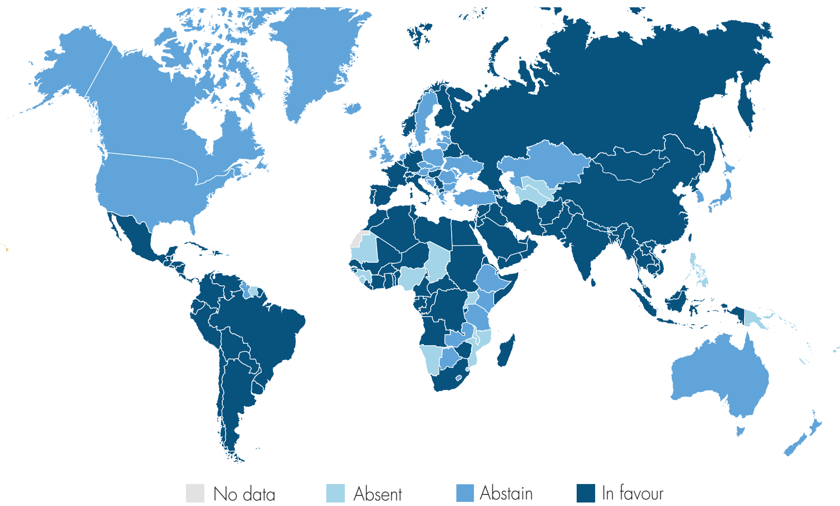

Figure 11.4 Map on voting for UN General Assembly resolution recognizing the human right to safe drinking water and sanitation. *Source: own elaboration*

States' international human rights obligations require them to go well beyond the targets set in the MDGs (for a methodological discussion see: Easterly, 2007; Albuquerque, 2012), whose indicators do not include or account for basic components of the human

3 The Joint Monitoring Programme of World Health Organization (WHO) and UNICEF measures the progress in meeting the MDG targets on water and sanitation to 'halve, by 2015, the proportion of people without sustainable access to safe drinking-water and basic sanitation'. It establishes categories of what are 'improved' and 'unimproved' sources of drinking water and sanitation facilities (WHO-UNICEF, 2012, p. 33), based in estimations about types of facilities used.

right to water and sanitation.[4] Thus, the right to water and sanitation must inform a state's design and implementation of its MDG policies (see Albuquerque, 2012) including the need to go beyond averages towards targeting groups that face discrimination and systemic exclusion.

Legal and institutional frameworks for water and sanitation often support the sustainability of interventions by creating a legal reference point for actors seeking to hold states accountable for their efforts (*ibid.*). Since the late 1960s and early 1970s, a series of pioneer LAC countries like Bolivia, Costa Rica, Uruguay and Venezuela started to include in their constitutional frameworks the implicit or explicit right to water. In the 1990s and early 2000s, more countries had enshrined this right into their constitution (Table 11.4, Figure 11.5), and HRWS now is present in the legislation of fifteen countries covering more than 75% of the population in LAC (Maganda, 2011; Waterlex, 2013).

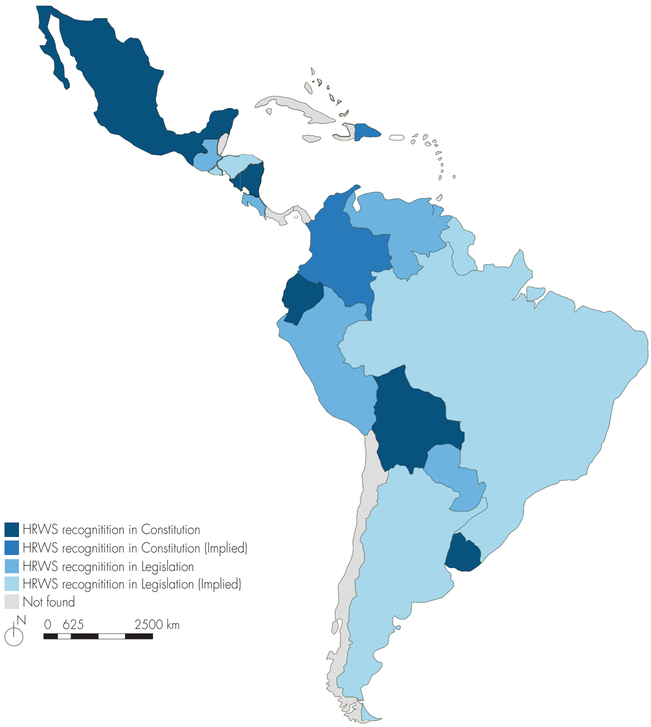

Figure 11.5 Map on inclusion of Human Right to safe drinking water and sanitation (HRWS) in constitutions. *Source: own elaboration*

4 Availability, quality, acceptability, accessibility, affordability, non-discrimination, access to information and participation, accountability and sustainability.

Table 11.4 Table summarizing State recognition of the human right to safe drinking water and sanitation (HRWS) in national constitutions, laws and policies in selected LAC countries. Sentences by the Constitutional Courts, which can represent very relevant advances in the field, are not included in this table.

COUNTRIES	HRWS recognition	SUMMARY [5]
ARGENTINA	In Legislation (Implied)	Every person may make use of public water free of charge (...) to satisfy domestic needs of drinking and hygiene (...) It is prohibited, however, to contaminate the environment.Art.25. Water Code of the Province of Buenos Aires, Law 12.257 of 9 December 1998.
BOLIVIA	In Constitution	I. Everyone has the right to water and food. Art. 16. New Constitution of Bolivia, 2009.
BRAZIL	In Legislation (Implied)	[Basic] public sanitation services shall be delivered in accordance with the following fundamental principles: I-universal access [...]. Art. 2. Law on Basic Sanitation, 2007.
CHILE	In Legislation (Implied)	Not in constitution but included in the legislation
COLOMBIA	In Constitution (Implied)	It will be a fundamental objective of state activity to address the unmet needs regarding health, education, environmental sanitation and drinking water. [...]. Art. 366. Constitution of Colombia, 1991, as last amended April 1, 2005.
COSTA RICA	In Legislation	Access to drinking water is an inalienable human right and must be guaranteed constitutionally. Art. 1.1. Executive Decree No. 30480-MINAE of 5 June 2002.
DOMINICAN R.	In Constitution (Implied)	The state shall ensure the improvement of nutrition, sanitation services and hygienic conditions, [….]. Art. 8. Constitution of the Dominican Republic, 2002.
ECUADOR	In Constitution	The human right to water is essential and cannot be waived. Art. 12. Constitution of the Republic of Ecuador, 2008.
EL SALVADOR	In Legislation (Implied)	The cities and urban populations shall be provided with services for the supply of drinking water (...). Art. 61. Health Code, Decree No. 955 of 1988, as last amended 2008.
GUATEMALA	In Legislation	a) Principle of Equality: Access to water for satisfaction of the vital and essential needs of the population and the improvement of these is a fundamental biological and social right of every human being. Article 2: Principles. General Water Law, Law No. 3702 of 26 September 2007.
GUYANA	In Legislation (Implied)	Subject to subsection (2), every public utility (...) shall make every reasonable effort to provide service to the public in all respects safe, adequate, efficient, reasonable and non-discriminatory. Section 25: Duty to provide adequate service. Public Utilities Commission Act, Act No. 10 of 1999.
HONDURAS	In Legislation (Implied)	The present law establishes the norms applicable to drinking water and sanitation services (...) as a basic instrument for the promotion of the quality of life of the population and for securing of sustainable development as an intergenerational legacy. Art 1. Decree No. 118-2003, Framework Law for the Drinking Water and Sanitation Sector.
MEXICO	In Constitution	Every person has the right to access, safe disposal and sanitation of water for personal and domestic use in sufficient quantity and quality. Article 4. Constitution of the United States of Mexico (1917, as last amended in 2011).
NICARAGUA	In Constitution	It is the obligation of the state to promote, facilitate and regulate the provision of (...), water, (...) and the population has an inalienable right to have access to these services. Art. 105. Constitution of the Rep. of Nicaragua. 1987, as of Sept. 2010.
PARAGUAY	In Legislation	b) Access to water for the satisfaction of basic needs is a human right and shall be guaranteed by the state in adequate quantity and quality. Art 3. Law on Water Resources, Law 3239 of 10 July 2007.
PERU	In Legislation	Access to water for the satisfaction of the primary needs of the human person has priority, even in times of scarcity, because it is a fundamental human right. Article III: Principles. Water Resources Act, June 2009.
URUGUAY	In Constitution	Access to drinking water and access to sanitation constitute basic human rights. Art. 47. Constitution of the Republic of Uruguay, 1967, as last amended 31 October 2004.
VENEZUELA	In Legislation	The principles governing the integrated management of water resources (...) are the following: Access to water is a fundamental human right. [...]. Art. 5. Water Law, 2 January 2007.

Source: own elaboration based on information from WaterLex Legal Database on the Human Right to Water and Sanitation (www.waterlex.org/waterlex-legal-database/index.php).

5 Non-official translations. Direct access to official documents through the WaterLex Legal Database.

11.4.1 Initiatives for implementation

The recognition of the HRWS and its consideration at a constitutional level is undoubtedly a milestone in the movement for universal access to these basic services. The HRWS framework applies to all stakeholders regardless of their nature: from states and citizens to public and private operators, who are involved in realizing its implementation and operationalization (Regional Process of the Americas, 2012), though the responsibilities differ among all stakeholders.

In Brazil, as of 2011 the federal government has put in place the programme 'Water for All', focused on the provision of water for poor rural communities of the semi-arid region of Brazil, and the main actors have been community organizations, NGOs and national and state governments in partnership with municipalities (see Figure 11.6). The provision of water cisterns has been promoted by a coalition of NGOs with the collaboration of households of all municipalities involved in the programme (Agua para Todos, 2013).

Similarly, in Chile, the national programme for public water supply in rural areas ('Programa Nacional de Agua Potable Rural') has been in place since 1994 and has increased water coverage in concentrated and semi-concentrated rural localities by over 95%. In this regard Uruguay can be taken as a model for extending the access to water, now with 100% coverage throughout the country. In addition, many countries are receiving support from the Spanish Fund for Water and Sanitation in Latin America initiated in 2007, which, with an estimated budget of US$1,500 million, aims to support the achievement of the human right to water in nineteen countries of the region.

In a region with a long history of inequality there are important citizen initiatives and social movements that contribute to monitoring governmental actions, and ultimately contribute to the achievement of the right to water. As an example, in 1998 the Central American Water Tribunal (CAWT) was set up for conflicts related to water ecosystems in Central America, creating a public space for democratic participation in water debates. In 2000 the CAWT became the Latin American Water Tribunal (LAWT) in order to increase the impact of this body throughout the region (Ávila, 2010). Similarly, rural water committees of the different regions have created associations at different levels (national, regional and continental) to share their concerns and raise the political profile of rural water in their countries (e.g. Confederación Latinoamericana de Organizaciones Comunitarias de Servicios de Agua y Saneamiento).

11.4.2 Public and private domestic supply service

The discussion about the recognition and adoption of the HRWS often goes hand in hand with the debate about the pros and cons of the privatization of the supply of domestic water service.[6] In this context, LAC represents a formidable 'laboratory' of

6 The term 'privatization' is used to describe different types of participation by private or government companies, with a range of contracts in which the government can transfer responsibilities related to a series of aspects such as water services, maintenance, investment, expansion, etc. (Budds and McGranahan, 2003).

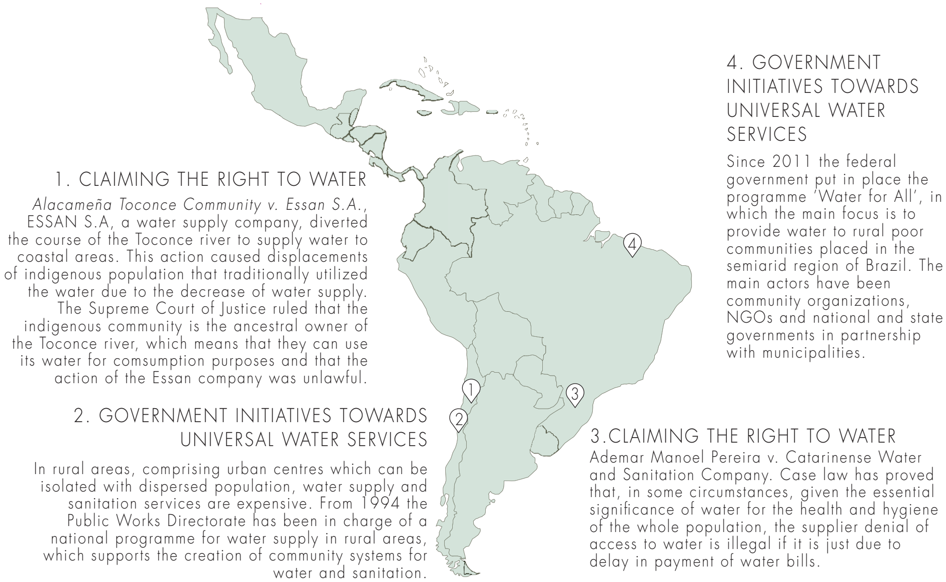

Figure 11.6 Map with examples of the implementation of the Human Right to Water and Sanitation. *Source: own elaboration.*

different approaches to water services provision. As a matter of fact, during the past three decades LAC governments have explored (and moved back and forth between) different paths to address the pressing challenge of providing adequate water and sanitation to their citizens.

Institutional reforms aimed at diminishing the role of the State in the provision of various services – including water – have been the key for many LAC countries since the 1980s (ECLAC, 2012a). These processes have included the privatization of water services and sanitation in many cities, due to what were considered favourable conditions for privatization, namely: cities with a relatively large middle class, poor financial conditions of public operators, and the momentum of neoliberal policies pushed by international organizations such as the World Bank or the International Monetary Fund (Budds and McGranahan, 2003). However, the reality was that many privatization processes did not always flourish. While concession contracts in Argentina and Bolivia were not successful (see Chapter 13), in others like Mexico these contracts have now taken root. The main aspect linked to failures in the implementation of water management programmes is related to weak or absent regulatory frameworks. This has led to problems such as unjustified asset and income transfers, and failure to ensure efficiency and new investment after privatization (Hantke-Domas and Jouravlev, 2011). Among the causes of this failure Castro (2007) points to corruption, lack of adequate or strong government regulation, lack of private investment, inadequate consideration of inclusive policies designed to reduce inequality, and as a result, resistance movements by civil society. However, the analysis of experiences worldwide and in the region suggests that the debate should not be focused on the 'dilemma' private vs. public service but rather on creating a legal and financial framework suitable to ensure an adequate service provision.

The analysis of water and sanitation service provision shows that the macro-economic context and the value of water as a key element in the economy, as well as sound governance (both of context and sectoral variables) are critical to the sustainable development of water services. Moreover, the design of the industrial structure of water supply and sanitation impinges on the ability to deliver services to the population. Assets are long-lived, allowing investments to be delayed and quasi-rents to be captured once initial investments have been made (Massarutto, 2007; Guasch et al., 2008). Fragmented services lose economies of scale, increase transaction costs, make services more expensive and may facilitate the capture by vested interests (Foster, 2005; ADB, 2009). Water supply and sanitation services have decreasing average costs (Krause, 2009). Therefore, both efficiency and equity are achieved by selecting optimal size in terms of economies of scale. At the same time, they require important investments, especially when new sectors of the population have to be served. This entails having guarantees of continuity of ownership in order to recover investments through tariffs. Adequate regulation of a natural monopoly, strategic planning of public policies, prioritization of water in public budgets and decisions with adequate subsidies for lower-income citizens are requisites for the institutional design of water and sanitation systems.

While each contract will have its own singularities, countries will need to consider the contractual and regulatory duties of contractors. In terms of implementing regulation, there are differences between, on the one hand, contracts and, on the other hand, comprehensive general regulation, franchizing and concessions. Almost 90% of water supply and sanitation privatizations in LAC during the 1990s were concessions, i.e. contracts (Estache et al., 2003). After a first wave of privatization of water supply and sanitation in the 1980–1990s mainly by international operators, during the 2000s there has been a radical reduction of their presence. Ducci (2007) identifies four main reasons for this decrease: a change in the overall strategy of the operator, e.g. in search of new business opportunities in other regions; re-orientation of the national policy in relation to water supply and sanitation; collapse of the financial and economic balance of existing water provision contracts; and social and political conflicts. As a consequence, it is clear that state-owned water companies will continue being the backbone of water supply and sanitation in Latin America (*ibid.*). Nonetheless, it should be noted that, for the characteristics of the service provided, there are incentives for members of the public sector (politicians, managers and employees of the utility itself) to capture quasi-rents (Wallsten and Kosec, 2008). It seems therefore important to identify alternatives for their control and regulation in order to ensure their accountability, e.g. through the establishment of clear service standards (in terms of quality, service reliability, tariffs affordability, etc.) and their strict enforcement by an independent supervising body.

11.5 Financing of the water sector

No institutional or legislative reforms can take place without solid financial backing. Thus there is little doubt that each country must address the permanent challenge of ensuring sufficient funds to sustain and further develop its water sector and the institutions that enable its functioning.

11.5.1 What needs to be financed?

Financing needs for water policy are contingent upon economic development levels. Some of the countries in LAC are currently going through a very incipient stage of water resource exploitation; and water policy within that context is very much a question of building canals to take runoff resources to where they are needed or, alternatively, boreholes to withdraw groundwater, where available. In these countries (or at a given stage for almost every country), water policy has focused on fostering irrigation and urban development, requiring substantial financing for capital investment (OECD, 2009). In some of the countries in the region, however, more and more often society's demands for participation, equity and environmental protection add new layers to water policy and create new funding needs.

Essentially, there are three major items to be financed (Figure 11.7): water resource management, including water use (both withdrawal and wastewater disposal) through charges or fees, plus forfeiture for non-use of water use rights; water service provision through public works (infrastructures), via water tariffs; and where a sui-generis or effective IWRM approach is in place, river basin management (i.e. joint water and land use management), conceivably through the use of payment for environmental services schemes or compensatory measures or levies.

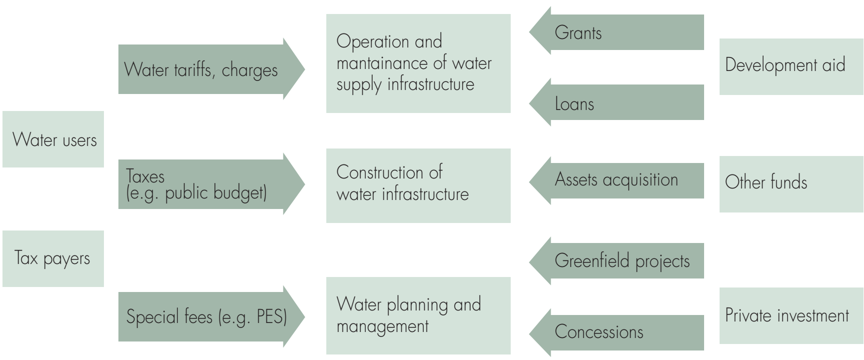

Figure 11.7 Water-related expenditures that need to be financed and sources of incomes in LAC countries. *Source: own elaboration*

Some of the countries in the region have faced severe foreign exchange shortages in the past due to sub-optimal saving rates or current account deficits. Over time, this has led to high levels of indebtedness (Adler and Iakova, 2013) or even a debt crisis (Reinhart and Rogoff, 2011). That debt burden for decades represented a significant restriction for economic development (Rodrik, 2011). It greatly hindered any possibility to harness the necessary resources in order to finance water policies, which in turn has a twofold impact: on the one hand, the financing gap impedes water policy as such; on the other hand, the need to repay an ever-increasing foreign debt led some countries to turn to their comparative advantage in terms of natural capital endowment, both increasing their exports of natural resources – including water-intensive goods – and also enduring lower levels of environmental quality overall (ECLAC, 2012a; OECD/UN-ECLAC, 2013).

11.5.2 Where and how to lever funds?

11.5.2.1 National financing

Not many countries in the region rely on their own (national) resources to finance water policy and, if they can, it is usually just for some water services (i.e. Chile and its sanitation service). Their funding gap (which is mainly a fiscal one, in those countries with no public budget surplus) refers to insufficient or unstable revenues to implement water policies at different levels of government (Hernández et al., 2012). However, a sustained growth pattern over the past few years in some countries (namely Brazil, Colombia, Chile, Peru, and Uruguay, amongst others, or Paraguay and Panamá very recently) should lead to improved financial self-sufficiency[7] (ECLAC, 2012a).

In this context, each country has to take its own decision on how to finance its water needs. The advantage of water tariffs is that they lighten the burden over national budget, which allows the diversion of revenues to sectors that are more difficult to finance on the basis of direct charges. These tariffs generate incentives for higher water use efficiency in business (control of revenues and costs), through the consolidation of a direct relationship between revenues and services provided (served clients and supplied volumes, recollected and treated). In addition, a clear signal is provided to consumers of the real cost of services, therefore fostering a more rational use. Further, tariffs make service provision less vulnerable to macro-economic fluctuations.

To date, the use of tariffs levied on the use of natural resources is not widespread in the region (see Chapter 13) but in those countries where tariff schemes have been implemented, this has meant a sort of self-funding source as well as a partial cost-recovery mechanism. As with taxes and charges, they tend to feed into the public budget at different government levels. Revenues from these taxes and charges are very unlikely earmarked for water policy purposes. However, as social efforts, be they user contributions or public investment, are often if not always insufficient, credit or private investment may also be required, either from domestic or foreign sources.

While multilateral development banks have been a traditional and important source of financial resources for the water sector in LAC (see over), private banks have not represented

7 For the decade 2000–2010, per capita GDP in the LAC region grew by an average of 1.9% per annum, as compared with 0.3% for 1980 to 2000, and 3.3% for 1960–1980.

such a reliable funding source: any water project has the potential to generate sufficient cash-flow to pay for the loan; though there are some risks associated with exchange rate fluctuations (this led to the failure of different Build, Operate and Transfer projects in Mexico in 1995). Capital markets, in turn, are well developed in countries such as Brazil or Chile, but have not played a major role elsewhere.

In LAC, despite funding flows from international sources, governments struggle and usually fail to meet financial requirements. This has led, amongst other things, to an increasing interest in water use charges or fees (both for water abstraction and wastewater disposal; see Chapter 13 for specific examples). This interest has a number of common features in the region:

- There is a search for new approaches since traditional ones, due to the lack of operational capability, have not been effective in most cases (see Easter and Liu, 2005, for cost recovery in irrigation and drainage projects; Ferro and Lentini, 2013, for water and sanitation).
- Many of the approaches to water use charging are deemed on the basis of ideology (rather than technology). Furthermore, there are double-dividend aspirations (Fullerton et al., 2008) and, occasionally, rent-seeking behaviour (Delacámara and Solanes, 2012).
- Within a context of increasing water scarcity, the public sector's attention shifts away from supply to combined supply and demand management, thus requiring further use of financial and economic policy instruments.

Despite the existence of such charges or fees, in almost all cases levies are not actually paid, but are paid just by a minority or are negligible for water users. However, this does not mean that water use charging is an easy endeavour. There are major obstacles: the lack of proper definitions of water use rights, including a pre-condition of payment for right purchase and holding; the level of information required (who uses water, how, how much, where, what actual revenue might be actually obtained, etc.); the weakness of procedures for the operational effectiveness of charging schemes; and the social and political acceptability of these levies, among others.

11.5.2.2 International financing

In LAC, national funds needed for developing and operating the water sector are complemented by public and private international sources. According to two major public databases of OECD and the World Bank,[8] during the period 2000–2011 the international

8 The contribution of international sources to the financing of part of water-related investments can be assessed through two major public databases: the Creditor Reporting System (CRS) of the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) for public funds (/stats.oecd.org/index.aspx?DataSetCode=CRS) and the Private Participation in Infrastructure Database (PPI) of the World Bank (http:77ppi.worldbank.org). From these databases it is possible to extract data about water and sanitation projects, hydropower and irrigation projects. Data correspond to investments committed on an annual basis and expressed in current US dollars. In CRS, the analysis presented in this chapter considers sectors with codes 14000, 23065 and 31140; in PPI infrastructure associated with water domestic supply and sanitation is considered.

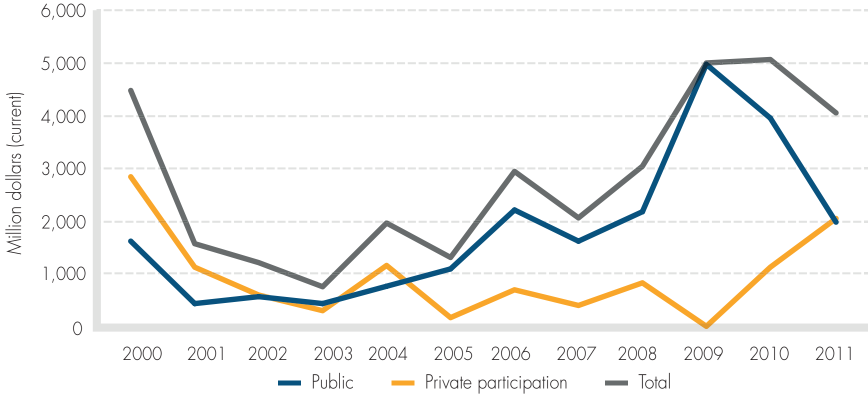

Figure 11.8 Evolution of international public and private funding to the Latin American water sector over the period 2001–2011 *Source: own elaboration based on data from CRS (2013) and PPI (2013).*

overall (public and private) investment commitment in LAC amounted to 33,238 million current US$, being the public investment about 66% of the total amount (21,877 million US$) (Figure 11.8).

Public grants and loans include both the Official Development Aid (ODA)[9] and Other Official Flows (OOF) that cannot be included in the ODA category. Between 2000 and 2011 the OOF to LAC amounted to over US$14,701 million, more than twice ODA flows in the region, which were US$7,170 million. Almost all of the OOF (99%) were loans, while ODA consisted of loans and grants in similar shares (50% and 48%, respectively) (CRS, 2013). Overall, since 2001 there is a clear positive trend in public investment, reaching its maximum in 2009 (US$4,972 million), which marked a tipping point towards a decline (Figure 11.9). The peak during the period 2008–2011 is due to the activation of Spain's cooperation fund for water and sanitation in the LAC region (US$1,500 million over a four-year period), whose investment commitments amount to 53% of the ODA of the period 2001–2011 and made Spain the main donor to the region in 2008 and 2009.

Over the 2000–2011 period, Japan was the main contributor to the ODA (35.24%), followed by Spain (24.07%) and Germany (11.93%). The main recipients were Peru (16.38%), Brazil (13.24%) and Bolivia (10.01%). As for the OOF, most of the funds were allocated to Brazil (30.05%), Argentina (17.09%) and Colombia (13.62%), while the main funding providers were the Inter-American Development Bank (54.1% of the OOF)

9 ODA is defined as 'flows of official financing administered with the promotion of the economic development and welfare of developing countries as the main objective, and which are concessional in character with a grant element of at least 25 percent (using a fixed 10 percent discount rate). By convention, ODA flows comprise contributions of donor government agencies, at all levels, to developing countries (bilateral ODA) and to multi-lateral institutions. ODA receipts comprise disbursements by bilateral donors and multilateral institutions. Lending by export credit agencies with the pure purpose of export promotion is excluded' (IMF, 2003)

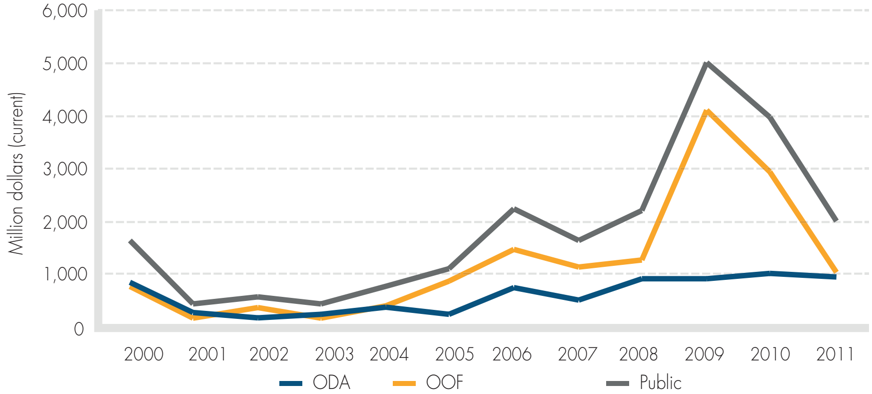

Figure 11.9 Evolution of international public investment during the period 2001–2011. *Source: own elaboration based on data from CRS (2013).*

and the World Bank (45.01%). Projects associated to large urban water supply and sanitation received 44% of the ODA, while small systems (rural and peri-urban), hydropower and agriculture received 28%, 10% and 3%, respectively (CRS, 2013).

In terms of private participation in investments in the water sector, during 2000–2011 LAC received 32% of the world's investment in the above-mentioned water-related sectors with private participation (Figure 11.10) being especially significant in 2001 (60% of the global investments) and in 2011 (78%) (PPI, 2013).

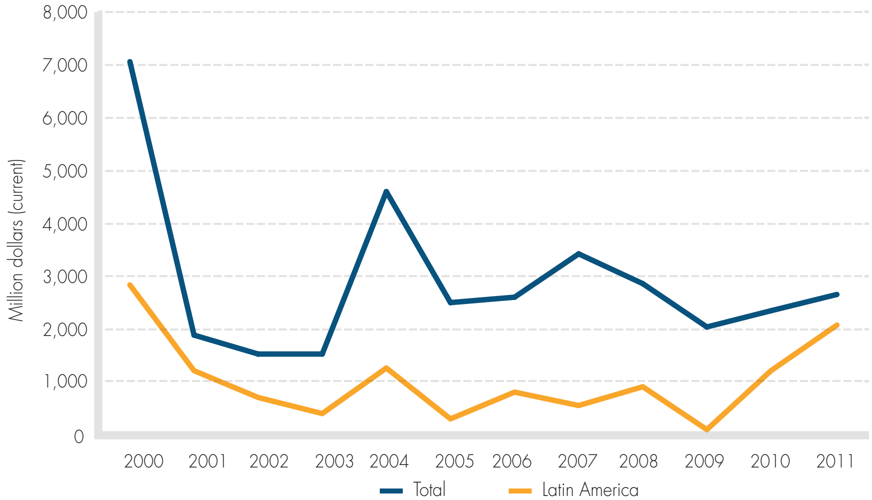

Figure 11.10 Global and regional private investment in the water sector. *Source: own elaboration based on data from PPI (2013).*

Between 2001 and 2011 almost 70% of private investment occurred in Chile, Brazil and Mexico (Figure 11.11), principally due to the support of big companies. The participation of private operators was noticed in the agricultural, industrial and sanitation sectors, characterized by the concessions of important systems, which represented 53% of the overall investment. By far, water supply and sanitation was the main recipient of private funds: about 77% of the total investments, mainly through contract for the construction or the rehabilitation of water supply systems, operation and transfer. Water purification and wastewater treatment plants received only 21% of the total investment, mainly through Build-Operate-Transfer (BOT) projects (PPI, 2013).

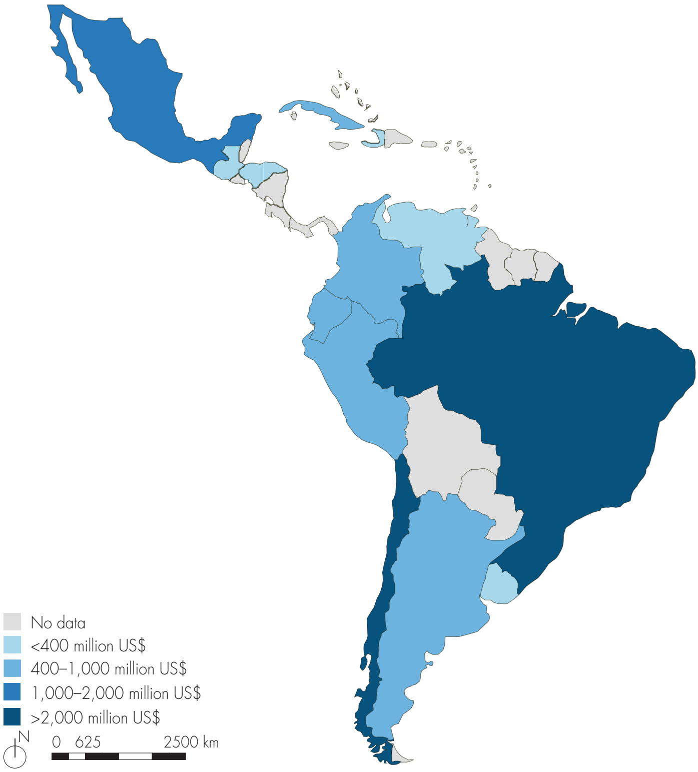

Figure 11.11 Geographical distribution of investments with private participation in the water sector during the period 2001–2011. *Source: own elaboration based on data from PPI (2013).*

From these figures it can be concluded that during the past decade international investors and organizations have played a significant role in funding the water sector, with special emphasis – for both public and private funds – in the development of infrastructure to provide water and sanitation to the population of the LAC region.

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12

THE ROLE OF STAKEHOLDERS IN WATER MANAGEMENT

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Highlights

- The abundance of still largely unexploited natural resources and the sustained growth pattern of many countries in the Latin America and Caribbean (LAC) region contribute to the creation of situations where different needs, interests and understanding of the concept of socio-economic development have led to tensions and conflicts.
- Poor legal compliance, insufficient legal instruments and lack of funds are often at the root of significant environmental damage and conflicts in the LAC countries. Disputes are mainly related to the construction and operation of water works, water diversion, industrial and mining pollution and the privatization of the water supply and sanitation coverage.
- Advocacy networks play a key role in empowering and giving national and international visibility to the local population directly affected by environmental degradation or social injustice.
- During the past few decades the demands from civil society organizations in LAC for a larger participation in decision-making processes supported the inclusion of participatory practices in the new institutional arrangement and the creation of new spaces for negotiation such as river basin committees and water councils.
- Formal participation is uneven in terms of level of involvement of stakeholders and is mainly limited to water users (usually the ones representing large scale economic activities). Other interests not associated to water rights or the views of indigenous population are often underrepresented in formal forums and social activism still prevails as the main means to voice their demands.
- In LAC, besides lobbying and direct access to the highest state leaderships, the private sector has two new strategies to influence the decision-making processes: as one of the main stakeholders in participatory formal institutions and through their partnership with international NGOs and development agencies in defining new rules for water certification and water accounting, that can lead to new water policies in the future.
- Most LAC countries have passed information transparency laws, which apply also to water-related public information. The actual implementation of the legal obligations to information disclosure is fostered by benchmarking initiatives and watchdog studies promoted by civil society and international organizations, mainly for the water and sanitation sector.

12.1 Stakeholders organizations and their spaces for negotiation

Latin America and the Caribbean (LAC) is a region well known for its social and economic contrasts. High levels of poverty and inequality coexist with high rates of growth and raw material exploitation. The lush nature, combined with large expanses of land also indicates a high concentration of natural resources. Development practices and economic growth lead to tensions between different social groups and actors about how this region should be. In this context, water and the struggles to access and control it have contributed to the construction of the political and natural landscape of the region.

Water access is disputed by different sectors of society and activities throughout the whole region. Tensions come from energy, mining, irrigation, urban demands and their impact over livelihoods of local and traditional populations as well as the environment. On the other hand, water pollution and the access to domestic water supply, particularly the privatization of water services, have become major sources of conflict in the last two decades.

Such tensions represent the challenge of promoting multiple water uses whilst guaranteeing its universal access as part of the strategy to ensure water security in this region. In order to deal with this, stakeholders[1] – ranging from economic agents to indigenous organizations – have been using and developing different strategies to express their agendas as well as to influence the decision-making processes and water governance in LAC. Such strategies include public demonstrations and campaigns, lobbying, participation on councils and committees, the proposal of new regulations, denouncing conflicts to the courts and asking for transparency on how decisions are made. These interactions are happening in different spaces of negotiation and discussion, involving different actors and networks, and in different moments.

Usually, when discussing civil society organizations and their participation in water management, the analyses focus mainly on practices of public participation that consider formal participatory institutions as the main venues for negotiation. However, the stakeholders' repertoire goes beyond such negotiation spaces and reflects the understanding of social participation as the direct involvement of an array of people in decision-making and implementation of water policy or management through the opportunity to express their voices and articulate their arguments in public forums (Berry and Mollard, 2010).

Even though nowadays many of the LAC countries have undergone water reforms (Chapter 11) in which stakeholders' participation has become part of the institutional arrangement, activism and public demonstrations still take place. Such strategy unveils

1 Stakeholders are understood as individuals, groups or institutions that are concerned with, or have an interest in the water resources and their management. Even though public sector agencies are also stakeholders, in this chapter, the focus will be on private sector organizations, NGOs and social actors.

how water reform, by itself, was not able to decrease water access inequalities through the creation of new spaces for negotiation. Actually, in many cases, reforms have worsened the situation as elites and corporations have taken advantage of government interventions (Boelens et al., 2011). As a consequence, some social actors believe that there are moments in which public demonstrations are more effective (relative to formal participation) in bringing a specific claim to the attention of the general public or to compel the state to include specific topics on the official agenda (Empinotti, 2007). On the other hand, in some cases civil society organizations have been withdrawing from water councils and committees, in which their representation is outnumbered and decide to focus their actions on other strategies such as direct lobbying, unilateral partnerships with the government and public demonstrations (Warner, 2005; Empinotti, 2011).

At the same time, the importance of the private sector – mainly farming, food traders and manufacturing – in the management of water has been unveiled as strategic in order to guarantee water and food security (Allan, 2013). Because of this, initiatives such as water certification and indicators of water efficiency have become new channels to promote alliances among manufactures, food producers, NGOs and development agencies that can lead to new agreements for regulated water use in the production sector (Pegram et al., 2009; Empinotti, 2012; Empinotti and Jacobi, 2013). Finally, the approval of transparency laws throughout the region, pushing for accountability and corruption control, has become an opportunity for civil society organizations to ask for information and to control the government's expenditure on infrastructure projects and plans to increase water availability in LAC.

Such considerations show that the analysis of how stakeholders influence water management should go beyond the understandings proposed by the concept of participatory citizenship and multi-stakeholders platforms, and also include other spaces impacting decision-making processes such as the courts, non-state market-driven governance systems and the increased attention to transparency and access to information.

Acknowledging the importance of different channels of expression and negotiation beside councils and committees, this chapter explores the different strategies that stakeholders apply in order to influence water governance in the LAC region, with a special focus on Brazil, Chile, Costa Rica, Mexico and Peru. The chapter starts describing the main sources of tensions regarding water in the region and the reasons behind it. Then it looks at how disputes and the disregard for traditional community-based water management practices lead to activism and advocacy that represent informal but important spaces of participation for civil society organizations, such as NGOs, social movements and networks. It also discusses whether courts are (or are not) spaces in which stakeholders can voice their claims. Following that discussion the chapter analyses how formal participation is taking place in these countries. In this case, stakeholders are members of the new spaces of negotiation such as river basin committees and water councils. Another space that has been increasing in relevance in the last few years is related to water use certification and water indicators, transforming the private sector into a key player in water management. Finally, the last section will present how accountability practices and transparency laws are becoming tools that stakeholders can use to influence how water is managed in LAC countries.

12.2 Tensions over water and social activism in LAC

In LAC, the origins of tensions over water are complex and diverse (Arrojo 2005; Arrojo, 2010; Oswald, 2011; Aguariosypueblos.org., 2013). They are generally rooted in different understandings of water allocation, national and regional priorities, contrasting views of development and environmental care, cultural and economic interests, and livelihood defence (Larrain and Schaeffer, 2010). They often originate from the development of economic activities and at times from the institutional reforms promoted to facilitate said economic development (Boelens et al., 2011). Thus, the regional growth supported mainly by commodities exports (Sinnott et al., 2011; ECLAC, 2013) is likely to accentuate tensions associated with dam construction, water diversions, urbanization and mining taking place at domestic and transboundary scales (Table 12.1).

Table 12.1 Features of main water conflicts in LAC

ISSUE	CONFLICT TRIGGER	STAKEHOLDERS INVOLVED
HYDROPOWER PLANTS AND DAMS	Loss of territory and livelihoods as a consequence of dam construction and operation	Rural works, indigenous populations, state, private sector, NGOs, social movements
WATER DIVERSION	Taking water from regions under water stress, prioritizing urban over rural areas and agribusiness activities.	Rural workers, small farmers, indigenous people, NGOs, unions, associations, church, state, agribusiness, municipalities.
IRRIGATION	Farmers do not respect previous formal and/or informal agreements with regard the amount of water they should take from the water body.	Small farmers, state, agribusiness, indigenous populations, social movements.
	Priority of agro-export activities over small farmers and indigenous farming practices.	
MINING	Impact on water resources quality and availability for other economic activities and domestic supply; non-compliance with legislation, destruction of natural landscape (e.g. Deforestation)	Indigenous people, small farmers, fishermen, mining companies, water supply companies, NGOs, local and regional government.
URBANIZATION	Water pollution jeopardizes domestic water supply even in areas that naturally are water abundant.	State, municipalities, NGOs.
CONCESSIONS	Privatization of drinking water, wastewater treatment plants with inadequate service and high prices.	Multinational enterprises, local and national governments, international tribunals (WTOCV).

Source: own elaboration.

In LAC, approximately 60% of territory is included in transboundary basins: the Amazon basin alone includes eight countries with more than 8,000km of shared borders (Rebagliati, 2004). Since each country has sovereignty over its water bodies, yet the river basin could be shared, often water uses impact neighbouring countries. In this context, the main reasons for tension are related to flow control, overuse of water, pollution from upstream countries and the impact of water uses over traditional livelihoods and the environment. Tensions between countries over water often find a venue to be managed in treaties and international agreements. As a matter of fact, overall only around 15% of the South American transboundary population and area is not covered by at least one treaty or an international River Basin Organization (De Stefano et al., 2012), and interestingly relationships over South American shared waters are far less confrontational than in other regions of the world (Wolf et al., 2003; Yoffe et al., 2003; De Stefano et al., 2010; Biswas, 2011). In some cases, multi- and unilateral agreements and financial support have contributed to managing some of the tensions in the region as, for instance, in the Colorado and Bravo rivers (USA and Mexico). In other cases, such as in the Lempa River (Guatemala, Honduras and El Salvador) and the Orinoco basin (Colombia, Venezuela and Brazil) tensions over water eventually led to the creation of cooperation and integration plans for the shared basins.

Conflicts over water can be triggered by environmental consequences of water uses or by their social implications and, even if a certain dispute can be focused only on one of those two factors, they cannot be taken apart (Castro, 2008). For instance, the increase in agro-export activities in LAC has pushed for intensive land use and the expansion of irrigation practices which increased pressure on water availability and ecosystems (Castro, 2008; Boelens et al., 2011). At the same time, changes in farming practices have often led to the loss of traditional knowledge and the disruption of livelihoods, showing that the changes in water use contribute to displace small and indigenous farmers that are replaced by the agro-export model (Boelens et al., 2011). Similarly, the construction of water infrastructure to meet the increasing needs for energy and water in LAC impacts rivers' ecosystems and, at the same time, contributes to the loss of territories and traditional livelihoods, pushing population to urban areas and disrupting local economies (Zhouri and Oliveira, 2007; Oliver-Smith, 2009; Boelens et al., 2011). In mining, the combination of highly polluting production processes with inadequate environmental legislation (and/ or disrespect of it) has had a negative impact on soil, biodiversity, water, and aquifers in almost all countries of LAC (Flota et al., 2012) and is at the root of intense conflicts throughout the region (Figure 12.1). Destruction of upstream ecosystems providing crucial services to urban supply systems and pollution of aquifers are common in LAC metropolitan areas (e.g. Mexico City, São Paulo, Rio de Janeiro, and Lima) and directly affect the capacity of water utilities to provide safe water to households.

Water services privatization has become one of the main sources for conflict in LAC during the last two decades. The rapid increase of urban populations combined with the lack of sufficient funds for the creation and maintenance of public supply services often pushed local and federal governments to grant water supply and sewage concessions to the private sector. Private companies or concessionaries are often reluctant to expand the water supply network to poor suburbs and shanty towns, where the recovery of investments via water tariffs is unviable and governmental subsidies are required. The lack of effective supervising bodies, however, often contributes to the establishment of abusive practices, like unaffordable prices or non-compliance of water supply standards. Although these practices can occur also in case of public providers, they have been especially obvious in some private water concessions in the region, obliging some governments to cancel concessions due to public opposition.

Figure 12.1 Location and number of mining conflicts in LAC. *Source: OLCA (2013)*

In this context, during the past few decades the LAC region has witnessed several grassroots mobilizations around water, which at times have led to intense confrontations (Box 12.1; Bell et al., 2009; FNCA, 2009). Collective actions often start in communities directly affected by a certain decision, but soon they come into contact with existing networks on the frontline in question, composed by both national and international NGOs. LAC is very diverse and it is difficult to generalize about the most salient features of water-related social activism in the region, as the emergence and characteristics of social movements is heavily influenced by the national socio-political context where they emerge and to which they have to adjust (Zibechi, 2006). However, a common thread of many of these social movements is the defence of the public (community) nature of natural resources and the opposition to their transformation into mere economic goods (Seoane, 2006). Moreover, their main way of influencing decisions is outside formal participation venues described in the next sections. Demonstrations, activism actions and legal litigation become means for some civil society organizations to gain a seat at the negotiating table or, for those that are already present at the table, to increase their negotiation power in formal participation venues.

Box 12.1 Examples of grassroots movements in LAC

Beyond networks of affected people, coalitions often occur, for example in Brazil with the MAB (Movement People Affected by Dams), in strategic partnership with Via Campesina and the MST (Landless Movement), thus achieving a strong impact of their actions nationwide.

The Cochabamba conflict on water privatization known as the 'Water War' not only ignited a continental and even global revolt against the privatization of water services, but cornered the Bolivian government and strengthened the role of Evo Morales as a national opposition political leader. In this case, the regional alliance of unions and city residents with indigenous irrigation communities was essential.

The movement of people affected by toxic pollution of the Santiago River, in Mexico, became so strong that the government had difficulties to deal with it, to the extent that the outbreaks of indignation in rural communities received the support of university researchers, neighbourhood associations and unions of the city Guadalajara.

The movement of Mazahua women, also in Mexico, put the federal government on the ropes when it progressed from being a protest of a small number of communities to a revolt of the Mazahua people, to finally mobilizing tens of thousands of citizens in Mexico City, who endorsed their claim to safe drinking water in their homes as a human right. In 2011, the Mexican Congress granted water as a human right in the Constitution.

Often grassroots movements find a counterpart in organized activism networks. Today, in LAC there are strong national and international networks against open pit mining, oil exploitations, large dams and the privatization of water and sanitation services. These networks provide local communities with information and technical assistance, legal advice and media projection, often in collaboration with important sectors of the scientific community. The incorporation of local communities into these setups is one of the keys to the success of activism networks. When they manage to transform the 'indignation' of whole territories into regional or national citizen mobilization, these movements expose a social conflict difficult to ignore (See Box 12.1). From there, complex political processes are usually open, in which the governments and transnational corporations are not only challenged, but questioned and conditioned. When this occurs, a political component soon emerges that ends up having parliamentary consequences or even producing changes in government. An example is the inclusion of water as a human right in LAC countries' Constitutions such as in Mexico. Because of this Latin America became the first region in the world to institutionalize such a claim (see also Chapter 11).

Social movements and networks, which tend to be non-violent, also resort to the courts. Despite the frequent successes obtained on the legal front, in LAC these favourable rulings are rarely effective in practice, which suggests the limited strength of laws and courts in some LAC countries (Box 12.2). This is why social movements rely primarily on non-violent resistance in their territories and citizen mobilization at regional and national levels. Often, the action moves to the international arena, either through important and prestigious ethical courts, such as the Latin American Water Tribunal or the Court of the People, or taking their complaints to the United Nations or the home countries of transnational corporations that are their opponents in the conflict.

Box 12.2 The use of the justice system to influence decisions

Since the 1980s, two parallel processes have taken place worldwide. On the one hand, greater decentralization and public participation were encouraged and promoted, sometimes without adequate attention to local capabilities and resources. On the other hand, developing countries have signed international treaties for the protection of private international investments. In practice, however, countries often did not fully understand what they were agreeing to (IISD, 2006). International investment agreements signed by central governments override decisions taken at local or municipal level. Countries transfer national jurisdiction to international investment courts that can only operate at the request of investors. International arbitration is thus a market created by investors that applies principles for the protection of investors, without having responsibilities for issues of local importance.

Investment agreements are signed by central governments without community participation. In addition, communities and the public are not necessarily parties to investment litigation (although their participation may be allowed by decisions of the arbitration courts) since their participation is contingent to the sovereign will of the arbitration courts. Thus, no matter the importance that litigation may have for local communities, cases are litigated only by governments and investors. Arbitration courts have condemned countries to pay compensation for environmental measures taken by local governments in relation to water resources (Álvarez, 2004). Thus, in the context of international arbitration, local issues and community participation risk irrelevance: local public interest is of little relevance to arbitration courts, since their mandate consists principally of protecting investors' interests. In fact it can be said that investment arbitration treaties and investment arbitration often empty the public participation processes of their original meaning and power.

Even though demonstrations and activism are important vehicles for civil society organizations to express their demands and points of view about water management decisions to authorities and production sectors, the reform of water institutions is increasingly creating new spaces for negotiation. Because of that, civil society organizations are becoming relevant stakeholders in decision-making processes related to water also through formal participation as discussed below.

12.3 Formal participation as a space for negotiation

Water reforms that have taken place in LAC since the 1980s[2] have restructured the institutional arrangements and introduced or officiated councils, committees and forums in which stakeholders are recognized as members (for more see Chapter 11). Even though participation in most of the cases is already part of the institutional engineering, its understanding and level of implementation vary from country to country. Indeed, institutional arrangements such as the main unit of water management, the scale at which participatory decision-making processes happen and the types of spaces for negotiation are intertwined factors that shape public participation in each country (Table 12.2).

Table 12.2 Comparative overview of participatory levels in selected LAC countries

	LAW	TYPE OF SPACES FOR NEGOTIATION	SCALE OF ACTION	MEMBERS
BRAZIL	Law 9433/1997	Watershed committees	State and Federal	Federal, state and local representatives, users, civil society organizations
		National Water Council	Federal	Federal, state and local representatives, users, civil society organizations
		State Water Councils	State	State and local representatives, users, civil society organizations
CHILE	Water Code 1981	Water Users Associations, Water communities, Water Channel Associations, Monitoring Communities	Local	Users, NGOs, social movements
COSTA RICA	Water Law 1942	Supplying Water and Sanitation Systems Association (ASADAS), Public consultations	Local and national	Users and civil society organizations
MEXICO	Water Law (Ley Aguas Nacionales - LAN) 1992/2004	River basin committees	Regional (watershed)	State, users associations, NGOs, enterprises, Academia
PERU	Law 23899/2009 (Ley de Recursos Hídricos)	Basin council	Local and regional	Users, universities, associations, campesinos and natives communities, state, local and regional representatives
		Water users organizations		

Source: own elaboration.

In the countries presented on Table 12.2, formal participation is understood as part of a strategy that will lead the competent water authorities to share the decision-making processes with different stakeholders. Despite that, the State continues to be the main and ultimate decision maker. Additionally, water authorities are responsible for influencing

2 The institutional water reforms started to take place in 1981, through the Chilean Código de Agua, followed by the Ley Aguas Nacionales in Mexico in 1992, the Lei das Águas in 1997 in Brazil and, recently, in 2009, the Ley de Aguas de Peru. However, countries such as Costa Rica still have not undergone institutional water reforms and water is still managed by institutions placed under different ministries that barely interact with each other (Table 12.2). Such dynamics were common in other Latin American countries such as Peru until 2008.

the speed in which participatory spaces are created, as well as defining and enforcing the rules to make them active (Scott and Banister, 2008). Users and other civil society organizations can participate in the control and maintenance of the system at local level, or make suggestions when water management plans are elaborated. The only exception is Chile, where the legislation identifies the market (instead of the State) as the main force influencing water rights allocation (Bauer, 1998).

This reflects how social participation takes place and its impact on water governance. For instance, Chile focuses on water management at the level of the water bodies and therefore its institutional arrangements establish that participation should happen mainly at local level through Water Users Associations, Water Communities, Water Channel Associations and Monitoring Communities. These are spaces where water is managed and controlled on a daily basis and conflicts among different water users should be negotiated (Bauer, 1997, 1998). The Peruvian system also allows for this type of participation through the Juntas de Usuarios y Comités responsible for operating and distributing water locally as well as for collecting water taxes and tariffs at local level. This type of participation is known as activity-specific participation in which stakeholders are asked to undertake specific tasks, working as executors instead of planners, defining how water should be allocated and who should have access to it (Pretty, 1995; Agarwal, 2001; Chambers, 2005; Empinotti, 2007). Participation at the local level is instrumental.

On the other hand, the Mexican, Brazilian and Peruvian systems assume river basins as the unit of water management and concentrate stakeholders' participation at the river basin and regional level. Participation takes place in the form of stakeholders input into planning, coordination and implementation of river basin plans as well as to build consensus among the members of these councils. In these cases, participation is basically a consultation since stakeholders are asked for opinions and suggestions during the elaboration of water management plans, although in Peru and Mexico their impact over the final decisions is still quite limited (Wester et al., 2005; Jiménez-Cisneros and Galizia-Tundisi, 2012). On the other hand, in the Brazilian context, stakeholders are able to influence decisions made in the river basin councils. Indeed, in those councils the number of seats for users and civil society organizations combined can outnumber those of the State, thus providing them with decisional power if their interests converge on a specific issue, while not one of the sectors alone can approve a proposal without the support of others. However, the impact of these negotiated river basin plans is void at the moment that the government disregards them as a tool to support its decisions in the construction of water infrastructure and water allocation, consequently weakening the water institutions and contributing to the understanding that the State still holds the main stake over water management in the country (Empinotti, 2011). Besides, in the Brazilian institutional structure, water governance also takes place at national and state level through the National Water Council and the State Water Councils respectively. In these councils, stakeholders and the State are responsible for defining the main guidelines for water management and for regulating water legislation. Nevertheless, the State has the majority of seats at the national and state councils, thus reducing the role of stakeholders and transforming participation into a consultative practice, hence maintaining the State as the main decision maker (Jacobi, 2009).

In Costa Rica, even though the Water Law does not create spaces for participation, other laws such as the Association Law and Law 8660/2008 allow associations that regulate the water distribution at the local level (Supplying Water and Sanitation Systems Association – Asociaciones Administradoras de Sistemas de Acueductos y Alcantarillados Sanitarios, ASADAS) and a national agency to promote participation of civil society organizations (Regulatory Authority for Public Services – Autoridad Reguladora de los Servicios Públicos, ARESEP). Users participate in different moments at the local level, and at the national level the participation of civil society organizations takes place while public consultation meetings are promoted by ARESEP. Recently the Ministry for Environment, Energy and Seas has reinforced water policy by creating the Vice Ministry for Water and Seas. However, it is early to see the results of these organizational changes.

Notwithstanding that the State maintains control over water institutions, it is worth emphasizing that water reforms have reinforced the participation of the private sector, as water users, within the decision-making processes, empowering this sector in comparison with other social actors. One of the reasons for that is how legislation defines stakeholders. For instance, in the Chilean, Mexican and Peruvian cases, stakeholders' participation occurs mainly through users associations and state agencies, thus allowing the private sector to become a main actor in the process with access to negotiation spaces that were not in place before. For this reason, stakeholders' participation is constrained to the scope and interests of each users association, including mining and electricity companies. This has led to uncoordinated actions, specifically related to bodies of water that, in the long run, can affect the sustainability of the river basin (IIC, 2011). These characteristics reflect the bias towards a technocratic and utilitarian perspective of water since the institutional arrangements consider that only sectors such as agriculture, industry, fishery or the mining industry should be involved in decision-making processes. From this perspective, water management should be restricted to direct users, the State, or the market as in the case of Chile, with little consideration of other perceptions such as those of NGOs, social movements or even unions, leaving social actors marginalized in the water governance processes.

The Brazilian, Mexican and Peruvian models, however, allow other organizations, besides users, to participate in water-related advisory or decision-making bodies. In the Brazilian context civil society organizations are represented by NGOs, communitarian and professional associations, unions, universities, research institutes and indigenous communities (Lei das Águas n. 9433, 1997). The Peruvian legislation reserves seats for natives and traditional communities in the river basin committees along with users (Ley de Recursos Hídricos n. 29338, 2009). In Mexico, rural groups, small businesses, environmental organizations and social platforms should be part of the river basin committees but they are systematically excluded from the councils (Boelens et al., 2011).

It is important to point out that natives and traditional populations are also underrepresented sectors in formal participatory forums, which exemplifies that there is a distance between having a seat, being allowed to negotiate and the ability to have your claims transformed into practices (Agarwal, 2001). Indeed, even though the Brazilian and Peruvian legislation recognizes and enables seats for these groups, they usually represent around 2% of the total council, thus barely having any power during the voting processes. However, their presence in participatory institutions at least allows for the introduction of their own agenda into the discussion, even if they have little guarantee that their claims will be addressed.

As a consequence of the persistent control of governments at different organizational levels over the participatory forums and their recommendations, civil society organizations such as NGOs, research institutes and social movements given visibility to their claims through activism and advocacy, while the private sector intensifies its influence through parallel forums and alliances with some civil society organizations in defining parameters for water certification and water efficiency indicators. The use of spaces to influence decision-making processes that go beyond the formal participatory institutions reflects the logic of the system's characteristics. First of all, multi-stakeholder platforms, such as water councils and committees, focus on consensus-building by providing a conductive space for mutual understandings. This is a recommended practice where a single actor does not dominate the field and there is a basic willingness to communicate (Warner, 2005). One of the main purposes should be to forestall conflict situations by discussing the water management practices and interventions among different stakeholders (*ibid.*). In this context, conciliation techniques help building a positive relation between the parties of a given dispute (Sgubini et al., 2004). The success of conciliation over environmental conflicts resides in strengthening collective imaginaries on the importance of rights and duties involved in the protection of the environment (Velásquez Muñoz, 2004).

Nonetheless, there are at least two problems that go against the multi-stakeholder platform assumptions described above. First, water issues are complex problems in which different actors have antagonist views on how to solve them, considering how water should be allocated and by whom (Warner, 2005; Jacobi, 2006). Second, decisions over water allocation and the construction of water infrastructure take place at government level, and then they are brought to councils and committees. Stakeholders' discussions concentrate mainly on decisions previously made, which leads some actors to believe that their participation is only to legitimize the government's decisions. As a consequence, frustrated civil society organizations withdraw from councils and committees since they perceive their participation as inefficient in promoting their own agenda or in changing government's plans. Thus, the government and private sector's agenda are the ones prevailing and influencing the water management in the region (Boelens et al., 2011; Empinotti, 2011).

In general, most participatory processes in LAC remain at the information and consultation stages. A meaningful and interactive participation would require devolving mandates down to the lowest practicable level and giving people the right to say 'no' to interventions proposed by the government. Nonetheless and even though in many cases formal participation is still incipient and does not meet initial expectations, it should be acknowledged that it is contributing to share water governance decisions and to expose problems and conflicts about how water is allocated in different regions and contexts.

12.4 Water certification as a new space for negotiation

Another space for negotiation that is effective but usually not recognized takes place when civil society organizations and private sector organizations discuss and propose new approaches to future public policies regarding water management. The private sector is one of the main water users and consumers. Industrial and agricultural practices together correspond to more than 90% of water consumption in the world (World Bank, 2010; Hoekstra and Mekonnen, 2012), which makes the private sector the main water user. Consequently, this sector's interest over water issues focuses on guaranteeing its access to water resources as a means to reducing water-related risks for its business activities. In order to achieve this goal, lobbying practices and the proposal for new market mechanisms become strategies to shape future water policies.

While green NGOs lobby the State and legislative bodies for an environmental agenda, or professional associations push for a technical approach to manage water, organizations representing the private sector's interests have been focusing mostly on securing regulations that do not constrain business and on ensuring that the regulatory environment is consistent across government departments, predictable and stable over time and applied to all the companies in a similar way (Pegram et al., 2009). In this context, the water law reforms that have occurred in LAC during the past three decades were an opportunity for the private sector to influence the process. In the Brazilian case, the industrial sector was one of the most active groups in Congress during the negotiation of the 1997 Water Law, advising their representatives and influencing the final text. In Peru, during the debates over and the formulation of the 2009 Water Resources Law in Congress, the private sector – mainly the National Mining, Energy and Petroleum Association – was able to actively influence the final text. Some of their agenda was translated into law through the authorization of economic activities in headwaters, and the introduction of concepts such as efficiency in water use and equity in access (Budds and Hinojosa-Valencia, 2012).

At the same time, multinational and international industries direct their attention to the discussion of water use indicators and future certifications related to water use in the production process. The strategy is to discuss and elaborate rules among companies and civil society organizations that could become the reference for future public policies. Researchers identified such practices as private governance and non-state market-driven governance systems that allow the private sector to influence the rules that will impact their production practices in the future (Cashore, 2002; Smith and Fischlein, 2010). One of the consequences of this strategy was the inclusion of water indicators into the corporations' social environmental responsibility portfolio. Such a trend has developed during the last six years, when the water footprint method, combined with the ISO initiative to create a protocol on water use, attracted the corporations' attention (Daniel and Sojamo, 2012; Empinotti, 2012). These initiatives of multinational organizations were triggered by their interest in assessing the water-related risks for their business – from both a regulatory and a physical point of view – as well as the need to address the consumers' expectation for environmental commitment (Hepworth, 2012; Larson et al., 2012).

The debate over the water footprint and other initiatives captured the attention of transnational corporations such as Coca-Cola, SABMiller and Nestlé, which compete in the international scale and have their production chain spread all over the globe. Moreover, LAC industries discussing such issues are usually large exporters of raw materials and have their main consumer markets abroad (see Table 12.3).

Interestingly, these types of initiatives have low participation rates of LAC industries in comparison to other regions of the world. For instance, only 36% of the invited Latin American corporations adhered to the Carbon Disclosure Project's Water Initiative, compared to 62% in North America, 80% in Europe, 80% in Africa, 51% in East Asia and 62% in Southeast Asia and Oceania (Deloitte, 2012). In the CEO Mandate, only two out of a total of ninety-one endorsing companies are from LAC. This could be partially explained by the geographical distribution of the corporations' headquarters but there could be also other more substantive reasons that ought to be explored.

While many of the Latin American companies listed in Table 12.3 are still in the process of calculating their water footprint, those that already have their results, in general, treat them confidentially and are discussing them internally. Initiatives for water accounting, however, did not promote changes in water governance practices nor did they trigger the discussion of new public policies, following an international trend (Hepworth, 2012, Sojamo and Larson, 2012). An interesting exception occurred in Brazil, where the industrial sector and international environmental NGOs engaged in a lively discussion over indicators for water efficiency and regulation (Empinotti, 2012). While supporting NGOs' initiative by creating a broad water indicator, the industrial sector was concerned with the possibility of having a public policy defining the acceptable amount of water that each sector should use. From the industrial perspective, such a reference would increase State control over water rights and distribution. Such concern led the industrial sector to redirect the discussion initially driven by governmental agencies towards the use of certifications that acknowledge the industries initiatives in reducing their water use, instead of establishing rules that could define and limit the average amount of water that can be allocated to each industrial sector (Empinotti, 2012).

During the past decades, the interaction between the private sector and civil society organizations has shaped environmental discussions and new public policies. However, it is understandable that the private sector participation in water-related spaces for negotiation serves the ultimate goal of ensuring water access for its production processes. Thus, there is no guarantee that water will be better or more equally distributed among the different society sectors or that water use will be more sustainable, if this does not revert positively in business activity. For this reason, the participation and contribution of the private sector to water governance should be adjusted and constantly evaluated, to push the private sector to understand water as a common good and human right, following the principles defined by most of LAC water legislations.

Table 12.3 **Latin American companies involved in water networks and initiatives on water accounting tools**

	SECTOR	COUNTRY	INITIATIVE
Natura	Cosmetics	Brazil	WFN [1] / WBCSD [2]
FIBRIA	Pulp	Brazil	WFN/WBCSD
Cimentos Liz	Cement	Brazil	WBCSD
Abril Group	Media	Brazil	WBCSD
Petrobrás	Oil	Brazil	WBCSD
Suzano Papel e Celulose	Pulp and paper	Brazil	WBCSD
Votorantim	Cement, metals, energy, steel, agribusiness	Brazil	WBCSD
Grupo Orsa	Pulp and paper	Brazil	WBCSD
Banco do Brasil	Banking	Brazil	The CEO Water Mandate [3]
Vale	Mining	Brazil	CDP – Water Initiative - WBCSD[4]
Cia. Siderurgica Nacional – CSN	Steel	Brazil	CDP – Water Initiative
ABInBev	Beverage	Belgian-Brazilian	BIER – water stewardship [5]
Quimico del Campo	Metals	Chile	WFN
Vinã Concha y Toro	Wine	Chile	WFN
Vinã del Martino	Wine	Chile	WFN
Vinã Errazuriz	Wine	Chile	WFN
Codelco	Mining	Chile	WBCSD
Masisa	Timber	Chile	WBCSD
Empresas CMPC	Pulp and paper	Chile	WBCSD
Cementos Argo	Cement	Colombia	WBCSD
EPM Group	Energy and water	Colombia	WBCSD
Grupo Nutresa	Food	Colombia	CEO Mandate
Ecopetrol	Oil	Colombia	CDP – Water Initiative
CEMEX	Cement	Mexico	WBCSD
Wal Mart de Mexico	Retail	Mexico	CDP – Water Initiative
Fresnillo	Mining	Mexico	CDP – Water Initiative

Source: own elaboration based on data from WBCSD, WFN, CDP, CEO Water Mandate
1 Water Footprint Network Initiative, 2 World Business Council for Sustainable Development
3 UN Global Compact's CEO Water Mandate, 4 Carbon Disclosure Project (CDP) Driving Sustainable Economies, 5 Beverage Industry Environmental Roundtable – Water Stewardship.

12.5 Accountability and information transparency: two faces of the same coin

Accountability and transparency are often pointed out as 'silver bullets' against corruption and bad governance in the water sector (Stalgren, 2006; Transparency International, 2008; Asís et al., 2009; UNDP, 2011; Regional Process of the Americas, 2012), which, in turn, are considered to have a key role in poor service provision, environmental degradation, society inequity and other important failings of the water sector.

Accountability implies being held responsible for one's actions: from the approval of e.g. a new water infrastructure, down to the decision of turning a tap on and off to provide water in a specific location or for a specific use. Thus, it is a relationship between those that are held accountable (e.g. politicians, government officials, private companies or individual citizens) and those entitled to demand accountability (e.g. social and State actors) and to apply sanctions in cases of poor performance or abuses (Hernández et al., 2013). Accountability entails answerability, i.e. the existence of formal processes where actions are judged according to specific criteria. Answerability, in turn, requires access to information by those who demand accountability and the obligation to justify one's actions and decisions if required to do so. For many, information transparency and justification alone, however, do not guarantee accountability, as it is necessary to have in place mechanisms and bodies with enforcement capacity, i.e. to apply sanctions for not meeting the established standards or not playing by the rules (Schedler, 1999; Schedler, 2004; Fox and Haight, 2007; Peruzzotti, 2008).

This section focuses on societal accountability[3] of the public authorities or companies that manage water resources or provide water services. The 'right to know' for constituents, customers or civil society organizations in general is usually pursued through two different strategies: the first is top-down, which means that public institutions proactively provide information to the public on issues relevant to water management (Fox and Haight, 2007). Typically this strategy is implemented through the internet, as proactive information. This method is relatively easy and inexpensive and it contributes to reducing the number of requests for information (Mendel, 2009). The second strategy (bottom-up) implies that the public files information requests normally following well-established procedures. However, even if these strategies are in place, information provision can be 'opaque', since the material is only nominally available given that it is often presented in a way that is difficult to understand/use or, more importantly, because it is not reliable (Fox and Haight, 2007).

12.5.1 Legal provisions to foster access to information

The analysis of existing initiatives to ensure information transparency suggests that in LAC there is a keen perception of this issue and a large body of legal provisions to pursue it. The legal basis comes from specific articles in the Constitution (e.g. in Colombia, Ecuador or Mexico) and/or from specific laws that deal with the issue of access to information. Most of the laws address the freedom of information in general, but in several countries there are also laws that regulate the access to environmental information (e.g. in Argentina), which is particularly relevant to water management. In some cases, sector laws like the Brazilian water law also establish the creation of an information system that should contain information to support decision-making processes related to water governance and management.

3 Downward or societal accountability means being answerable to a constituency (users, customers or society in general).

Since the end of the 1990s in the LAC region there has been a surge of information transparency laws (Figure 12.2), and currently about two-thirds of the countries in the region already have a specific law for access to information in place. Moreover, transparency portals are becoming a common way of conveying information to the citizens in a centralized way and examples of it can be found in Peru, Guatemala, Bolivia, Colombia, Chile, Brazil and Mexico. Usually they are websites managed by the government devoted to publishing public financial information regarding public companies, municipalities and government procurement (Solana, 2004) and can be a tool to empower civil society organizations. These portals, however, rarely have specific information about water.

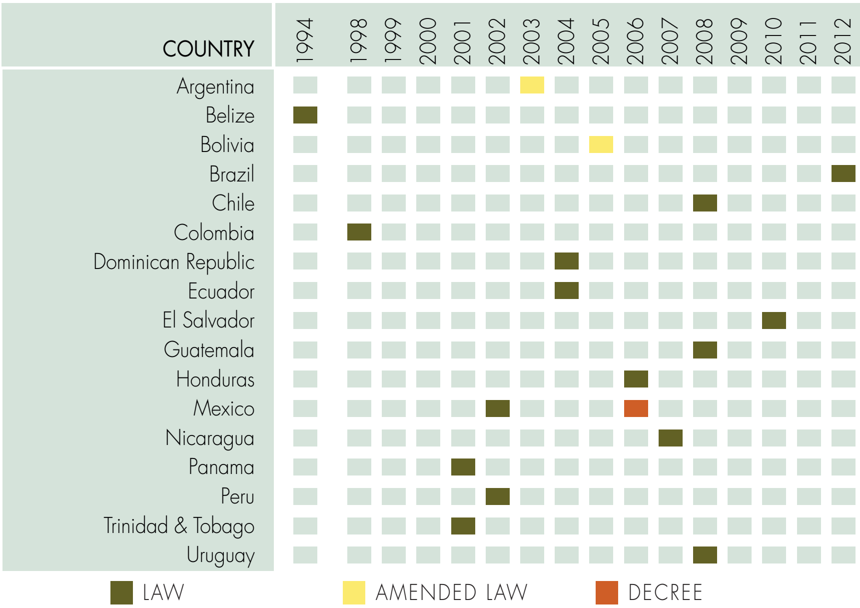

Figure 12.2 Timing of approval of information transparency law in LAC. *Source: own elaboration with data from Mendel (2009), Vleugels (2009) and Michener (2010).*

A comparative analysis of key elements of transparency laws in twelve LAC countries (Michener, 2010) suggests that the weakest points of the existing legal provisions for information transparency are related to the regulation of exceptions and of the appeals in cases of information denial, while the scope of the law and the duty to publish are quite well developed (Table 12.4).

LAC laws, and in particular the Peruvian one, have progressive rules in relation to the duty of public bodies to publish information in a proactive manner. Several countries have, at least on paper, well-developed systems to foster agile access to information. For example, in Mexico, Nicaragua and Ecuador there are specific rules on how to make information, that is subject to proactive publication, easy accessible (e.g. information index, list of classified information) (Mendel, 2009). The dominant trend in all countries in the region is to make increasingly more information available on a proactive basis, particularly via the internet, even in cases when it is not required under an information transparency law (*ibid.*).

Table 12.4 Strengths and weaknesses of the existing transparency laws in several LAC countries. Scores are from 0 to 3. Colours are for interpretation only. Criteria for the scoring can be found in Michener (2010).

COUNTRY	SCOPE OF THE LAW	PROCEDURAL GUARANTEES	DUTY TO PUBLISH	EXCEPTIONS	APPEALS	SANCTIONS
Brazil	1.5	2.1	1.5	1.9	1.5	2.2
Colombia	1.5	1.7	1.3	1.1	1.2	1.3
Chile	2.2	2.7	3.0	1.9	2.5	2.1
Dominican Republic	1.4	1.7	1.3	1.3	2.0	1.0
Ecuador	2.1	1.4	2.1	1.4	1.3	2.3
Guatemala	2.3	2.9	2.5	2.4	2.3	1.3
Honduras	2.1	1.9	2.8	1.4	1.7	2.3
Mexico	2.6	2.9	3.0	2.3	2.8	2.3
Nicaragua	2.8	2.9	2.3	1.9	1.7	1.7
Panama	2.3	1.9	1.5	1.6	1	2.0
Peru	2.0	1.7	2.3	2.3	1.7	1.7
Uruguay	1.6	2.0	2.0	1.9	1.5	1.7

Source: own elaboration based on Michener (2010).

Many LAC transparency laws, but not all of them, impose the duty to publish not only to public corporations but also to private bodies, which receive funding through public contracts. In Peru, the obligation is even extended to all bodies exercising a public power or performing a public function (Mendel, 2009). In some countries, like Chile and Colombia, only corporations with 50% public ownership are covered, although a large block of State involvement ought to adhere to the principle of openness, since significant involvement of the State in a corporation normally signals a public interest in its operations (*ibid.*).

The two most common options for appeal in case of refusal of information are internal complaints or complaints to an independent oversight body and/or the courts. Many laws – e.g. in the Dominican Republic, Guatemala and Peru – include legal provisions for an internal appeal, usually to a higher authority within the same body which originally refused the request. Chile, Honduras and Mexico appoint an independent administrative oversight body for the review of denials of information (*ibid.*). Most laws in Latin America, as well as globally, include a regime of sanctions for individuals who obstruct access to information, and some also provide for the direct responsibility of public bodies. In some countries – like the Dominican Republic and Peru – it is a criminal offence to obstruct access to information, while in other countries – like Chile, Honduras and Mexico – the law provides for administrative liability (*ibid.*).

12.5.2 Implementing legal provisions: are they enough to have transparent water sector?

As for any legislation, the mere existence of a legal framework is no guarantee of achieving satisfactory access to information, either because of flaws in the design of the law or, more often than not, due to difficulties in its implementation. In LAC, most of the existing comparative studies focus on the strength on paper of legal provisions, but several watchdog initiatives and academic studies also point out gaps in the implementation of the law (Alianza Regional, 2009; Fraga, 2012; IDB, 2012; Soto and Rojas, 2012; Torres, 2012). But how does this apply to water? Do legal provisions for information transparency manage to make the water sector truly transparent? In the water sector, benchmarking exercises typically assess the technical performance of water utility companies (Table 12.5). In some cases, they also include criteria related to governance, financial performance, or customer service. Thus, they do not assess information transparency but do contribute to making water and sanitation companies more transparent. Transparency benchmarking as such is rare. An ongoing initiative to improve Brazil's water agencies' transparency is based on a methodology first applied in Spain and has been adapted to Brazil (Empinotti and Jacobi, forthcoming). It represents an exception to the rule in that it looks at water management as a whole and not only at a specific sector (e.g. water utilities).

Table 12.5 Examples of benchmarking initiatives of water and sanitation utilities companies

EVALUATING AGENCY	COUNTRIES	PERIODICITY	INDICATORS
Interamerican Development Bank	LAC countries	On request	Service quality, business management efficiency, operating efficiency, access to service, investment planning and execution, financial sustainability, environmental sustainability, corporate government and accountability
Fitchratings	Mexico, Colombia, Panama	Yearly	Control, coverage, charges, cash, capital, capacity, legal compliance, community and clients
Grupo Regional de Trabajo de 'Benchmarking' de la Asociación de Entes reguladores de agua y saneamiento	Several LAC countries	Yearly	Performance indicators: service structure, operational structure and service quality, economic indicators
Superintendencia Nacional de Servicios de Saneamiento	Peru	Quarterly/ yearly	Access and quality of the service, billing, economic and financial sustainability, management efficiency, governance, customer service and eco-efficiency
Superintendencia de Servicios Públicos Domiciliarios	Colombia	Monthly/ quarterly	Registration of property, control of assets, fixed assets insured, compliance of contractual agreements, settlement of contracts
Superintendencia de Servicios Sanitarios	Chile	Yearly	Water treatment, drinking water quality, water continuity, accuracy in billing, complaints
Benchmarking Central American Water Utilities	Cosra Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama	Yearly	Water quality, water standards, leaks, operation costs, water consumption, connections networking, service coverage, metering, water cost
International Benchmarking Network International Bank	International	Yearly	Service coverage, production, non-revenue water, metering practices, network performance, cost and staffing, quality of service, billings and collection, financial performance, assets, affordability of services, process indicators

Source: own elaboration.

As mentioned previously, the internet is a powerful tool for conveying relevant information about water management to society. An online search of some key information in some countries in LAC provides insights into areas where there is a very progressive and proactive information provision and issues that still have a poor coverage (Table 12.6). Interestingly, online consultation seems to be a real possibility in the considered countries. Water authorities use the internet to make water rights registers accessible or publish documents for public consultation, but they rarely use it to record and make public the received comments. Significant gaps in information provision are related to the application of water law infractions, sanctions and the follow-up of the execution of public works.

Table 12.6 Online availability of information about selected issues in five LAC countries. The table reflects the information available online on February 2013 and that which could be found by consulting the websites of public organizations in charge of managing water resources in each country.

COUNTRY	BRAZIL	CHILE	PERU	COSTA RICA
Comments received to water-related documents issued for public consultation	Usually yes	Yes, for EIA studies	No	No
Registers of water right	Yes, in most of the Brazilian states	Yes	Yes	Yes
Statistics about water law infractions and sanctions	Usually not	No	No	No
Background studies supporting the planning process	Yes, in most of the cases	Yes	No	No
Data about the incomes from water tariffs	Yes, where water tariffs are in place	Yes (non-use tariff)	No	No
Data on the process for granting water-related contracts and tenders	Yes but not always easily accessible	Yes, in most of the cases	No	No
Data on follow-up and control of public works execution (duration and cost)	Not in a consolidated way	Yes	Not in a consolidated way	No

Source: own elaboration.

From the above, it can be concluded that most LAC countries have well-developed and in some cases very progressive information transparency laws, which can contribute to the transparencys of water-related public bodies. The actual implementation of the legal obligations to information disclosure is ongoing and it surely fostered by benchmarking initiatives and watchdog studies promoted by civil society and international organizations, mainly for the water and sanitation sector. To provide water for human uses in a sustainable way, however, it is key to have a holistic approach and consider the system that provides those resources – rivers, aquifers watersheds, wetlands. Thus, the next step is to assess and seek information transparency in the management of the whole system, and not only at the end of the pipe, where water is supplied.

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13

ECONOMIC INSTRUMENTS FOR ALLOCATING WATER AND FINANCING SERVICES

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Highlights

- All countries with post-Dublin (1992) new water legislation have implemented more or less sophisticated economic instruments and financial mechanisms to treat water and supply service as an economic good.
- The notion of water as a public resource domain, coupled with the need to increase cost recovery rates, is at the root of the legislative foundations of all economic instruments applied to water.
- The 'polluter-pays-principle' is also a designing principle in all modern legislation, but in practical terms there are numerous difficulties that hinder its application. Environmental taxation has been implemented in some countries, but the revenue collected is still low, and does not act as a true deterrent for polluters.
- There are several examples of advanced water charging in agriculture, which differ amongst crops, irrigation technology and areas. After decades of little or no cost recovery rates in irrigating schemes, some countries, such as Argentina, Mexico, Peru and Brazil, have taken significant steps to make farmers pay for operation and maintenance costs of the infrastructure supplying their water.
- Chile is the sole Latin America and Caribbean (LAC) country with decades of experience in water trade mechanisms. It seems that recently passed laws in other countries have not been developed nor have they enabled trading mechanisms, whereas the 1981 Chilean Water Code and its subsequent amendments had specific provisions defining water rights as tradable. Market prices for water rights are quite high, with the mining sector being one of the major purchasers.
- Payments for ecosystem services (PES), and in particular Payments for Watershed Services (PWS), have seen an important growth in the past years, bringing renewed hopes for a conservation approach that could succeed where other approaches have failed. LAC has led this development and is continuing to develop new initiatives, although strong growth is observed in other parts of the world.
- To be more efficient and effective, PES should be applied according to size, service per unit of land and type of watershed. Most large (national) schemes are government funded through special taxes, and receive funding from multilateral/aid organizations or governments thus threatening the scheme's sustainability.

13.1 Introduction

Principle 4 of the Dublin Statement[1] reads that 'Water has an economic value in all its competing uses and should be recognized as an economic good.' The Dublin Statement also claimed that '[The] Application of the "polluter pays" principle and realistic water pricing will encourage conservation and reuse.'

Economic instruments are used to allocate water resources, manage demand, reduce pollution discharges, finance water service costs and incentivize environmentally positive actions (positive externalities). Water and food security demands that scarce resources should be properly managed and services sufficiently financed. This chapter reviews four kinds of economic instruments, namely, (a) tariffs, levies and charges, (b) environmental taxes (c) water markets and (d) payments for ecosystem services.

As will be reviewed in this chapter, the urban supply sector is undergoing a second round of reforms, after the feverish privatization processes of the late 1990s (see Chapters 8 and 11). The challenges have been well diagnosed: how to expand the networks in order to reach the continuously growing population of cities; to bring drinking water and sanitation services to all neighbourhoods and households whilst at the same time keeping water prices at reasonable levels. Improvements and innovations are abundant, and the LAC region is clearly on track towards improving most indicators (see Chapter 6).

Ferro and Lentini (2013) reported that evaluations of the Interamerican Development Bank (IDB) indicated that to meet the water-related Millennium Development Goals (MDG) in LAC investments amounting in 2003 to US$16.5 billion in drinking water services, 22 billion in sanitation, and 17.7 billion in treatment of serviced waters, totalling 56.2 billion (approximately US$ 200 per person) were necessary.

In the field of irrigation, tariffs always face opposition and have been questioned as effective mechanisms to allocate scarce resources (Molle and Berkoff, 2007). And yet, around the region we have seen numerous initiatives on cost-recovery objectives, which have then evolved towards demand-management instruments. Ensuring adequate and self-sustained operation and maintenance is the main target.

Environmental taxes have been implemented in some countries, and this is one of the policy areas that will require longer implementation processes. Also the region has seen tremendous growth in the use of payments for ecosystem services (PES, see Chapter 14 for an assessment of LAC's ecosystem services).

The chapter also looks at water trading mechanisms. Little or nothing has been truly implemented in the region except in Chile, where trading occurs regularly in many regions and prices vary according to changes in the supply and demand.

1 The Dublin Statement On Water and Sustainable Development (1992).

13.2 Water tariffs

13.2.1 Fees or charges for the use of water resources

Many countries consider that the use of natural resources imposes costs on society and requires conservation and management activities. In order to reimburse the state for these costs of conserving the natural sources, many countries have established charges or fees that all users must pay.

In Mexico, for instance, at least eight categories are defined, whose rates increase when water is scarcer in the region (see Table 13.1). Note that the rate for irrigation is zero in all the regions and that for hydropower or exceeding the concession for irrigation do not vary with the regions' availability.

Table 13.1 **Levies for water use for different zones in Mexico, 2010 (US$ cents per m^3, exchange rate Mexican peso/US$ of 2010)**

	AVAILABILITY AREAS								
TYPE OF USE	1	2	3	4	5	6	7	8	9
General regime	143.15	114.57	95.46	78.70	62.02	56.07	42.21	11.20	0.00
Drinking water, for consumers greater than 300/l per person	5.67	5.67	5.67	5.67	5.67	5.67	2.64	1.32	0.66
Drinking water, for consumers less than 300/l per person	2.84	2.84	2.84	2.84	2.84	2.84	1.32	0.66	0.33
Agricultural, within the concession	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural, for units beyond the concession	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Spas and Recreational centres	0.08	0.08	0.08	0.08	0.08	0.08	0.04	0.02	0.01
Hydropower	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Fish farms	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Source: CONAGUA (2012)

In Costa Rica, different conceptualizations of water charges have evolved since the enactment of the 1942 Water Law. Presently, users must pay a charge called the 'environmentally adjusted water use charge' (*Canon ambientalmente ajustado por aprovechamiento de aguas*), which has two components: (a) an aggregate value which differs on the type of use (hydropower, agricultural, household consumption or industrial), and takes into account cost estimates and marginal valuations; and (b) a payment for the water environmental service. In general, the water charge (canon) in Costa Rica is considered a success story, with benefits identified in (a) the more efficient water allocation mechanism and reduced pressures; (b) the revalorization of the water resources; and (c) stakeholder's participation in designing the instrument (LA–Costa Rica, 2012).

In Chile, since 2005 there has been a 'non-use' fee (*patente de no uso*) that is charged to the users with surplus water rights who do not have the infrastructure required to make effective use of the water. It is calculated differently for consumptive and non-consumptive uses and varies from region to region. The elevation difference between the abstraction point, the return flow point and the length of the non-use period are also taken into account. The main objective of this fee is to 'correct' the distortions that were generated by the initial allocations (Melo et al., 2004)

Brazil's 1997 water law establishes that water be considered an economic good and introduces water fees with the triple objective of communicating the value of water, rationalizing its use and generating revenue for the further development of water resources. The model for setting water tariffs (*cobrança*) has been followed by a somewhat flexible and adaptive methodology (Formiga-Johnson et al., 2007). See Box 13.1 devoted to the basin of Paraíba du Sol in Brazil.

Peru passed the Law of Water Resources in 2009, which was later developed into a detailed regulation including a financial and economic regime. It defines a fee for using water resources, in lieu of the fact that they belong to the Nation's domain. Fees are differentiated by users (Article 177) and then collected revenue is used to fund basins' planning, administration and environmental protection among other goals. Interestingly, users that obtain individual or collective certificates of 'efficient use' can obtain fee rebates and also access water preferentially.

Box 13.1 An integrated approach in the Brazilian Paraíba do Sul Basin (PDSB)

PDSB covers 5.5 million hectares, located in Brazil's economic epicentre, covering the states of Sao Paulo, Rio de Janeiro and Minas Gerais, servicing 180 cities totalling 5.6 million people (8.7 million in the metropolitan area of Rio de Janeiro are outside the basin but are served through an inter-basin transfer). Four elements are identified in order to enable the implementation of a bulk pricing reform in the PDSB: (a) an inclusive and bottom-up negotiation; (b) collected fees would be invested in the basin; (c) a paradigm shift accepting the notion of water as an economic good was to be embraced by key actors in the basin; (d) advanced technical knowledge dating back several decades, so that committee members agreed on the primary problems and the role that bulk pricing would play in solving them.

The approved formula includes three components: a withdrawal component, a consumption component and an effluent dilution component. Upon the first implementation period it was found that the system had some flaws and was due for revision in 2006. There were several drawbacks that were corrected: (a) coping with illegal users; (b) taking the treatment of non-paying users more seriously; (c) solving the asymmetric status of users in different States, given that they were subject to different jurisdictions.

Some lessons can be drawn from this example. First, the formula was simple and had low implementation risks; second, the system had a hybrid approach with market-inspired schemes that preserved the role of the state (ANA and CEIVAP[2]); third, the idea of water being an economic good was deeply ingrained among users and the professional circles in the CEIVAP; fourth, the problems were well-diagnosed, with pollution being the direct one, and a consensus around the most practical means to face them was easily built among users and agencies; fifth, cross-cutting three important states, a federal component was required and essential; sixth and lastly, there were attractive incentives for implementation, including matching funds from the national programme to combat pollution, and revenues were earmarked for specific and visible basin projects. And yet, Ioris (2010) found some weaknesses and reported that, between 2003 and 2006, the charging scheme was responsible for collecting a total of 25.4 million Brazilian reals (US$10.85 million at the exchange rate of 2 July, 2005), which is considerably less than the budget required to restore the environmental quality of the basin.

Source. Formiga-Jhonson et al. (2001) and Ioris (2010)

13.2.2 Irrigation charges and fees

Irrigation schemes charge farmers fees to meet the operations and maintenance (O&M) costs. IWMI, USAID and FAO agreed that attention should be paid to five items (Molle and Berkoff, 2007). First, rational water use should be achieved by careful control of distribution and by allocating water to broadly meet crop requirements, with fees having little or no impact on irrigation performance. Second, the presumable efficiency gains from irrigation tariffs would most probably be realized by the control of supply or some kind or quotas. Third, the most critical financial factor is the level of fiscal autonomy of the irrigation agency, providing an incentive for cost-effective performance. Fourth, cost recovery should be contextualized to factor in irrigators' ability to pay, and O&M activities should be prioritized for cost recovery strategies. Fifth, subsidized users should repay some of the investments, but should not be expected to pay the extra-costs imposed by inefficient or miscalculated investments or overstaffed organizations.

Despite these caveats, it is also true that irrigation water given free of charge would also generate welfare losses, in the form of opportunity cost and externalities. Furthermore, many large countries like Mexico or small countries like Suriname have suffered the abandonment of irrigation infrastructures because of insufficient fees collection and poor cost-recovery rates.

Consider the case of Mexico. Irrigated agriculture is extremely important in terms of both irrigated acreage (more than 5.5 million hectares) and total water use. Since the passing of the Water Law in 1992 and the creation of the National Water Commission, Mexico

2 National Water Agency of Brazil (Agência Nacional de Águas) and Integrated Comittee of the Hydrographic Basin of Rio Paraíba do Sul (Comitê de Integração da Bacia Hidrográfica do Rio Paraíba do Sul).

embarked on a massive policy reform to allocate the water management of its large water districts to the recently created users associations (WUAs). This involved setting up new institutions such as basin agencies, giving WUAs managing capacity to administer both capital assets and water resources, and transferring the financial responsibility of running districts and collecting charges to the WUAs. During the devolution process, water prices increased by 45–180% and government O&M subsidies were removed. Molle and Berkoff (2007), citing other sources, claimed that O&M charges have been quite low (equivalent to 2–7% of the gross product), and that maintenance may be suboptimal in many cases. Garrido and Calatrava (2009) reported significant increases in irrigation water charges upon the implementation of the devolution process.

There are about 3.5Mha under irrigation in Brazil, although 29Mha are estimated to be suitable for irrigation by the National Water Agency (ANA). The Irrigation Law, enacted in 1979, and its regulations provide for the cost recovery of investment and O&M costs of government-supported irrigation projects through water charges to beneficiaries.

There is an interesting case of volumetric control and two-part charging mechanism in the Chancay-Lambayeque in Peru (Vos and Vincent, 2011). The Chancay-Lambayeque irrigation system achieved high performance with on-demand delivery to some 22,000 smallholders in a command area of some 100,000ha. Full cost recovery rates, accompanied by the requirement to pay in advance, reinforced the management and ensured the control of water use and cropping operations. Rates were US$0.003 per m^3 (four soles, the Peruvian currency, for a service module of 576m^3) in 1995, and were adjusted with inflation reaching US$0.005 per m^3 in 2010.

13.2.3 Charges for urban consumers

13.2.3.1 Regulatory frameworks

The design of the industrial structure for water supply and sanitation impinges on the ability to deliver services to the population. Assets are long-lived, allowing investments to be delayed and quasi-rents to be captured once initial investments have been made (Guasch et al., 2008). Fragmented services lose economies of scale, increase transaction costs, make services more expensive, and may facilitate capture by vested interests (Foster, 2005; ADB, 2009). Water supply and sanitation services have decreasing average costs (Krause, 2009) and therefore both efficiency and equity are achieved by selecting optimal size in terms of economies of scale.

Economies of scale lead to natural monopolies that must be regulated to ensure that the market operates as if it were a competitive market in order to achieve the maximum social welfare. Regulation should guarantee that the service is safe, sufficient, regular, physically accessible, convenient, and affordable. In terms of implementing regulation there are differences between, on the one hand, specific contracts, and on the other, comprehensive general, regulation, franchizing and concessions. Almost 90% of water supply and sanitation privatizations in LAC during the 1990s were made through concessions (Estache et al., 2003). More developed countries prefer to grant licences controlled by general regulations of compulsory application, approved by law, and enforced by fully empowered, permanent, professional regulators (Jouravlev, 2005). Chile has embarked on a process of privatization of water supply and sanitation that has been considered a success (see Box 13.2).

Efficiency covers costs while considering equity by facilitating improvements in the quality of services and their expansion to the poor. The Brazilian case has its particularities, as the private sector represents presently around 10% of the total concessions in the country, it has been constantly growing and changes are underway through the growth in the implementation of concessions, and the private utilities association expects to reach 40% by 2023. One of the causes is the lack of investment capacity of municipalities and state-owned companies to maintain and renew equipment. While there are diverse regulation frameworks in LAC, state-owned companies continue to be very relevant, but their main challenges are lack of accountability and regulation (see Chapter 11).

Box 13.2 Privatization of water services in Chile

In the system of water supply and sanitation in Chile, there is a tariff law according to which the Superintendence of Sanitary Services (SISS) periodically conducts studies to set the maximum prices that are authorized to sanitation concessionaires. These rates are set so as to allow each company to cover investment and operating costs and to obtain an agreed return on the investment required to provide the service of production and distribution of drinking water, collection, wastewater disposal and treatment. In order to establish efficiency incentives, water rates are set based on an efficient firm model, so that the values and parameters entering the formulas are not the actual company's, but of a fictitious company called 'business model'. The business model has been a useful tool in regulating utilities in Chile in recent decades. Currently, however, it has shown some problems. One the one hand, the current rates are not a real incentive to reduce water consumption. On the other hand, rates are set for the next five years, independently of potential water shortages, or water abundance which occur with much greater frequency, a variability that is not being captured by the price. Regarding the operation of private water companies, they operate through concessions, which may be overthrown if these do not meet quality standards, flow, or tariff standards.

13.2.3.2 Tariff levels and structures

In a very recent study of 308 large cities around the world, Zetland and Gasson (2012) evaluated the differences in water charges and researched reasons behind these differences. They found that the average water tariff for urban consumers was US$1.21 per m^3 (σ=1.13; max=7.54), whereas the wastewater tariff was US$1.02 per m^3 (σ=1.07; max=5.68). The following factors are identified by Zetland and Gasson (2012) to explain water and wastewater tariffs around the world: (a) labour costs; (b) regulatory price control which aim at minimizing tariffs; (c) public vs. private organizations; (d) water scarcity; (e) the age and condition of infrastructure; (f) subsidization schemes and the type of socially targeted policies.

Ferro and Lentini (2013) recently assessed the pricing policies in the LAC region. They assembled data from fifteen major utilities from Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Panamá, Paraguay, Perú and Uruguay, with a total population served of approximately 100 million people (see Table 13.2).

Table 13.2 Average monthly bill and average price in the main fourteen water utilities in LA

UTILITY	AREA OF SERVICE	YEAR	AVERAGE BILL (US$)	AVERAGE PRICE (US$/m^3)
AySA	Buenos Aires + 17 municipalities	2011	4.82	0.17
ASSA	Province of Santa Fe, Argentina	2011	5.87	-
SABESP	Estado de São Paulo (Brazil)	2010	48.43	2.63
COPASA	Belo Horizonte, Minas Gerais (Brazil)	2010	36.09	2.94
Aguas Andinas	Metro Santiago de Chile	2011	38.98	1.77
Aguas de Antofagasta	Antofagasta, Chile	2011	67.69	3.54
EAAB	Bogotá, Colombia	2011	31.82	2.64
ACUAPAR	Cartagena S.A. (ACUACAR) Distrito de Cartagena de Indias, Colombia	2011	32.51	1.98
SEDAPAL	Lima, Peru	2011	27.74	1.01
SEDACAJ	Cajamarca, Peru	2011	12.93	0.94
AyA	Supplier of drinking water and sanitation, Costa Rica	2010	22.72	1.07
EMAAPQ	Quito, Ecuador	2011	19.76	0.72
IDAAN	Supplier of drinking water and sanitation, Panamá	2011	15.54	0.3
OSE	Supplier of drinking water and sanitation, Uruguay	2009	26.27	1.8

Source: Ferro and Lentini (2013)

Increasing block tariffs (IBT) have become commonly used because they fulfill three goals (Olivier, 2010): (a) affordability and fairness, with a highly subsidized first block (subsistence first block); (b) resource conservation (higher consumption is charged at a higher price); (c) economic efficiency, with the higher block corresponding to short-term marginal cost of provision.

Small private operators are often in the business of supplying the poor, using tankers and informal companies selling water to the poor, usually at many times the price of tap water (see Box 13.3). Nauges and Strand (2007) found that average tap water price (PPP corrected) in three Salvadorean cities is about US$0.25 per m^3, and in the marginal quarters in Tegucigalpa, about $US0.4 per m^3. The average non-tap price in Tegucigalpa is US$8.43 per m^3.

The history of the Buenos Aires water concession is now a classical example of mismanagement and poor regulatory practice. The domestic supply service was awarded to the Aguas Argentinas Consortium in 1993, when only 70% of the metropolitan area population was connected to the water system and 58% to the sewerage system. In the suburban areas, these percentages were even lower, 55 and 36%, respectively, but almost 100% in the Capital District. Coverage targets specified expansions to the benefit of the poorest households in marginal areas. In 2003, the coverage and sewerage rates lagged behind targets by 47 and 70%. To compensate for the increasing investment costs of servicing new customers, initially estimated at US$1,120, totally out of the price range for the poorest consumers, the regulator approved increasing the rates of existing consumers by 93% from US$17.57 per month in May 1993 to US$33.88 in 2002. Casarin et al. (2007) observed that the concession left 1 million people unserved, and only 50% and 25% of the expansion targets with water connection and sewerage services.

Lima's water system was on the verge of collapse at the end of the 1980s. Severe under-financing, under-maintenance and little or no expansion were all parts of a vicious cycle facing rapidly growing cities in developing countries (Fernández-Maldonado, 2008). A new law to regulate sanitation services opened the door to private capital and created the SUNASS,[3] the regulatory body. In 2006, 3.9 million new customers were added on top of the 3.1 existing ones in 1980, and still 1 million Limeños were left served with trucks selling water at US$2.2 or US$3 per m^3, which was in 2006 nine times more than the socially regulated SEDAPAL's tariff ($0.33 per m^3). After 2006, revenue collected through tariffs was 90% of the costs, and because of the cross-subsidies only 11% of the customers paid more than the cost of provision. Presently, Lima's water problems are still unsolved: more than one-third of the serviced water is not billed, and in 2007 only 13% of its wastewater was treated.

Manaus, capital of the Amazonas state of Brazil, has 1.7 million inhabitants, in addition to another half million in the suburban areas. Drinking water reached 80% of the people in 2004; although access to sanitary networks reached only 7% of the households (Olivier, 2010). An attempt was made to embed a cross-subsidy mechanism so that the wealthiest and industrial consumers would subsidize socially targeted consumers, but failed because not enough revenue was generated in the former two groups. As a result, tariffs for the poorest consumers had to be raised by 31% to ensure that the company would not lose money. Furthermore, the largest consumers had the option to disconnect from the network, taking advantage of loopholes in groundwater regulations. In the Metropolitan Region of São Paulo similar difficulties were found when readjusting the tariffs for the poorest customers, who paid in the early 2000s slightly higher average prices than richer households, and in terms of percentage of disposable income ten times more (Ruijs et al., 2008). According to Ioiris and Costa (2009) the minimal payment for water services (the so-called 'social tariff') was significantly higher in Rio de Janeiro than in other parts of Brazil, which certainly contributed to the high rate of unpaid debt: in CEDAE (Rio de Janeiro) it was R$30 for 15$m^3$/month; DMAE (Porto Alegre), R$7.5 for 10$m^3$/month; and SABESP (São Paulo): R$4.42 for 10$m^3$/month (all 2008 data).

3 SUNASS: Superintendencia Nacional de Servicios de Saneamiento, Peru (www.sunass.gob.pe).

Box 13.3 Social equity: social tariffs

Most large LAC cities have been growing rapidly in the last decades, requiring continuous expansion of drinking water and sanitary networks. Charging the expansionary costs on new customers, generally in marginal areas, would be unaffordable for the poorest households. One difficulty of socially targeted policies is that if social rates are not sufficiently compensated by the revenue collected from regular customers, the water operator may be dissuaded to expand the network to add more marginal consumers.

Most pro-poor policies and arrangements involve one or a combination of the following features:

- A minimum volume free of charge, which in LAC ranges between 4 and 15m^3 per month and per household. The first priced block, that varies between 18 and 25m^3 per month and household, is set at an affordable cost. In Chile, 15m^3 per month is the maximum serviced at subsidized price; in Colombia 20m^3 per month is offered at subsidzed rates; in São Paulo paying the flat rate gives a rate to 10m^3 per month free of charge.
- Consideration of affordable tariffs. Capacity to pay or affordability are dubious concepts for which there is no clear theoretical foundation. Various authors and organizations have defined various thresholds in percentage terms of the household's income (5%, by The World Bank; Vergès, 1%; PNUD, 3%; IAD, 5% for the poorest households). The findings are that in Campinas, Brazil, charges are below 2%; about 5% in LAC cities with no pro-poor provisions; 1.8% in Arequipa, Perú; 9.8% in Cost Rica, whereas in cities with pro-poor provisions, it ranges from 0.9% in Ceará, Brasil, and Trujillo, Perú to 8.4% in Bogotá, Colombia. In Chile the goal is to keep the water and sanitation bill below 3%.
- An increase in the flat rate accompanied with a reduction of the volumetric rate, increasing the billing frequency, reduced or limited service as opposed to disconnection for non-paying customers, and a control over sumptuary consumption (car washes, swimming pool).

Source: Ferro and Lentini (2013)

13.3 Economic instruments applied to water quality management

In addition to command-and-control (CAC) instruments, two types of economic instruments (EI) have received the most recent attention: discharge fee programmes, which charge plants for each unit of pollution emitted, and marketable permit programmes, which assign plant emissions allowances that they may trade with other plants. Caffera (2010) claims that the experience in the region with economic instruments in pollution control is limited to three programmes: Santiago de Chile's Total Suspended Particles' Emissions Compensation Programme (ECP) of 1992 and its extensions to industry emissions of

Nitrogen Oxides and Particulate Matter in 2004; Colombia's 1997 Discharge Fee for Water Effluents' contents of Biochemical Oxygen Demand and Total Suspended Solids; and Costa Rica's 2009 Environmental Fee for Water Discharges of Chemical Oxygen Demand and Total Suspended Solids.

Colombian Law 99 of 1993 established the legal foundation for a national discharge fee programme. While the programme was plagued with difficulties and serious non-compliance in the first five years after 1997, BOD and TSS discharges dropped significantly following the initiation of the program in 1997 (Caffera, 2010). This could have resulted from the economic incentive and efficiency properties of the new discharge fee programme or because of the improved permitting, monitoring, and enforcement of both the new discharge fees and existing emissions standards.

In reviewing, the Colombian discharge fee, Caffera (2010) indicated that its main problem was the broad non-compliance by municipal sewerage companies. Because emissions of these sources did not decrease, the environmental quality targets were not met, and the fees never stopped increasing. In view of this, a new decree (Decree #3100), was enacted (later modified by Decree #3440 of 2004), which introduced the following changes: (1) it mandated the regional and municipal authorities to establish (a) individual targets of pollution reduction for municipal sewage companies and sources whose loads are more than a fifth of the total loads received by the water body, and (b) group targets for the rest of the sources, according to the group's type (industrial branch, etc.); (2) it mandated the regional and municipal authorities to ask the municipal sewage companies to present a Plan for Pollution Management in accordance with the pollution reduction target; (3) it changed the method by which the fee is adjusted. However, Caffera (2010) wrote 'it is obvious that the changes sought to leave the municipal sewage companies and large polluters outside the fees' program, changing a monetary incentive to invest in pollution abatement by a prescriptive-type pollution abatement plan' (p.13).

Inspired by the Colombian programme, Costa Rica implemented an Environmental Fee for Discharges which puts a price on each kilogramme of COD and TSS discharged. The Costa Rican programme also faced implementation difficulties. It was challenged in court by the sugar cane industrial-agricultural union, on the basis that the fee was a tax, something that could only be decreed by the congress, the appeal was ruled against by the Supreme Court. The Ministry of the Environment approved a new decree (#34431) in 2008, which changed the amount and structure of the fee. Other implementation difficulties were related to the lack of trained personnel, of databases, and of monitoring equipment. The collection of fees was estimated to be only 80% of the total potential and as such prevented the purchasing and installation of treatment plants and monitoring equipment. Costa Rican regulators found that the most difficult sources of pollution originate from public utilities providing water services such as sanitation, drinking water, and irrigation.

In Chile the Decree #70 of the Ministry of Public Works established in 1988 that water utilities can charge for water provision but also water collection and disposal services. At the time very few cities had isolated collection and treatment services. But since the investments required to provide these services can be included in water tariffs once they are operational, water utilities now collect and treat almost all urban water. Water discharges from other sources are still regulated through traditional command and control methods (Donoso and Melo, 2006).

13.4 Payments for environmental services

Some of the goods and services provided by ecosystems are traded in markets, but others are not. In the latter case some or all of the costs of providing, and the benefits of using, these goods and services are not transmitted through prices, what economists call an externality. The main idea behind payments for environmental services (PES) is to establish the incentives lacking due to the existence of an externality, by putting in place a mechanism that compensates suppliers/producers and charges beneficiaries of the ecosystem service. This section introduces the concept of PES, which is further developed and expanded upon in the next chapter (14).

While different approaches that use market-based mechanisms have been labelled as PES, more recently the concept has been narrowed down. For example Wunder (2005) defines PES as '(1) a voluntary transaction in which (2) a well defined environmental service (or a land use likely to secure that service) (3) is "bought" by a (minimum of one) buyer (4) from a (minimum of one) provider (5) if and only if the provider continuously secures the provision of the service (conditionality)' (p. 3). An alternative and less restrictive definition is proposed by Porras et al. (2008), and considers only three criteria: that an environmental externality; is addressed with a payment, is voluntary in the supply side, and has conditionality.

As Chapter 14 explains, several payment mechanisms can be used including in cash or in kind transfers between governments and landowners, tradable development rights, voluntary contractual arrangements, and product certification and labelling (MEA 2005). The former ones are the most common in schemes that conform to the current PES definition. PES could deliver environmental and social co-benefits. The payment component of PES schemes, on the other hand, could have a relevant role in poverty alleviation (Pagiola et al., 2002).

Landell-Mills and Porras (2002) identified sixty-one watershed initiatives, twenty-two of them in LAC, but only eleven where in a pilot or mature stage of development and were still ongoing by 2006 (Porras et al., 2008). Of these projects, six are implemented at a national level in Colombia, Costa Rica, El Salvador, Guatemala and Mexico. There are also some regional initiatives that are replicated in several countries, like the Regional Integrated Silvopastoral Ecosystem Management Project (RISEMP) in Colombia, Costa Rica and Nicaragua, funded by the Global Environmental Fund (GEF) and the World Bank (WB), and the Programme for Sustainable Agriculture on the Hillsides of Central America (PASOLAC) in El Salvador, Honduras and Nicaragua, funded by the Swiss Agency for Development and Cooperation (SDC). More recently, Bennet et al. (2013) identified 205 active programmes in 2011 worldwide, twenty-eight of them in LAC (Ecuador, Colombia, Brazil, Mexico, Costa Rica and Bolivia). These authors also report that initiatives in this region are putting more emphasis on building social capital and more frequently use payments in-kind. Table 13.3 presents a summary of some of the most significant Payment for Watershed and Water-related services (PWS) initiatives in Latin America.

Table 13.3 PES schemes for watershed protection and water-related ecosystem services in LAC

NAME	COUNTRY	ACTIVITY PAID FOR	SERVICE	SELLER	SCALE	SPATIAL EXTENT (hectares)	YEARS	AMOUNT TRANSACTED IN 2011 (million USD)
RISEMP	Colombia, Costa Rica, Nicaragua	Biodiversity, carbon, watershed	Restoration (silvopasture)	NGOs, Intern. Org., States	International (3 countries)	3,500	2002–2008	393.8
Pimampiro	Ecuador	Watershed	Conservation/ minor restoration	Municipal government	Local	496	2000–present	4.6
PSA program	Costa rica	Carbon, watersheds, biodiversity, landscape	Conservation/ minor restoration	Public sector, Intern. Org.	National	270,000	1996–present	340
PSA PROGRAM	Mexico	Watershed	Conservation and restoration	Private and communities	National	600,000	2002–present	82.5
Los Negros	Bolivia	Watershed, biodiversity	Forest and paramo conservation	Farmers	Local	2,774	2003–present	8.0

Source: adapted from Wunder et al. (2008). Notes: RISEMP ended in 2008, and the amount transacted is estimated from Pagiola et al. (2004) an is an average for the duration of the programme. For Pimampiro, the amount transacted is calculated from Patanayak et al. (2010). For the rest of the programmes the amount transacted from Watershed Connect website.

Martín-Ortega et al. (2012) reviewed thirty-nine PES programmes in LAC, which have been summarized in Table 13.4. There is a great variety of approaches and partnerships, but most focus on forests' and land conservation to protect watersheds.

The next chapter (14) will also review PES, jointly with biodiversity markets, REDDs and CDMs and other instruments.

13.5 Water markets as a water allocation mechanism: the case of Chile

With increasing water scarcity and decreasing supply augmentation options, water managers and policy makers see interest in implementing market allocation systems (Rosegrant and Gazmuri, 1995; Easter et al., 1999; Saleth and Dinar, 2004). Efficiency and activity of water markets (WM) are intrinsically linked to the design of institutional and physical water systems (Bjornlund and McKay, 2002).

With WM the price of water rights (WR) reveals the opportunity cost of water, creating incentives to use water efficiently and employ it in its most productive use. WM are expected to lead to a socially optimal and efficient allocation by inducing two key changes. First, water is transferred from low-value users to high-value users. Second, WM

Table 13.4 Main characteristics of water-related PES programs in LAC

ASPECT	DEFINITION
COUNTRIES	10 in Costa Rica; 6 in Ecuador; 4 in Bolivia, Brazil, Colombia and Mexico; 2 in El Salvador and Nicaragua; 1 in Guatemala and Honduras
CONTEXT	Local specific component, 92.1% National components only, 26.3%
ENVIRONMENTAL ASPECT	42.1% Undefined Among the remaining 57.9%, 77.3% targeted deforestation and land cover; 31.8% water pollution; 22.7% water overuse
STAKEHOLDERS	40% a leading national NGO 23.7% Municipality 18.3% Governmental 16% Semi-autonomous agencies
INTERMEDIATION	78.9% use intermediary 21.1% direct transaction between buyers and sellers.
AGENTS INVOLVED	96.4% landowners and farmers
PAID ACTIONS	73.7% have more than one action, with a majority focusing on forest conservation and reforestation for water catchments 23.7% forest management
TARGETS	91.3% Aim at improving water supply 53.3% Aim at improving in-stream supply (water flow regulation for hydropower)
DIFFERENTATION	42% include some kind of differentiation (from 2 to 12, average 2.14), according to: 74.8% type of activity 23.9% type of forest or land feature
EVOLUTION OF SCHEMES	42.1% include several transformation stages

Source: Martín-Ortega et al. (2012)

generate greater investments in water conservation technologies due to the trade induced price increase (Chong and Sunding, 2006).

However, WMs can also result in third-party effects, speculative behaviour in water trade, social and environmental externalities. The Chilean government introduced a tax for holding unused water rights as a reaction to speculative behaviour and WR hoarding, which did not inhibit but did distort the market (World Bank, 2011). In Chile, trades need to be registered and approved by Water User Associations (WUA) so as to reduce negative third-party effects caused by return flows (Donoso, 2006).

Once initiated, markets ideally evolve towards maturity. In a mature market, allocation and productive efficiency of water are maximized (Bjornlund, 2002). Researchers assess market maturity in different ways, such as by the number of transfers or by price dispersion. Frequent transfers and small price dispersions indicate mature markets. However, if water rights are initially allocated to high value uses, few transactions are required for a mature market (Easter et al., 1999). Price dispersions can also be caused by geographical flexibility and reliability of infrastructure of irrigation canals (Hadjigeorgalis, 2004; Donoso et al., 2012), commodity prices (Challen, 2000) and quantities traded (Bjornlund and McKay, 2002), leaving both measures open to improvement.

Since the establishment of the water allocation mechanism based on a market of WR in Chile, a series of empirical and theoretical studies have been carried out to determine: the existence of a WM, the market activity measured through the number of transactions; WM efficiency; bargaining, cooperation, and strategic behaviours of market participants; and marginal gains from trade.

Several authors (Cristi and Trapp, 2003; Quentin et al., 2012) find evidence that markets are more active in those areas where water is a scarce resource with a high economic value. These studies indicate that the market mechanism has, in general, represented an efficient water allocation system. This is the case of the Limarí Valley, where water is scarce with high economic value, especially for the emerging agricultural sector. Inter-sectoral trading has transferred water to growing urban areas in the Elqui Valley and the upper Mapocho watershed, where water companies and real estate developers are continuously buying water and account for 76% of the rights traded (Donoso et al., 2012).

Table 13.5 presents WR transaction data based on data of the Dirección General de Aguas (DGA), for the period 2005–2008. The results for this four-year period show that there were 24,177 transactions of which 92.3% were independent of other property transactions, such as land. The value of transactions independent of other property transactions is US$4.8 billion, which on average is US$1.2 billion per year. The average WR price is US$215,623. WR prices in the north of the country are greater than in the south, which indicates that the market at least in part reflects the relative scarcity of water. WR prices present a high coefficient of variation of 465. However, price dispersion is lower in the more active markets.

A key conclusion of these studies is that WM are driven by demand from relatively high-valued water uses and facilitated by low transactions costs in those valleys where WUAs and infrastructure assist the transfer of water. Market functioning differences are explained by scarcity, the distribution infrastructure and water storage capacity, and the proper functioning of WUAs. More frequent transactions in the 21st century than in 1980s and 1990s indicate a degree of maturity in the public's knowledge concerning the new legislation and possibly a growing demand for water.

Analysing WM in Chile, Jouravlev (2005) concluded that they (i) facilitate the reallocation of water use from lower to higher value users, (ii) mitigate the impact of droughts by allowing for temporal transfers from lower value annual crops to higher valued perennial fruit and other tree crops, and (iii) provide lower cost access to water resources than alternative sources such as desalination.

By analysing the effect of WM, it can be seen that numerous problems have been resolved through their implementation. The use of such an allocation mechanism has allowed users to consider water as an economic good hence internalizing its scarcity value; constitutes an efficient reallocation mechanism which has facilitated the redistribution of rights already granted; has permitted the development of mining in areas in the semi-arid

Table 13.5 **Water rights (WR) transactions and prices for the period 2005-2008.**

	TOTAL TRANSACTIONS of WR	TRANSACTIONS OF WR INDEPENDENT OF OTHER GOODS SUCH AS LAND	WR TRANSACTION VALUES (ONLY WR TRANSACTIONS INDEPENDENT OF OTHER GOODS) (10^6 US$)	AVERAGE WR TRANSACTION PRICE (US$)
I	568	564	20	36,121
II	153	131	216	1,652,519
III	16	15	8	530,933
IV	3,489	3,448	550	159,615
V	3,191	2,839	517	182,029
RM	4,804	4,226	2,312	547,095
VI	2,315	2,010	509	253,367
VII	6,518	6,159	622	101,059
VIII	2,330	2,162	29	13,432
IX	494	487	8	16,805
X	225	223	23	103,390
XI	68	68	0	2,588
XII	6	6	0	20,200
Total	**24,177**	**22,338**	**4,817**	**215,623**

Source: World Bank (2011)

northern region of Chile by buying water rights from agriculture; has resolved problems associated to water deficits derived from a significant increase of water demand caused by the significant population growth in the central region of Chile and additionally has helped to solve water scarcity problems above all in instances when a rapid response has been required (Donoso, 2006; World Bank, 2011).

The problems that WM have not been able to resolve are water use inefficiency in all sectors, not only in the agricultural sector, environmental problems, and the maintenance of ecological water flows. A major challenge of WM in Chile is how to ensure optimal water use without compromising the sustainability of rivers and aquifers. The sustainability of northern rivers and aquifers is at present jeopardized due to the over-allowance of WRs by the DGA. On the other hand, increased consumptive WR market activity has generated increased conflicts with downstream users due the existence of WR-defined over return flows.

Research in Chile on the impact of water markets on small farmers has been limited and no reliable conclusions have been reached to date. Some critics contend that small farmers have not regularized their rights, risking losing them, and in other cases have sold their water rights thus losing their means of subsistence. But Hadjigeorgalis (2008) shows that the WM in the Limarí basin has been successful in moving water and water rights from low- to high-valued uses and that resource-constrained farmers use temporary WM as a safety net. She did not find inequity with respect to offer prices; resource-constrained farmers receive the same offer prices as wealthier ones. The Limarí watershed has the most complex irrigation reservoirs system in the country, which has allowed the spontaneous development of a spot market for water volumes. Although this market has represented an important 'pressure valve' to withstand dry years, it also faces efficiency challenges that need to be addressed (Alevy et al., 2011).

While the institutional replication of the Chilean WM may seem like an option for LAC countries faced with increasing water scarcity and decreasing supply augmentation options, the contextual uniqueness of each WM makes the establishment of universal rules for replication difficult (Shah, 2005).

13.6 Implications for improving water and food security

The implementation of economic instruments provides revenue to finance water services and should provide incentives to agents to act more responsibly. Urban tariffs are the fundamental source of revenue to expand coverage of drinking water and sanitation. It seems that a significant part of the investment costs that are required to meet the water MDGs in the region cannot be funded by the targeted households. And yet, it is clear that implementing adequate tariff structures is essential to make progress and bridge the gaps reported in Chapter 6. Improved sanitation, will not only reduce the prevalence of many water-borne diseases, but also improve the ecological status of numerous important rivers and waterways.

As discussed in this chapter, pollution charges are meant to deter contaminants' discharges and generate revenue to fund monitoring and mitigation actions. The cases of Colombia and Costa Rica show that large and medium-size cities are among the heaviest pollutants. A vicious cycle commonly prevails not only in LAC but in virtually all countries where urban tariffs are below US$1.5 per m^3. Below this level proper urban water treatment and secure drinking water supply in adequate conditions are barely possible. Improving water security indicators has a large cost (aproximately US$100 per person and year, including drinking water supply and sanitation).

Therefore, three aspects converge and have implications for improving water security indicators: (a) a balanced and efficient tariff regime for urban water, accompanied by pro-social provisions; (b) better implementation of pollution charges and the polluter-pays-principle; and (c) payments for ecosystem services and watershed conservation. All three of them complement each other, but it seems that in LAC there is a long way to go in terms of sanitation and urban and industrial wastewater treatment. For the moment, PES are very limited to avert the consequences of urban and industrial growth, and are focused only on areas of high ecological value or headwaters of specific rivers.

Irrigation water prices are essential to increase food production sustainably. Billions of dollars of investment in irrigation have been wasted as a result of insufficient and poor maintenance of infrastructure. Adequate pricing of irrigation water is also essential to ensure that water resources are not wasted or assigned to low-value crops. Investment in irrigation, new and that in need of rehabilitation or technical improvements have been estimated at US$95 billion cumulatively up to 2050 (Schmidhuber et al., 2009), or US$ 7 billion up to 2030 (Faurès, 2007). These represent huge investments that may need proper tariff mechanisms and financial structuring. More stable food production will surely result from it, improving also food security indicators.

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14

LEGAL FRAMEWORK AND ECONOMIC INCENTIVES FOR MANAGING ECOSYSTEM SERVICES

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Highlights

- Payment for Ecosystem Services (PES) are rapidly emerging in LAC as complementary conservation measures to classic command and control policies. The majority of the PES programmes being implemented so far are focused on protecting headwaters in order to ensure the provision of water related services for urban areas. Carbon and biodiversity markets are less developed yet.
- Water-related PES schemes tend to be set up within a well-defined geographical setting, i.e. the watershed, which makes relatively easier to identify service sellers and buyers. Carbon and biodiversity services deliver benefits on much broader scales (often global), making difficult the identification of those service 'buyers' that should pay for supporting ecosystem services.
- The existing PES schemes in LAC have arisen from specific social and political arrangements between public and private actors involved in conservation rather than through legal mechanisms that have fostered these schemes. Legal frameworks explicitly supporting PES or PES like schemes are emerging across many countries, particularly in Peru, Brazil, Colombia and Mexico.
- The great majority of the PES initiatives in LAC have been developed at a local scale. Nevertheless, the development of institutional and legal frameworks related to ecosystem services management occurs on at least two political-geographical scales: national and sub-national (provincial governments and municipalities).
- PES could benefit from a legal framework but it is not a requirement for implementation. However, stable and enforceable contractual law and clear and secure land tenure along with property rights are necessary conditions for successful implementation.

14.1 Introduction

Latin America and the Caribbean (LAC) region has an outstanding natural capital and contributes to the provision of multiple ecosystem services (ES) at a wide range of scales. ES are here understood as 'all those benefits, material and in-material provided by nature, which contribute to human wellbeing' (adapted from MA, 2005). They include productive services like food, drinking water, fibre or minerals, but also all those other benefits derived from the well functioning of ecological processes (e.g. clean water, climate regulation, soil formation) and biodiversity conservation (e.g. eco-tourism, pollination, natural medicines).

The importance of LAC's natural capital is evidenced by the fact that this region holds approximately 70% of the world's vertebrates biodiversity (IUCN, 2013), 40% of the global aboveground carbon stocks (FAO, 2010a), 30% of total blue freshwater resources (FAO, 2013) and 13% of world heritage sites (UNESCO, 2013). Yet, the fast pace of development taking place in the region is generating a large pressure on LAC's natural capital, causing important environmental impacts and the loss of multiple ES, particularly regulating services (see Chapter 3). Two important factors explain current pressure on LAC's natural capital: 1) the prevailing economic model, which is natural resource use-intense and highly coupled yet; and 2) the large and often poorly urbanization process, which has large impacts on freshwater ecosystems and constitutes the most important driver of point water pollution. High commodity prices have stimulated the rapid growth of the primary sector in LAC (mostly of agriculture and mining), generating large negative environmental externalities (e.g. deforestation, diffuse pollution, soils degradation, etc.) and low interest in internalizing these costs to remain competitive, i.e. maintain its comparative advantage and support the prevailing *cheap* food policies. Similarly, urban growth encompasses a growing water demand to meet citizens needs, i.e. infrastructure development and water transfers, and yet investments in wastewater treatment plants are scarce, exacerbating the water pollution problem.

During the last decade different initiatives are emerging to incentivize the conservation and sound management of critical ES. Among all the different initiatives, economic incentives and payment for ecosystem services (PES) schemes are emerging as complementary strategies to traditional command and control environmental regulations, in an attempt to internalize the cost of non-market ES and deter its progressive degradation. Such schemes are also surfacing in those cases where no regulatory framework exists for managing natural resources but interest in preserving ES is significant (e.g. ensuring water quality to downstream urban citizens).

LAC is currently a leading region in the implementation of PES – particularly of water-related programmes – (Martín Ortega et al., 2012; Bennet et al., 2013), although the effectiveness of these programmes remains so far unclear, due to a variety of problems, including absence of baseline conditions, lack of clearly defined land tenure and property rights, and the financial un-sustainability, in many ongoing initiatives. Given the development path this region still has ahead, this chapter aims to review the success of ongoing PES schemes in LAC, as well as their institutional setting, to assess whether these instruments are useful and can foster a more green growth in this region and what would be the challenges ahead. Accordingly, Section 2 provides a fresh and up-to-date outlook on existing PES programs across LAC; Section 3 summarizes the legal and institutional setting in place for managing ES in the region; and lastly, section 4 analyses what are the main challenges and threats of PES schemes.

14.2 Economic incentives for managing water and land sustainably: payment for ecosystem services

As discussed in Chapter 13, economic mechanisms and incentives like PES, that pursue the integration of positive environmental externalities are increasingly being proposed as a promising approach for conserving ecosystem services. Mechanism such as PES are not intended to replace traditional command and control measures but to complement them by making them more acceptable (FAO, 2010b). In fact, PES incentives can support existing regulations, reducing the expected gain from non-compliance and even define opportunity costs for PES schemes (*ibid*). Also, when command and control regulations do not exist or are ineffective, PES might provide room for inclusive solutions that involve different stakeholders, as long as a stable contractual legal environment is in place (Grieg-Gran et al., 2006).

Yet, there is no overall agreement in the literature on what are PES schemes and what are not. Wunder (2007) has defined a set of criteria a PES scheme should fulfil to be distinguished from other incentive types: (1) a voluntary transaction in which (2) a well-defined environmental service (or land likely to in which a well-defined environmental service (or a land use likely to secure that service) (3) is 'bought' by a (minimum of one) buyer (4) from a (minimum of one) provider (5) if and only if the provider continuously secures the provision of the service (conditionality). Lately, however, there has been much debate over definitions when applied in practice, since many so-called PES schemes do not fulfil all the criteria set above. Other definitions providing a more encompassing approach to PES have been provided by Sommerville et al. (2009), who considers PES as an umbrella term where different schemes can be classified to '(1) transfer positive incentives to environmental service providers that are (2) conditional on the provision of the service, where successful implementation is based on a consideration of (1) additionality and (2) varying institutional contexts'. Muradian et al. (2010) propose a different conceptual framework, in which PES should not be limited to market transactions, but regarded as 'a transfer of resources (monetary or not) between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources'. Such a framework would help PES schemes to not be rejected in a number of communities e.g. the indigenous Andean communities, which are highly sceptical on the monetarization of nature and ES, due to its public and collective prevailing nature (Wunder, 2006; FAO, 2010b).

Since there is yet not a clear consensus on what PES encompass, we have chosen to adopt a broad definition and generally refer to PES as 'any transaction, voluntary or regulated where there is a payment or exchange of credits (not necessarily monetary) between a buyer and seller that promotes some improvement of an ecosystem service' (adapted from Stanton et al., 2010). This implies that agreements such as 'reciprocal agreements', 'benefit sharing mechanisms', 'mitigation obligations' or 'offsets' are here included under the umbrella of PES or PES-like incentives.

LAC is today one of the frontrunners in the implementation of PES worldwide (Martin-Ortega et al., 2012). The reasons are diverse but probably influenced, among other factors, by the large number of ongoing environmental problems, the importance of its vast natural capital and perhaps also the cultural values of LAC society towards nature. PES schemes in LAC took-off in the 1990s with Costa Rica taking the lead thanks to the development of the national PES programme *Pago por Servicios Ambientales* in 1997. Ongoing PES programmes in LAC can be classified into four main categories: water, biodiversity, carbon and marine programmes. Table 14.1 summarizes the main characteristics of ongoing water, carbon and biodiversity PES schemes. The countries supporting the largest and most diverse number of active PES programmes are Brazil, Mexico and Costa Rica. Ecuador is the country holding the largest number of active water-related PES. Among the different schemes, water-related PES are still the most popular initiatives (see Box 14.1) followed by carbon programmes. Biodiversity markets have not yet proved as popular in LAC. The underlying reasons for the success of water-related PES schemes could be partly attributed to the fact that these ecosystem services deliver their benefits within well-defined geographical settings (basin or a watershed), making it easier to identify service providers and beneficiaries, and facilitating the negotiation process. Conversely, actors engaged in carbon and biodiversity initiatives are harder to identify, since the benefits normally exceed the limits of a well-defined spatial unit (basin, country, continent), further complicating the negotiations and identification of services beneficiaries (and thus, buyers).

Table 14.1 Overview of PES and PES-like initiatives found across Latin America and the Caribbean

TARGET ES	PAYMENT/MARKET TYPE	FREQUENCY	NUMBER OF ACTIVE PROGRAMMES BY COUNTRY	
WATER	Bilateral agreements (voluntary)	++	Bolivia Brazil Colombia Costa Rica Ecuador Mexico Peru	(5) (4) (3) (2) (10) (3) (1)
	Beneficiaries-paid fund (~ trust funds)	+++		
	Water quality trading & offsets (regulatory)	+		
BIODIVERSITY	Cap and trade (mitigation & compensation)	+++	Argentina Brazil Colombia Costa Rica Mexico Paraguay	(1) (2) (1) (1) (1) (2)
	Voluntary provisioning	+		
	Government-mediated payments (buyers of land to preserve an area)	+		
CARBON	Forestry based projects (REDD, afforestation, reforestation)	+++	Brazil Costa Rica Ecuador Peru Panama Mexico Nicaragua	*
	Renewable energy investments (wind, landfill, biomass)	++		
	Investments in energy efficiency and fuel switch	++		

Source: own elaboration based on Bennett et al. (2013); Madsen et al. (2010) and Peters-Stanley and Hamilton (2012).

* No information was found on the number of carbon related programmes, rather on the amount of offset per country. In 2011 countries who achieved emission reductions through voluntary markets were: Brazil (>5 $MtCO_2e$/year) and to a lesser extent Peru, Ecuador, Panama, Nicaragua and Mexico (< 0.5 $MtCO_2e$/year).

Box 14.1 Watershed payment for ecosystem services in Latin America

Since the early 1990s various water-related PES schemes have been developed in Latin America (LA) to achieve win–win solutions that allow both finance conservation as well as stakeholder engagement at different levels. However, only a few of these PES schemes have so far been successful. Most have not managed to consolidate a common structure, with a lack a clear policy and institutional framework. Thus there are notable threats to this type of initiative, which prevent them from being successful.

Water-related PES programmes can be classified into: payments for watershed services (PWS), water quality trading (WQT) markets, and reciprocal or in-kind agreements (Stanton et al., 2010). Globally, between 2000 and 2008 the number of water related PES programmes had grown 500%, from fifty-one to almost 288[1] (Bennett et al., 2013). Among these 288 initiatives, the majority were PWS (75%) and the remaining (25%) were WQT. By 2011 the number of programmes had slightly dropped to 205. Some 60% of these programmes (128) are being developed in China and the US, whereas LA accounts for twenty-three active initiatives, the majority of which located in the Andean countries (Figure 14.1). Between 2008 and 2011 the number of water-related PES in LA declined (-22%). This variation, however, could be due to different factors like changes in the methodology used to record water-related PES schemes since 2008.

Figure 14.1 Watershed PES trends in the Latin America region. *Source: based on Stanton et al. (2010) and Bennett et al. (2013)*

Despite the negative overall trends, Peru, Bolivia, Brazil or Ecuador show an increase in water PES schemes. According to Bennett et al (2013), water PES in LAC are expected to grow in the years to come due to new water funds being created and increased funding for national programmes (e.g. in Mexico and Ecuador).

1 The information available is very heterogeneous in quality and quantity which makes it difficult to establish trends on the current state of PES initiatives.

Regarding the nature of the PES schemes, voluntary programmes prevail in LAC, particularly among water and carbon initiatives, while biodiversity markets are for the most part regulatory based (cap and trade schemes). Examples of voluntary agreements of water-related PES schemes include the bilateral agreements where service buyers, e.g. drinking water companies and hydroelectric generators (public or private), pay upstream service sellers, e.g. landowners, within a watershed to improve their land use management practices to ensure service provision downstream i.e. sufficient water and/ or of good quality (Table 14.2). Besides the monetary exchanges, in-kind payments, e.g. provision of agro-inputs, technical training or land tenure security are also frequent types of transactions. Monetary payments are frequently determined in two ways: either through the opportunity cost or by the estimation of willingness to pay. In some cases the price per hectare paid to landowners is estimated as an anti-poverty subsidy in order to provide a 'fair' income to poor communities.

Table 14.2 Main characteristics of water-related payments for ecosystem services programmes

WATER PES TYPES	PAYMENT MECHANISM	ACTIVITIES FUNDED	TRANSACTION TYPES	ACTORS INVOLVED
PUBLIC (GOVERNMENT)	Direct Subsidies Land Purchase Transfer of development rights	Improving land management activities (Best Agricultural Practices; Ecological restoration) Forest Management Practices (Afforestation/ Reforestation) Protection measures aiming at promoting economic activities alternative to those driving land degradation and deforestation.	Monetary or in-kind payments (Agro-inputs, technical training, or tenure security)	**Buyers/Funders:** Governments, NGOs, private companies **Sellers/Beneficiaries:** Land owners, informal stewards, government nature reserves, NGOs with title and management responsibility of protected areas **Administrators:** those establishing the specifics of the transaction and facilitating any negotiation between the buyers and sellers **Intermediaries:** facilitators of the transaction or implementation of the project **Funders:** Governments and donors (multilateral banks, NGOs, private interests) financing part of the project in addition to the buyers
PRIVATE (COMPANIES, NGOS)	Subsidies from private sources rights Fees for watershed protection			

Source: own elaboration based on Stanton et al. (2010)

Other voluntary water-related PES schemes rapidly emerging in LAC are the 'water trust funds'. Such water funds are normally created by different public and private partners, including agent donors, who create a long-term financial mechanism or a trust fund as defined by local financial regulations. The returns of this fund and sometimes some portion of the principal investment are directed towards watershed actions e.g. restoring degraded lands, adopting sustainable farming practices, reforestation and educating children about sustainable water management (Bennett et al., 2013). This fund is managed by a stakeholder board also called 'administrators' who are different from the service buyers; they make joint decisions about best investments across the watershed. These types of water funds are currently the dominant form of active watershed PES schemes in LAC. In fact, a new public–private initiative, the so-called 'Latin American Water Funds Partnership', a joint initiative supported by the Nature Conservancy, the FEMSA Foundation, the Inter-American Development Bank (IDB) and the Global Environment Facility (GEF) has committed $27 million to develop and spread water funds across LAC. The Partnership plans to support at least thirty-two funds in total, protecting more than 2.8 million hectares in the coming years.

Regarding carbon payments, they can be either regulated or voluntary. Regulated markets, specifically designed for developed countries or Annex I parties of the United Nations Framework Convention on Climate Change (UNFCCC), are bound to certain emission reduction targets. Options to meet this commitment include different mechanisms where the project-based Clean Development Mechanism (CDM) is among the most common. The project-based CDM refers mostly to projects funded by developed countries or companies which contribute to reducing emissions in developing countries and make progress towards sustainable development. In doing so, developed countries offset part of their emissions and at the same time promote low carbon economies in developing countries. Renewable energy projects (e.g. wind, biomass, and landfill) and forestry projects (afforestation and reforestation) are the most common initiatives currently active in LAC. Since LAC countries are non-Annex I, they are not bound to any emission reduction commitment and therefore carbon market initiatives are all voluntary. Voluntary markets include emission reduction projects like REDD (Reduced Emissions from Deforestation and Forest Degradation), a source of funds still under negotiation from which LAC countries could benefit by receiving compensation payments for maintaining forests and preventing deforestation. The designers of REDD hope to deliver additional sustainable development benefits beyond simple carbon sequestration, creating a triple 'win' for climate change mitigation, biodiversity conservation, and poverty alleviation (Johns, 2012). However, UNFCCC negotiations on REDD are ongoing and significant aspects of the final design remain unresolved (see Box 3.2, Chapter 3).

Payments specifically designed for biodiversity conservation are very limited in LAC. Biodiversity markets are normally established with the purpose of creating a payment that can help to protect or restore habitats and species. Principally there are three types: regulatory compliance, government-mediated payments, and voluntary provisioning. The prevalence of the regulatory type in LAC is probably related to the fact that biodiversity markets are not yet well developed. Such regulatory transactions occur in countries like Brazil or Paraguay, where companies and developers are enforced by the national law or by the constitution to mitigate and compensate the environmental impacts of their activities. For instance, the Brazilian Forestry Code (Codigo Florestal, enacted 1965) stipulated that landowners must keep a certain percentage of natural vegetation on their land. In those cases where deforestation and vegetation clearance will exceed the legal quota, compliance with the law can still partly be met through off-site conservation, e.g. compensating other landowners within the same watershed to retain more than the minimum percentage of native vegetation cover. These Forest Code offsets have the potential to evolve into a formal bank, which is still under discussion at the state level. However, their success requires strict law enforcement to avoid uneven ecological compensations (e.g. destruction of a high-quality habitat by purchasing a low quality one). Some voluntary biodiversity markets also exist in LAC. For instance, government-mediated payments have, for a long time, been the most frequent mechanism to achieve conservation goals. Such types of payment involve governments and in some cases non-profit organizations purchasing land or creating payment programmes for biodiversity stewardship in those cases where there is public demand for biodiversity goods and services. Other voluntary markets include the Conservation Trust created in Paraguay where project developers can pay into a fund to compensate for damages as required by the Paraguayan Constitution. Emerging voluntary biodiversity PES schemes will include land markets for habitats of high biodiversity value, payments for biodiversity management, payments for private access to view a species or see its habitat, tradable rights and credits and biodiversity-conserving businesses (Bishop et al., 2008).

Overall, it is important to highlight that, while many of the PES schemes are focused on a single service, the number of programmes aimed at protecting or simultaneously restoring multiple ecosystem services is growing. These combined programmes are known as either 'bundle' or 'stacked' payments (Cooley and Olander, 2011). A bundle payment is a unique payment for the conservation or restoration of an area that simultaneously delivers multiple services (e.g. payments executed through the Costa Rica PES programme *Programa de Servicios Ambientales-PSA*). In this case, landowners receive a single payment for preserving or restoring the forest with the intention of ensuring the provision of multiple services such as carbon sequestration, biodiversity conservation, maintenance of the landscape aesthetic and the provision of hydrological services. Stacked PES programmes are separate payments sold by a landowner to different buyers with the intention of securing different services within the same area.

14.3 Enabling conditions for implementing incentives supporting ecosystem services

14.3.1 Constitutional recognition and existing laws on ES and PES

The social, economic and biophysical aspects of ecosystem services have received considerable attention in the past. However, little analysis exists on the legal and institutional setting and to what extent such frameworks support or hamper the flow of ecosystem services. In LAC, most constitutions recognize the right of people to enjoy a good quality environment and the duty of the state to preserve it, although in practice this has very different conceptualizations. This recognition is due to two factors: first, to an increase in the standard of living conditions; and second, to the growing importance of post-material and ecological values in society, spurred by international summits such as Stockholm (1972), Rio (1992), Rio +10 (2002) and Rio +20 (2012). This environmental awareness links with deep, entrenched autochthonous concepts such as 'good living' (*buen vivir*). Globally, over 177 countries explicitly recognize a 'right to a clean environment' (Boyd, 2012), fifteen of which belong to LAC (see Figure 14.2). LAC as a region in fact leads both in the recognition of a right to a clean environment, guaranteeing the environment as an individual's right, and also recognizing nature in terms of rights, as is the case of Ecuador (Murcia, 2011). Yet the main criticism associated with environmental rights in LAC, and elsewhere, is the weaknesses of mechanisms that could enforce this protection, since these rights are not always fundamental rights (Olivares, 2010).

ES are not explicitly considered in any of the LAC constitutions except for Ecuador, which acknowledges in article 74 of its political constitution that '*ecosystem services will not be subject to appropriation; their production provision, use and exploitation shall be regulated by the state*'. The inclusion of ES conservation in the constitutions has a great potential to give legal standing to the value of nature and/or ecosystem services, thus creating an acquiescent regulatory frame for developing pro-conservation mechanisms. However, reality shows that explicitly recognizing ES can sometimes limit environmental conservation. In Ecuador, ownership and exploitation of ES is attributed to the government, which instead of supporting local PES schemes is working towards obtaining international financing for ES maintenance, which may undermine the establishment of locally funded PES schemes (Southgate and Wunder, 2009). The non-explicit consideration of ES in political constitutions might not pose a problem as long as it does not prevent the development of initiatives aimed at preserving and maintaining them (Greiber, 2009). As previously mentioned, PES schemes operate effectively when property rights and land tenure are defined and it is easy to sign PES contractual agreements by the different stakeholders (FAO, 2010b).

From this constitutional acknowledgement, different legal frameworks have been developed to protect LAC's natural capital, e.g. biodiversity, carbon, forests, water and protected areas (see Table 14.3). Yet, no country in LAC has passed a national law on the general regulation of ES nor on PES, although Brazil, Peru, Mexico and Colombia are pending approval of such legislation. Regional and sub-national regulations on PES have been yet established in Brazil and Mexico. As Table 14.3 shows, in most countries, ES management falls under the umbrella of a wide range of environmental laws, predominantly those of forestry and water resources. Within these different environmental laws, arrangements have been set up regarding specific regional PES programmes. For instance, in Costa Rica under the Forestry law 7575 the managing body of the national PES programme, FONAFIFO, was established; and in Mexico legal frameworks and government funding channels were set up from the outset of their respective PES programmes (PSAH and PSA-CABSA) (Hall, 2008).

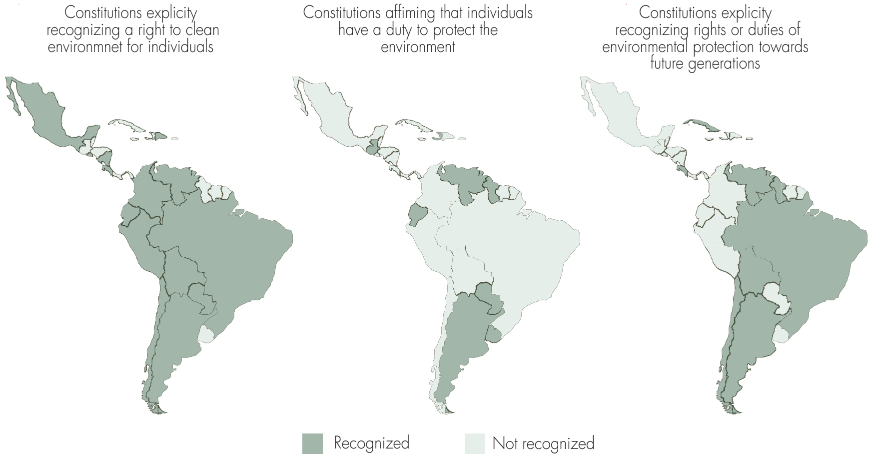

Figure 14.2 Constitutional recognition of the right to a clean environment in LA. *Source: own elaboration based on NCJM (2011) and RBA (2013)*

Most legal frameworks that refer to ES and PES foresee the creation of valuation instruments of natural resources according to their social and economic contribution and the ES these provide. Whether all these regulatory frameworks are effective or not in managing and preserving ES is hard to assess since, in many cases, no baseline exists to compare and analyse progress (See Table 14.4). Thus a more detailed assessment is needed, as well as determining to what extent such measures balance out other policies that hinder the sustainable management of ES.

Legislation at all levels – from local to national – can play an important role in the promotion and implementation of PES and PES-like schemes. Particularly, legislation is required for those PES programmes set out at a national level or those that have international financing in order to be implemented, such is the case of REDD+ programmes and cap-and-trade (Greiber, 2009). Given the limited amount of national PES programmes and associated legislation, in terms of numbers, the majority of PES schemes are local. However, this represents a good starting point since legislation improvements could benefit from practical experience, with local projects informing regional and national legislation which, in turn, provides greater legal certainty and a framework that enables, rather than restricts, regional and local initiatives.

Additionally where PES schemes are regulated, attention must be paid to its integration in the existing legal and institutional frameworks. In the case of public PES it is important not to make the process overly bureaucratic. In the case of private PES, these would benefit from specific legal frameworks that go beyond basic contract law. However, for both private or public PES schemes to be up-scaled, a robust legal framework is required to ensure both formal coherence and effectiveness.

Table 14.3 Legal frameworks supporting ecosystem services directly or indirectly

		COSTA RICA	PERU	BRAZIL	COLOMBIA	MEXICO	ARGENTINA
Laws directly supporting PES	SUB-NATIONAL			Espírito Santo: LN 9.864 PES Law Amazonas: 'Law On Climatic Change, Environmental Conservation And Sustainable Development' (Bolsa Floresta)**		Sustainable Development Of Forests Law, Morelos State** Sustainable Development Of Forests Law, Baja California State**	
	NATIONAL	Pending	N° 2386/2007-cr Ecosystem Services Law (Drafted,2009) Pending	Payment For Ecosystem Services Law (Pending) Law 5.487/09,	Draft National PES Strategy (pending)	National Development Plan 2013 – 2018*	
Laws indirectly supporting ES and/or PES	ENVIRON-MENT	General Environment Law 755 Law On Soil Use, Management & Conservation 7779	General Environment Law, 28611. Law On Sustainable Use Of Natural Resources, 26821. Supreme Decree 012-2009MINAM, National environmental policy.	LN 6938 National Environmental Policy.	Renewable Natural Resources And Environmental Protection Code General Environmental Law 99 Climate Change Convention, Law 164/94	General Law Of Ecological Equilibrium And Environmental Protection Climate Change General Law	General Environmental Law25.675
	BIODIVERSITY	Biodiversity Law 7788 Conservation Of Wild Life Law 7317	Conservation And Sustainable Use Of Biological Biodiversity Law 26839.		Law Decree 216 de2003 which determines the objectives, structure of Ministry of Environment, Housing and Land Development.	General Law On Wildlife	Protection And Conservation Of Wild Fauna Law 1981
	WATER	Water Law 276	Law On Water Resources No. 29338 Law Decree On Water 17752	Water Law LN 9433	Water Law 99/93	Federal law on Rights(art223)(National Programme for Hydrological Environmental Services (PSAH))** National Water Law	Federal Agreement On Water 2003
	PROTECTED AREAS	Services Of Natural Parks 6084	Natural Protected Areas Act 26834	National Protected Areas System Law (9985/00)	Decrees 1865/94 and 708/2001 establish the development of regional policies of environmental management		
	FOREST	Forestry Law 7575** (FONOFIFO)	Forestry And Wild Fauna Act 27308	Brazilian Forest Code LN4.771 Management Of Public Forests, Implementation Of Brazilian Forest Service, (Regional)	Decree 900/97 Regulates Forestry Incentive Certificate	Development Law Sustainable Forestry The Sustainable Rural Development Act Presidential Decree 4thApril2001 creating National Forest Commission (CONAFOR)**	Forest Act No 13.273
	OTHERS	Public Services Regulating Authority Act 7593 Income Tax Act No.7092		Substituto De Proyecto De Ley 792,1.190, 1.667, 1.920, 1.999 Y 2.364 (Programa Bolsa Floresta). **	National Development Plan Laws: 152/94 & 1151/2007* Tax Legislation: Law 223/95, Decree 1996/1999, Law788/2002, Decree 3172/2003	Agreement establishing the Rules of Operation for the granting of payments for the Programme to develop ES markets for carbon sequestration and those derived from biodiversity and to stimulate the establishment and improvement of agroforestry systems (PSA-CABSA)**	

Source: own elaboration

*No direct mention/regulation of PES as such but recognizes ES and the need for their conservation and preservation thus creating the enabling conditions.

** Legislation creates organisms and/or financial mechanisms for specific national PES programmes (programme name and/or organization set up).

Table 14.4 Summary of the advantages and disadvantages of having legal regulation for ecosystem services payment schemes

ADVANTAGES	DISADVANTAGES
PES become *legitimate* policy instruments creating ***legal certainty*** which enhances PES effectiveness	Possible further fragmenting of environmental legislation
Scope of PES instruments clarified	May conflict with other legal frameworks
Can streamline the process of setting out a PES programme by decreasing bureaucracy and tax incentives	May hamper implementation through increased bureaucracy and discrimination of eligibility for other financial subsidies especially for smaller PES
Only way of creating and implementing a ***national*** PES scheme	

Source: Greiber (2009) and FAO (2010b)

14.3.2 Land tenure and property rights in LAC

For any PES scheme, secure land tenure and clearly defined property rights are crucial for their effective implementation (Dent and Kauffman, 2005; FAO, 2010b; Contreras-Hermosilla, 2011; Larson and Petkova, 2011; Montagnini and Finney, 2011). One of the key aspects of a PES scheme is to establish a transaction whereby the service seller contracts an obligation to either stop, maintain or undertake specific land use activities and in some cases even gain rights to trade the service such as in the case of carbon sequestration credits (Muradian et al., 2010). Thus the PES contractual agreement always requires that the tenure rights of all actors are clearly defined and recognized.

Land tenure as defined by the FAO (2002) is the 'relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land'. (For convenience, 'land' is used here to include other natural resources such as water and trees). Land tenure is an institution, i.e., rules invented by societies to regulate behaviour. Rules of tenure define how property rights to land are to be allocated within societies. They define how access is granted to rights to use, control, and transfer land, as well as associated responsibilities and restraints. In simple terms, land tenure systems determine who can use what resources for how long, and under what conditions.' Property rights on the other hand, define how the land (and all natural resources present on that territory) or property can be used, controlled and transferred.[1]

1 FAO's simplified representation of property rights includes:
– use rights: rights to use the land for grazing, growing subsistence crops, gathering minor forestry products, etc.
– control rights: rights to make decisions how the land should be used including deciding what crops should be planted, and to benefit financially from the sale of crops, etc.
– transfer rights: right to sell or mortgage the land, to convey the land to others through intra-community reallocations, to transmit the land to heirs through inheritance, and to reallocate use and control rights.

The current situation of land tenure and land rights recognition in LAC is very heterogeneous given the extension of the region; however, there are some characteristic trends that are common for the majority of countries. Land and tenure security are still incomplete, even though most countries have established property registries with cadastres,[2] in many countries less than 50% of their national territory is covered by the cadastre (Figure 14.3). It is important to note that there are very different idiosyncrasies between continental Latin American countries and the Caribbean islands regarding land tenure. The Caribbean is characterized by the prevalence of state-owned land, which is not legitimized by its citizens, who follow alternative collective forms of land tenure. While in continental Latin America land tenure institutions are more entrenched, both formally and customarily, tenure security is still not achieved as less than half of farmers have solid title deeds over their lands (ECLAC, FAO, IICA, 2012). All over LAC several programmes of land titling are under way, which would provide a more secure environment for the widespread implementation of PES programmes. However, past experience has shown that titling programmes may bring increased disputes. Therefore there is a need to differentiate between the problems of access and distribution of land among farmers, as well as the territorial claims of indigenous populations (ECLAC, FAO, IICA, 2012; Van Dam, 2011).

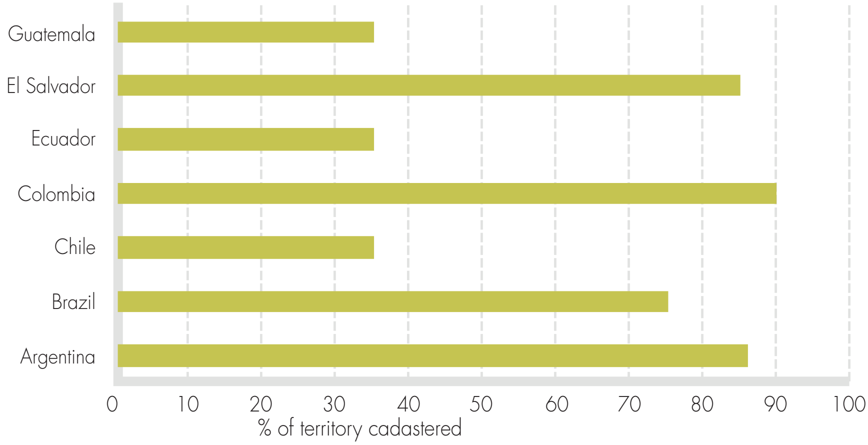

Figure 14.3 The percentage of national territory covered by cadastre survey. *Source: own elaboration based on data of CPCI (2011).*

To sum up, the lack of clearly defined land tenure systems and unsecure property rights undermines the possibility of effectively spreading the implementation of PES programmes across LAC regions for several reasons. First, identifying the legitimate users is complex:

2 FAO (2002) defines a parcel-based land information system that includes a geometric description of land parcels, usually represented on a cadastral map. In some jurisdictions it is considered separate from, but linked to, the register of land rights and holders of those rights (land register), while in other jurisdictions the cadastre and land register are fully integrated.

in many LAC countries ES and natural resources are publicly owned and managed by the state, thus a contract cannot be signed unless the state enables the de facto users and communities to use and benefit from PES schemes. In cases of private ownership the de facto users of land are sometimes not legally recognized as either owners or tenants, and thus payments cannot be made to them since they cannot contract such obligations. In other cases de jure users are not capable or willing to allow usufruct users to sign contractual agreements. Unsettled disputes of land claims also impede the effective implementation of PES schemes. Furthermore, there have been cases, such as Costa Rica, where users that had benefited from land reform or other governmental subsidies were not eligible for PES programmes and the other way around, once a user became part of PES programmes they were then excluded from receiving other financial support (Grieg-Gran et al., 2005).

Second, users that do not have secure land tenure[3] have no incentive to participate in PES schemes, or implement more sustainable land practices because they do not have any guarantee of obtaining the long-term benefits. Third, PES needs to be perceived as fair for the effective implementation of the programme. In order to achieve this, allocations need to be carried out carefully to not provide benefits to the large estate owners (*latifundios*) rather than those most in need. Such distribution would add an element of income redistribution and social equity to PES.

14.3.3 Institutional arrangements

There is no blueprint for an ideal institutional set up. Instead, institutions should be adjusted to national and local circumstances, in particular the prevailing governing structure. Overall the basic requirements for a PES scheme among private users, as stated in FAO (2010b), are:

- the absence of any legal provision that outlaws PES schemes
- basic contractual law: '*pacta sund servanda*' (contracts need to be fulfilled)
- civil law to enforce contract rights in case of non-compliance.

Public PES schemes require more regulation, since a public entity needs to be created or enabled in order to implement the scheme. However, public institutions at all levels fulfil important PES-related functions. Local institutions connect PES to the reality on the ground, regional institutions help to overcome administrative boundaries and national institutions can introduce PES visions and coordinate related policies. Private institutions may complement public institutions in the development and implementation of PES schemes. They can bring more flexibility and independence, which are important external capacities, as well as additional financial resources.

3 FAO (2002) defines tenure security as: the certainty that a person's rights to land will be protected. People with insecure tenure face the risk that their rights to land will be threatened by competing claims, and even lost as a result of eviction. The attributes of security of tenure may change from context to context: investments that require a long time before benefits are realized require secure tenure for a commensurately long time.

An appropriate institutional framework for PES needs to consider three financial dimensions: increasing available funds through specialized fundraising and fund-managing institutions; limiting institutional transaction costs; and providing sufficient financial means to ensure institutional performance.

As far as the management and administration of PES schemes are concerned, national institutions should perform only those activities which cannot be performed effectively at a more immediate or local level. Trust is fundamental to the long-term success and sustainability of PES programmes. Good governance – in particular public participation, transparency and access to information, as well as accountability and the rule of law – helps to build trust and is therefore key in the context of managing ES correctly.

14.4 Challenges and threats in PES implementation for LAC

Some key challenges regarding PES initiatives in LAC have been identified, particularly those related to water. These are four key challenges that can help explain why a large number of the initiatives, despite their potential, have had a low level of implementation.

First, *low stakeholder engagement and high dependence on foreign capital*. PES schemes are multi-stakeholder initiatives. One of the key added value is that PES are powerful tools for raising awareness and actively involving important stakeholders from different sectors of society (public sector, private sector, civil society). To ensure the uninterrupted provision of ecosystem services, funding conservation should be based on co-responsibility linked to risk management through the identification of specific threats and vulnerabilities. Most existing PES schemes in LAC are promoted by international institutions, using in many cases imported models that include foreign funding, which should in theory work as seed funding. However, this seed funding may finally create a dependency for local stakeholders and make the initiative unsustainable over time. If the institutional structure is weak and there is high dependency on external resources, financial sustainability could become uncertain. One of the conclusions of the latest Ecosystem Market Place report (Bennet et al., 2013) is the limited participation of the private sector in PES initiatives. Most initiatives so far have been promoted by NGOs or public sector entities, which may indicate the limited knowledge the private sector has about environmental risks.

Second, *lack of stability and clarity in the institutional and legal framework*. The prevailing sectorial approach to manage natural resources, the existence of weak public institutions and the unconsolidated regulatory framework, are some of the major constraints for a PES initiative to be effectively and efficiently integrated into water management in the region. In relation to the legislative framework: first, the lack of stability in the legislative, regulatory and institutional contexts make PES initiatives highly vulnerable due to their long implementation timelines (more than four to five years). Second, it is necessary to fulfil two basic conditions for the creation of a sustainable market scheme: a) define land property rights and b) establish trust between the supplier and the buyer of the environmental service (the role of the intermediary). The lack of viable and sustainable land titling programmes is a problem which affects particularly native communities, attempting to respect their traditional rights over land. Third, the use of public funds in PES schemes is essential for the active involvement of the public sector. However, these have to be accompanied by means to charge fees, and use and manage public funds, facilitating involvement in PES schemes.

Third, *lack of government coordination of isolated, small and disjointed initiatives*. A large number of local initiatives started a few years ago and the few schemes that are still active demonstrate a lack of coordination between initiatives. Government involvement as a regulator and coordinator could facilitate this process, particularly given the widespread lack of regulatory frameworks for PES scheme implementation. At present there is some evidence of significant progress in the implementation of regulatory frameworks and national programmes, which allows for the coordination of existing isolated initiatives. This is the case in Peru where a bill-regulating environmental services is being discussed. The case of Colombia that has recently approved methodological guidelines for watershed payments,[4] through which the government can create incentives to promote the investment in ecosystem services. Article 111 of the Colombian national environmental law (law 0953, published May 2013) establishes legal and institutional frameworks for purchasing strategic areas for water supplies. This purchase requires a minimum investment of 1% of municipal budgets in Colombia in order to establish hydrological PES.

Fourth, *vision of PES from a local, social and cultural perspective in the LAC region*. The PES approach raises a wide number of questions on the risks and opportunities posed by these schemes due to the ideological opposition to commoditizing nature or economic valuation of ES. The multiple values of water frameworks not only include the value of water for production, but also include water as a fundamental human right, water as the provider of ecological sustainability for the environment and biodiversity, water as the source of cultural sustenance of people and as a natural provider of social relations. This concept goes against the conceptualization of water as a tradable product involved in a market scheme, where ecosystem services can be bought and sold. In the Latin American region, particularly Bolivia and Ecuador, indigenous communities have been opposed to PES schemes based on the ancient Andean worldview of the relationship between people, earth and water. This situation has forced several ventures to change their names from 'payments' to 'compensation', so as to transform the relationships from a purely economic transaction. Landowners can receive cash, as well as in-kind payments, which can include income-generating activities as well as education and health benefits to communities.

To conclude, PES and PES-like mechanisms are only some of the possible solutions to the dichotomy of, on the one hand, increased production and consumption, and, on

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the other, the conservation and preservation of natural resources. Nevertheless, they are interesting instruments, combining environmental conservation and economic development, which is especially important for rural communities. The extent to which PES programmes can be financially sustainable in the long term and whether good practices and behaviour promoted by PES can become entrenched and adopted even after the programme has finished remains still unclear. One thing is for sure, any strategy aiming at preventing the degradation of LAC's natural capital, will require instruments (being PES just one among many other options) which can provide development alternatives for those who steward ecosystem services. And this will require as well the compromise of the international community since LAC's capital delivers benefits far beyond it borders.

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15

RETHINKING INTEGRATED WATER RESOURCES MANAGEMENT: TOWARDS WATER AND FOOD SECURITY THROUGH ADAPTIVE MANAGEMENT

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Highlights

- Integrated Water Resources Management increasingly means looking at the anthropo-hydrogeological cycle, thus considering a range of conventional and non-conventional resources which are part of water resources management, such as conjunctive use, the potential of rainwater harvesting, water reuse and virtual water trade.
- Virtual water is an important component of integrated strategies in redistributing water resources. On the whole, in terms of agricultural products, the Latin America and Caribbean (LAC) region was a net exporter of green virtual water (141.5km^3/yr) especially from Argentina and Brazil, and a net importer of blue virtual water (16.1km^3/yr) especially Mexico, during the period 1996–2005.
- There are many opportunities for LAC to achieve more sustainable, equitable, and efficient use of their resources thus facilitating a transition towards a green economy, already present in numerous successful cases. Although many challenges still need to be faced; in many cases economic growth in LAC has been achieved through intensive use of natural resources like land and water – coupled with an increase in the levels of pollution and the loss of ecosystems and biodiversity. Collectively, these represent a serious challenge to water-security.
- In the LAC countries water governance occurs at very different levels – from the international political sphere down to the irrigation district level. Despite the progress made during the past decade, coordination of all these levels, i.e. achieving integrated water resources management, and strengthening stakeholders' involvement are fundamental to ensuring the legitimacy of the process and thus achieving clearly stated policy goals.
- The LAC region is in active pursuit of water security through IWRM with a clear focus on social equity and environmental quality and the way forward is clear, with a well-defined pathway. However, it will require institutional communication, political will and a strong dose of civil-society engagement in the planning process; the building blocks required for a resilient, robust future.

15.1 Introduction

IWRM is coordination (process), water security is the goal (result, status). IWRM is a process of change, which takes place continuously and dynamically. Water Security is a development objective. (Christopher Scott)

The Integrated Water Resources Management (IWRM) paradigm has just celebrated its twenty-first birthday in 2013, a period over which it has become dominant in both the water sector and sustainable development circles. It was born in 1992 as a result of the International Conference on Water and the Environment in Dublin and at Rio de Janeiro with Agenda 21 (Ait-Kadi, 2013). Its conceptual and implementation framework was developed by the Global Water Partnership, under the auspices of the World Water Council (GWP/TAC, 2000; GWP, 2004). IWRM is defined as '*a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner, without compromising the sustainability of vital ecosystems and the environment*' (GWP/TAC, 2000).

Yet, due to the rapidly changing times we are currently immersed in, the lifespan of concepts and paradigms is also put to the test more quickly. According to Kuhn (1962), scientific progress is the result of 'development by accumulation', i.e. when normal science is interrupted by periods of revolutionary science. The IWRM paradigm is therefore in a state of flux (GWP, 2012; López-Gunn et al., 2013). This chapter aims to identify new trends and directions, as well as potential changes in its conceptual basis, particularly from fast-emerging complementary concepts such as water security (GWP/TAC, 2000; Grey and Sadoff, 2007; Pochat, 2008; GWP, 2010; Cook and Bakker, 2012; UN Water, 2013) analysed in Chapter 6. Along these lines, are there enough anomalies in the IWRM paradigm to warrant major changes? This chapter will argue that in order to 'speed up' the implementation of IWRM it is fundamental to ask new questions about its main tenets. The chapter analyses and evaluates the main ingredients of the IWRM paradigm, looking at a) the integration of resources, b) of sectors and c) across organizations. IWRM acquires real added value once a series of clear and specific policy goals are set, e.g. those provided by water security or the upcoming Sustainable Development Goals (SDGs) on water (Sachs, 2012) that in 2015 will effectively replace the merely target-oriented Millennium Development Goals (MDGs).

15.2 'W and R' in IWRM

This chapter will first revisit the resource base and consider how to re-think the hydrological cycle by adopting an 'anthropo-hydrogeological' cycle, i.e. a cycle in the context of the new era of the Anthropocene (Steffen et al., 2011). Building on Chapter 2, it also considers interactions within the unitary water cycle affected and modified by human use, and also innovative ways of thinking about water such as the concept of virtual water.

15.2.1 Water resources: the 'anthropo-hygeodrological cycle'

As highlighted in Chapter 2, the Latin America and Caribbean (LAC) region has great wealth in terms of water resources and presents a resource intensive development pattern, where much of the population lives in cities and human activities deeply and radically alter the water cycle in terms of its quantity and quality in time and space (Figure 15.1). The increasing demand for water on the one hand, and supply constraints on the other, implies a need to rethink the hydrological cycle in order to increase water security for both urban and rural areas, but also from a sectorial point of view (agriculture, mining or energy). The understanding and correct quantification of water in its different forms (atmosphere, surface and underground) are fundamental for the proper management of water resources and this also includes the need of breaking down any false paradigms about sustainability. Thus a first step for IWRM is proper water accounting, where the concept of 'water savings' does not necessarily detract from other uses (see Chapter 10 on water efficiency).

From an IWRM perspective, it is therefore necessary to characterize each source of water available in the water-cycle and their interdependencies. The opportunities offered by both conventional and non-conventional resources add increasing complexity to water management, which will require a new matrix-based approach considering an anthropo-hygeodrological cycle (Galbraith, 1971; Barlett and Goshal, 1990). In modern societies, there are six main sources of water: surface water (lakes, rivers and reservoirs), groundwater (aquifers), soil water (edaphic), precipitation water (rain harvesting), water reuse (treated or untreated), and desalinated water, to which a seventh – 'virtual water' – should be added (as will be discussed below). The first two are the most commonly used for the large water supply systems of cities and agricultural areas. In LAC this represents more than 90% for the cities water supply. The fourth (rain harvesting) has been used for a long time by families in poor regions (in semi-arid zones of Brazil, for example) as an adaptation mechanism and it is starting to be used more widely as an additional source of water in some cities. Desalination and water reclamation are also being implemented in LAC countries due to the increasing costs of obtaining water from conventional sources. In specific locations these new resources can represent a key strategic option for addressing local problems. For example, desalination for mining or for public water supply in Chile and northeastern Brazil respectively is an emergent trend.

The coordination and integration of both conventional and non-conventional sources is likely to be fundamental for specific locations in order to reduce water risks and pressures. Groundwater and surface water feature a clear complementarity in many aspects, which is crucial in order to increase water security for societal needs, e.g. public water supply and economic activities. In many cases, the problem of water supply in cities or for crops production is related to seasonal rain variation (periods of drought) and also to a lack of water infrastructure. Aquifers can store large amounts of water, as available 'natural (green) infrastructure', though there are few cases of planned joint management of surface and groundwater in LAC countries. Some positive examples are in Lima (Peru) and some

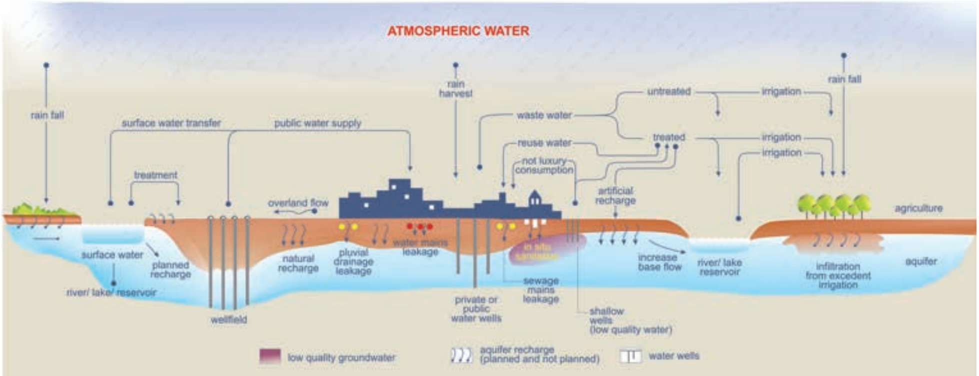


Figure 15.1 The 'anthropo-hygeodrogeological' cycle. *Source: expanded from Foster et al. (2011)*

cities in Mexico, but these are the exception rather than the rule due to the high level of technical knowledge and institutional coordination required. As a consequence, the high-quality, drought-resilient capacity of groundwater resources tends to be underestimated (Garduño et al., 2006). It is also necessary to recognize that there are more cases of spontaneous (or unplanned) conjunctive use than a planned conjunctive management of groundwater and surface water (López-Gunn et al., 2011). This is the case in the State of São Paulo, Brazil, where 15% of cities are supplied by both surface (main source) and groundwater resources (complementary source, i.e. 12,000 wells in the metropolitan area of São Paulo) (Hirata et al., 2006). Although surface and groundwater represent the 'bulk' of apparent resources, a wider perspective should also consider the opportunities of non-conventional resources and the largely unseen or 'forgotten' water resources of virtual water flows and green water. Thus for IWRM, particular attention should be paid to the range of resources and the advantages and disadvantages of each.

From the perspective of IWRM, it is also important to go beyond the evaluation of supply and demand interventions to a more systemic perspective. In this sense, the diversification of resources means a probable reduction of risk (Table 15.1), which allows for the re-visiting of supply side engineering measures, in order to consider alternatives such as rainwater harvesting, aquifer recharge enhancement (with an excess of surface runoff or reclaimed wastewater), desalination, and urban wastewater reuse. Likewise, examples of demand side measures are water conservation, promoting crop changes, improving irrigation efficiency (e.g. irrigation water use quotas, covering open canals, economic incentives to use high-pressure systems or the use of low-pressure water distribution pipes in agricultural areas) or measures that incorporate seasonal and spatial aspects.

One important issue for the integrated management of this resource portfolio refers to the allocation of responsibilities and information. With regard to this, sound information on resource use, accurate water accounting and extended participation would make integrated water resources management more likely (see section 15.4.2). For example,

Table 15.1 Comparative features of different components of water resource portfolios

FEATURE	GROUND-WATER	SURFACE WATER	DESALINATED WATER	RAIN HARVEST WATER	RECLAIMED WASTE WATER
HYDROLOGICAL CHARACTERISTICS					
STORAGE VOLUMES	Very large	Small to moderate			
RESOURCE AREAS	Relatively available	Restricted to water bodies	Restricted to saline water location	Relatively unrestricted	Restricted to water availability
FLOW RATES	Very low	Moderate to high	Depends on the infrastructure	Depends on the infrastructure	Depends on the infrastructure
RESIDENCE TIMES	Generally decades/centuries	Mainly weeks/months	Centuries	Hours/days	Months/years
DROUGHT PROPENSITY	Generally low	Generally high	Low	High	Low
EVAPORATION LOSSES	Low and localized	High for reservoirs	Low	High	Low
RESOURCE EVALUATION	High cost and significant uncertainty	Low cost and often less uncertainty	High and often less uncertainty	Low and often less uncertainty	High and often less uncertainty
ABSTRACTION IMPACTS	Delayed and dispersed	Immediate	Low to moderate	Low	Low to moderate
NATURAL QUALITY	Generally (but not always) high	Variable (but generally needs treatment)	(-)	Generally high to moderate	(-)
POLLUTION VULNERABILITY	Variable natural protection	Largely unprotected	(-)	Associated to atmospheric contamination	(-)
POLLUTION PERSISTENCE	Often persistent in the short to medium term	Mainly transitory	(-)	(-)	(-)
SOCIO-ECONOMIC FACTORS					
PUBLIC PERCEPTION	Not well known by the public	Aesthetic, predictable	Moderate	Moderate	Low
DEVELOPMENT COST	Generally modest	Often high	High	High or modest (depending on technology used)	Low
DEVELOPMENT RISK	Less than often perceived	More than often assumed	Less than often perceived	Less than often perceived	Less than often perceived
STYLE OF DEVELOPMENT	Mixed public and private	Largely public	Mixed public and private	Mixed public and private	Largely public

Source: expanded from Tuinhof et al. (2006)

in Costa Rica the regulatory framework does not allow for the use of groundwater, which makes joint management almost impossible. This links up with transparency on resource use (see Chapter 12), adequate data gathering and the availability of good water registers. For example, in the case of Mexico the Registro Público de Derechos de Agua (REPDA), the main approximation tool for federal water use is incomplete and its validity rather poor. In the case of Costa Rica the water information system (SINIGIRH) compiles information on river basins from different data sources (universities, AyA, ICE, IMN, SENARA, MINAE) into a single database and aspires to improve the hydrologic and hydrogeological information by strengthening the network of metering stations in order to support decision making.

Box 15.1 Extreme water security? Floods, droughts, population growth and migration in the Andes

One of the main functions of water management is dealing with water availability and in particular with climate variability which includes extreme events such as floods, droughts and general climatic changes. Water management when there is too much or too little water, and under a new scenario where underlying baseline resource conditions are subject to change due to climate change, are real stress tests for IWRM. Focusing on the Andean region, composed of Colombia, Ecuador, Peru and Bolivia, we briefly discuss issues related to extreme events, IWRM and water security. In the case of floods, there is a large portion of the population exposed to floods (approximately 15% of the population; see Table 15.2) (General Secretariat of the Andean Community, 2009). As can be seen in Figure 15.2 and Table 15.2 the areas most affected by droughts are in southeastern Peru and southwestern Bolivia. The population that has the potential for being affected by droughts reaches 19% of the total. An extreme drought can cause the total loss of work and capital for a small community. In addition and less well known, the absence of humidity can cause the presence of pests. The areas more prone to droughts have the lowest population growth rates (see Figure 15.2). This indicates that climate variability affects people significantly, forcing them to move to areas in which jobs may be more secure (Figures 15.3). Knowledge and data on climate variability and change can facilitate improved water resource management to reduce the vulnerability of people and areas most exposed, thus increasing system resilience. This is especially if information is produced on how this variability and change affects other systems e.g. economic system (losses), and impact on social system (e.g. migration).

Table 15.2 Population prone to suffering droughts and floods in the Andean Community countries

		UNITS	BOLIVIA	COLOMBIA	ECUADOR	PERU	ANDEAN COMMUNITY
POPULATION	TOTAL	Million	9,427	48,889	13,215	27,254	92,785
	EXPOSURE TO FLOODS	Million	600	5,232	2,428	8,459	13,710
		%	6%	12%	18%	20%	15%
	EXPOSURE TO DROUGHTS	Million	1,819	8,235	4,547	2,616	17,217
		%	19%	19%	34%	10%	19%
AGRICULTURAL AREA	TOTAL	Km²	268,954	533,431	115,342	256,118	1,173,845
	EXPOSURE TO FLOODS	Km²	57,000	120,000	14,000	34,000	225,000
		%	21%	22%	12%	13%	19%
	EXPOSURE TO DROUGHTS	Km²	88,000	59,000	24,000	120,000	291,000
		%	33%	11%	21%	47%	25%

Source: own elaboration based on data from the General Secretariat of the Andean Community (2009).

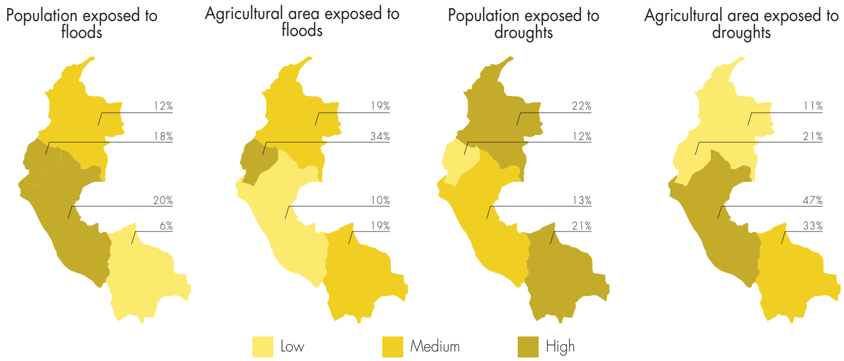


Figure 15.2 Population and areas most affected by droughts and floods in the Andean Community. *Source: own elaboration based on data from the General Secretariat of the Andean Community (2009).*

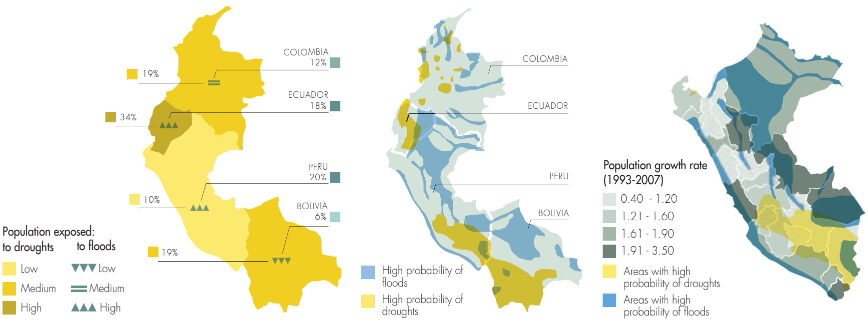


Figure 15.3 Population and areas most affected by droughts and floods in the Andean Community and Peru. *Source: own elaboration based on data from the General Secretariat of the Andean Community (2009).*

15.2.2 Innovations in resource 'thinking': virtual water in IWRM

The virtual water concept represents an important dimension of IWRM, particularly because it links water to use. However, it alone cannot determine optimal water resource allocation in importing and exporting to and from LAC countries and regions since water resources management requires consideration of multiple objectives and trade-offs from different options (Allan, 2011; Yang et al., 2013). The problem of water scarcity can be addressed by different means, i.e., improving water use efficiency locally, transferring water from outside, and transferring virtual water into the region in order to reduce local water demand. These measures are not mutually exclusive and can be combined to form an integrated approach in addressing water security problems. Thus, the trade of virtual water is one important component of integrated strategies in tackling water security (Guodong, 2003). The essence is that countries/regions can undertake economic activities (including agriculture) in which they have a comparative advantage. Virtual water strategies could potentially improve overall water use efficiencies in agriculture by adjusting crop structure and importing most water-intensive crops, thereby easing the level of water stress in specific regions, particularly in arid areas or areas with high population growth (Yang et al., 2013). However, it is fundamental to take the local context into account and to consider whether the local economy can import virtual water in exchange for other value added exports. With regard to agricultural products, during the period 1996–2005 the LAC region was a net exporter of green virtual water (141.5km^3/yr) and a net importer of blue virtual water (16.1km^3/yr), as concluded by Mekonnen and Hoekstra (2011), exporting through agricultural products three times more virtual water than it consumed. Thus when considering water security for countries with lower water availability, virtual water is a key element.

The water footprint indicator provides additional information for policy makers that can complement the classical measure of water withdrawals. Traditional national water use accounts only refer to the direct blue water withdrawal within a country. Beyond this, the water footprint assessment provides additional information on green and blue water consumption and pollution (grey water) including data on direct and indirect water use (virtual water flows), which makes the water footprint very different from other IWRM indicators (Table 15.3). By just looking at water use within its own country, most governments have a partial view of the sustainability of national consumption. In order to support a broader analysis and better informed decision making, national water use accounts could be extended to national water accounting on the basis of the water footprint methodology or other similar water accounting methods (Molden, 1997; Molden and Shakzivadivel, 1999; Molden et al., 2007; Perry, 2012). The specification on whether water resources are being used or consumed, and also whether they refer to blue (surface or groundwater) or green water (soil water) would provide a stronger information base from which to formulate national water plans and specific river basin plans, which are coherent, well aligned and integrated with national policies in relation, for example, to the environment, agriculture, energy, trade, foreign affairs and development cooperation (Hoekstra et al., 2011). Ideally, economic values and also energy implications would also be taken into consideration, as discussed in the next section.

Table 15.3 **Total water footprint and total virtual water flows in Latin American countries**

	TOTAL WATER FOOTPRINT				TOTAL VIRTUAL WATER FLOWS											
					VIRTUAL WATER IMPORT				VIRTUAL WATER EXPORT				NET VIRTUAL WATER IMPORT			
	Green Water Mm³/yr	Blue Water Mm³/yr	Grey Water Mm³/yr	Total Wf Mm³/yr	Green Water Mm³/yr	Blue Water Mm³/yr	Grey Water Mm³/yr	Total Import VW Mm³/yr	Green Water Mm³/yr	Blue Water Mm³/yr	Grey Water Mm³/yr	Total Export VW Mm³/yr	Green Water Mm³/yr	Blue Water Mm³/yr	Grey Water Mm³/yr	Total Net VW Mm³/yr
ARGENTINA	176,194	5,708	9,189	191,091	4,285	266	1,116	5,667	93,307	1,863	2,875	98,045	-89,022	-1,597	-1,758	-92,377
BELIZE	677	14	177	868	70	14	22	105	445	19	67	530	-375	-5	-45	-425
BOLIVIA	31,559	601	284	32,444	1,212	134	182	1,528	3,551	23	38	3,613	-2,339	111	144	-2,084
BRAZIL	135,966	13,826	31,930	481,722	29,475	2,368	3,701	35,544	105,427	1,944	5,121	112,492	-75,952	424	-1,421	-76,949
CHILE	9,143	2,797	3,888	15,828	4,720	369	987	6,076	1539	600	851	2,990	3,180	-230	135	3,085
COLOMBIA	50,173	2,384	7,210	59,767	8,065	742	1,714	10,521	11,778	190	1,286	13,254	-3,713	552	428	-2,733
COSTA RICA	5,412	428	1,437	7,277	2,240	386	488	3,114	4,638	246	606	5,489	-2,398	141	-117	-2,374
ECUADOR	26,444	2,443	3,366	32,253	2,192	207	410	2,809	6,362	399	396	7,156	-4,170	-191	14	-4,347
EL SALVADOR	5,202	134	879	6,215	2,025	346	335	2,705	3,305	101	252	3,657	-1,280	245	82	-953
GUATEMALA	13,248	378	1,030	14,656	2,359	424	481	3,264	6,964	177	1,133	8,273	-4,605	247	-652	-5,010
GUYANA	1,632	257	135	2,024	251	58	48	357	719	135	34	888	-467	-77	14	-530
HONDURAS	7,573	182	600	8,355	870	195	223	1,288	6,723	108	284	7,115	-5,853	87	-61	-5,827
MEXICO	109,021	16,453	23,053	148,527	65,407	14,169	12,724	92,299	13,128	8,870	4,107	26,105	52,279	5,298	8,617	66,194
NICARAGUA	5,877	230	333	6,440	751	113	158	1,022	2,389	69	68	2,525	-1,638	44	90	-1,504
PANAMA	2,556	141	478	3,175	805	106	246	1156	1,137	248	164	1,549	-332	-143	81	-394
PARAGUAY	32,845	323	655	33,823	437	44	134	616	12,520	56	153	12,729	-12,082	-12	-19	-12,113
PERU	18,040	4,553	3,022	25,615	6,983	526	971	8,479	2,499	559	474	3,532	4,484	-34	497	4,947
SURINAME	290	80	74	444	96	12	24	132	92	31	27	151	4	-19	-4	-19
URUGUAY	11,504	888	344	12,736	975	61	193	1,230	6,652	732	203	7,587	-5,676	-671	-10	-6,357
VENEZUELA	23,341	1,926	4,844	30,111	6,832	607	1,102	8,542	1,425	128	497	2,051	5,407	479	605	6,491
TOTAL	966,697	53,746	92,928	1,113,371	140,048	21,148	25,256	284,597	284,597	16,498	18,635	319,730	-144,548	4,649	6,620	-133,279

Source: own elaboration based on data from Mekkonen and Hoekstra (2011)

15.3 The 'I' in IWRM

This section discusses issues linked to sectorial integration – or rather coordination – and the future challenges and trade-offs. It thus looks first at the nexus between food–water–energy and new concepts such as ecological boundaries and environmental security by looking at the human footprint (ecological, carbon and water) and how it fares when compared with the human development index. Both the nexus and the green economy offer important emergent sectorial themes for IWRM.

15.3.1 The water–food–energy nexus

The need for integration is particularly relevant in relation to the water, food and energy nexus to ensure water, food and energy security in the LAC region. This is because energy, food and water security partly pivot around successfully managing the interactions and potential trade-offs in the nexus. For example, the interconnections as discussed in detail in Chapter 9 are evident: the use of dams and waterfalls for hydroelectricity production and storage (water-energy); the need for energy to pump water for irrigation (Scott, 2013); the use of food crops or crop residues to obtain biofuels (food-energy); or the high water consumption required by food production (water-food) (Lundqvist et al., 2008; Hoff, 2011) (see Figure 15.4).

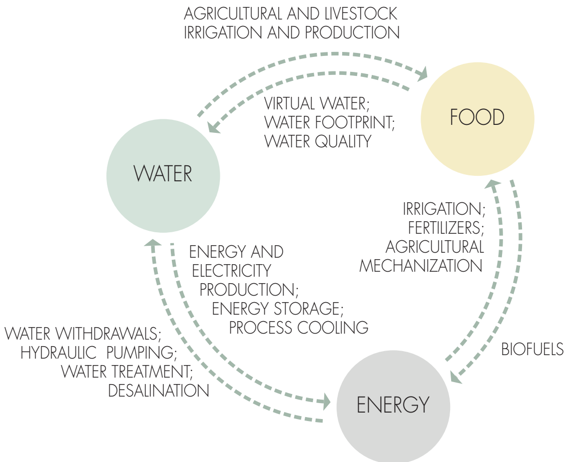


Figure 15.4 Understanding the nexus. The water, energy and food nexus. *Source: own elaboration.*

Within the energy–food–water nexus context, LAC is a region with abundant resources yet with important choices in terms of the prioritization of resource use. As Allan (2011) shows, this is particularly important in the case of Brazil. For example, in relation to the food/energy nexus, i.e. biofuels/soybean crops will have consequences not only for Brazil or the region but probably also impact other regions in the world. In terms of energy, in the Andean, Amazonian and Southern Cone regions, the sector is dominated by hydropower (see Box 15.2), which accounts for 60% of the total energy mix (Meisen and Krumpel, 2009). Meanwhile, Brazil is the world's second biggest producer and exporter of ethanol fuel (see Chapter 9). These energy sources are strongly dependent upon water and land availability, making these regions vulnerable to climate variations (extreme events, severe droughts, rainfall and temperature oscillations) and climate change, thus it will be necessary to consider in more depth the implications of different development models on local energy security, economic development, and food security.

Most relevant for policy makers is to make the potential synergies and trade-offs in these inter-linkages as explicit as possible. These can provide water and energy managers with new tools and cleaner paths towards sustainability and efficiency (solar decontamination, application of renewables for irrigation, dry cooling, energy production from water treatment plants, etc.).

It has been estimated that in LAC water for energy will increase by 50% in 2050 (WEC, 2010), although it should be noted that there is a high level of uncertainty around the water consumption data of primary energies (Figure 15.5). The high unitary water footprint of biofuels and their share in some of LAC's countries energy mix (especially relevant in the case of Brazil), allows bioenergy to be identified as by far the highest water consumer within the primary energy matrix, and thus highlights the importance of starting to produce some approximate numbers on this variable.

From the perspective of the nexus it is important to increase knowledge on how to achieve the balance between development, environmental sustainability and social equity. For the primary energy matrix, an IWRM 'nexus thinking' would look at synergies and trade-offs in the soybean dichotomy in terms of energy/food for countries like Argentina and Brazil who are global world producers. Furthermore, the nexus, under green growth and geographical constraints, would look in much greater depth at a gradual move to a low carbon economy, renewable energy (Meisen and Krumpel, 2009) and energy options that have a low water footprint (in terms of consumption). Costa Rica is spearheading this approach after deciding to stop the exploration and exploitation of oil and start the development of an energy matrix with 92% of the production based on renewable resources.

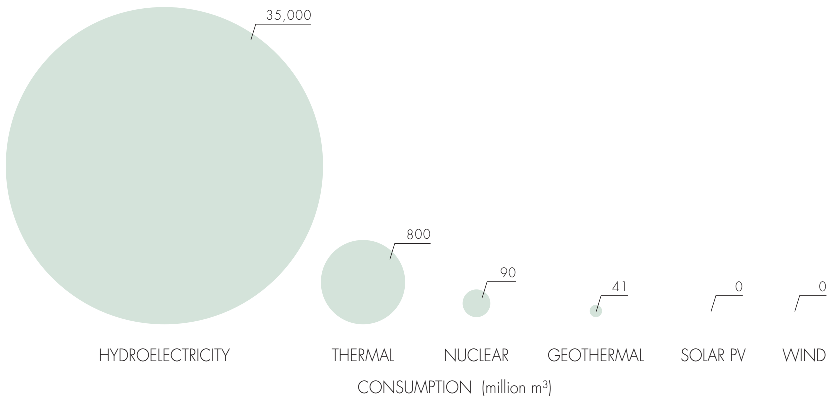


Figure 15.5 Water footprint of electricity production in Latin America. Note: biofuels footprint is not considered here as it is part of the primary energy mix. *Source: own elaboration.*

Box 15.2a Brazil: an example of energy–food nexus or trade-offs?

Brazil is the best example of the need to integrate water, energy and food trade-offs caused by the country's elevated production of biofuels. It has the greatest quantity of accessible blue and green water resources in the world and has enough technology to compensate for its lack of arable land. Moreover, it is the leading producer of sugar, second largest producer of soybean and the third largest producer of maize (Allan, 2011). Therefore, Brazil is likely to become a main exporter of virtual water embedded in food commodities globally, as well as in the raw materials of first-generation biofuels.

However, especially in the last decade, there have been side effects to this policy. Since the oil price rise in 1975, Brazil has opted for the development of nationalized biofuels production as a means to secure energy independence and give a boost to the country's economy. This process was conceived at the outset, considering land use, energy and food issues together and culminated in 2007 with the launch of the 'economic-environmental zoning' plan for the state of Minas Gerais (Coehlo et al., 2012). It consisted in the elaboration of studies about the social, economic and physical conditions (type of soil, climate, water availability, ecological values, etc.) of geographical regions in order to determine the most suitable areas to grow sugar cane with maximum yields and minimum impacts and then limiting the activity to those areas. First-generation biofuels are options for Brazil at least in the medium-term, due to its considerable availability of land and water resources. (Allan, 2011). How much this shift from food commodities exporter to biofuels exporter will impact on global food security, especially in those countries which depend on Brazil's food imports for national supply, is yet to be seen.

Box 15.2b The water–electricity (energy) nexus: what is the water footprint of electricity production in LAC?

The main sources of electricity generation in LAC are hydropower and thermoelectric power, together with biofuel production for transportation, heat and cooling. The key issue for the water–energy nexus is to determine whether increasing energy use affects water use or water consumption. For example, cooling from thermoelectric energy refers mainly to use while bioethanol refers more to consumptive use. In most of LAC, hydroelectric production plays a major role in the electric mix (see Figures 15.6 and 15.7), reaching some 100% in Paraguay, 83% in Brazil, 77.8% in Venezuela or 71.7% in Colombia (IEA, 2013). Those countries are therefore especially vulnerable to rainfall variability, such as the El Niño and La Niña phenomena and to climate change predictions reported by the IPCC's Climate and Water report (Bates et al., 2008). This variability should therefore also be taken into account for future management of the electricity sector. For the whole of LAC the total water footprint or consumptive use, estimated on the basis of IEA (2013) for the different energy technologies, is around 35,000Mm^3 per year, from which almost 97% of consumptive use comes from hydroelectricity. Meanwhile, thermoelectricity and nuclear energy, the other main contributors to the electricity mix in the Andean and Amazonian regions, account for only 0–3% of the total water consumption from electricity. Coincidentally, water use for the whole of LAC accounts for 35,800 million m^3, almost the same as water consumption. However, there are some aspects that must be taken into consideration. First, water use for both thermal and nuclear energy vary considerably depending on the type of cooling system used – i.e. the average value of water use can range from 68,000 million m^3/yr with once-through cooling down to 1,160 million m^3/yr for closed loop systems. As cooling processes are the main water requirements for nuclear and thermal energy, clear data in this respect would be crucial for accurate water use estimations, especially within the Mesoamerican region (Mexico, 82.9%; Nicaragua, 79.6% or Guatemala, 76.7%). Along with thermal power, some other sources of renewable energy are emerging in the Mesoamerican region, such as geothermal in El Salvador (26.3%), Costa Rica (12.8%) or Nicaragua (8.6%), which for LAC in general only represents some 3% of total generation. Wind and solar photovoltaic, which have a low water footprint, are barely developed, despite their potential to decouple the water–energy nexus.

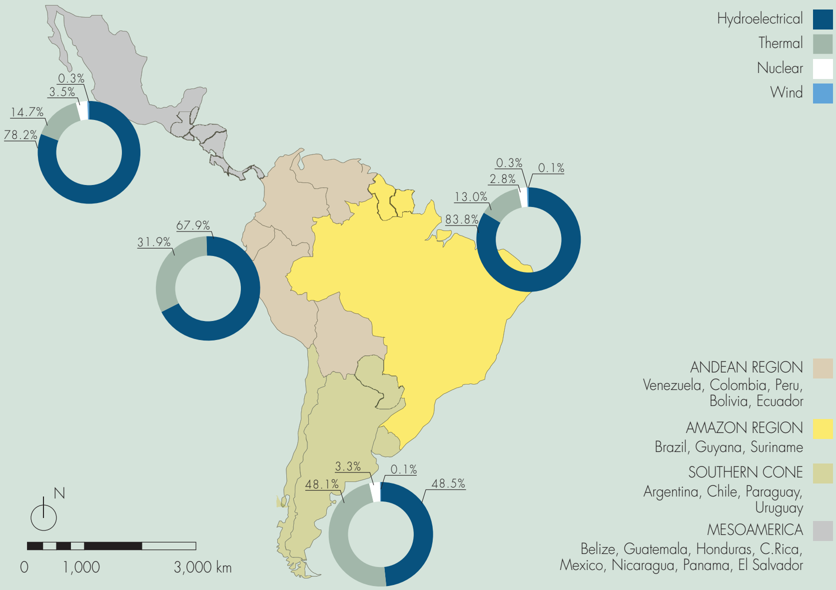


Figure 15.6 Electricity generation by source and per sub-region (Southern Cone, Mesoamerican, Amazon and Andean) in Latin America. *Source: own elaboration based on electricity data from 2009 in IEA (2013).*

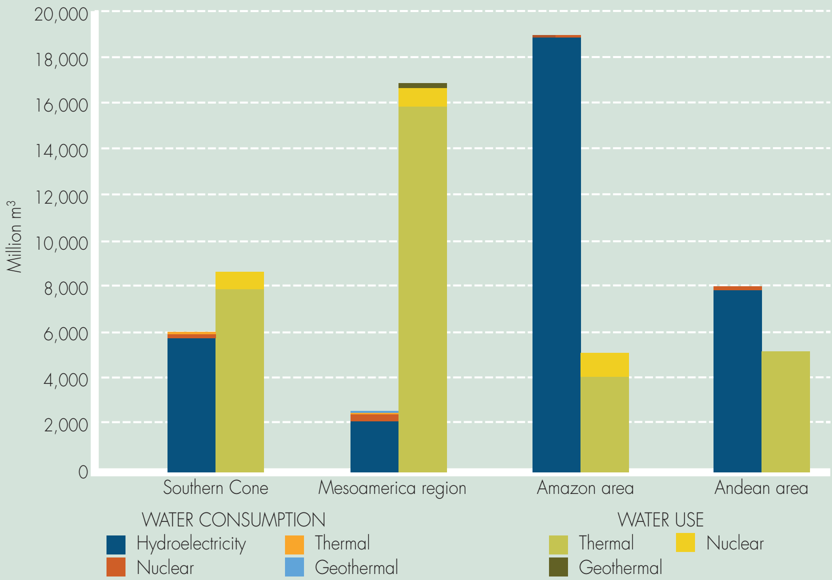


Figure 15.7 Water consumption and water use for electric generation per sub-region (Southern Cone, Mesoamerican, Amazon and Andean) in Latin America. *Source: own elaboration based on electricity data from 2009 in IEA (2013).*

15.3.2 Green growth and green economy in LAC

IWRM includes guaranteeing environmental sustainability as one of its three targets, together with efficiency and equity. At the Rio +20 meeting in June 2012, one of the main issues centred on water and green growth. In this context, the idea is to create a virtuous circle of economic incentives, able to generate the funds necessary for good water management. For example, where water is scarce – like in large parts of Mexico or Chile – incentives could focus on the rational use by agriculture as the dominant sector, via economic tools that support innovation in the use of water and force the internalization of external costs – i.e. valuation of water under realistic water prices. Environmental policy in countries such as Brazil is fairly advanced but its implementation is very slow while degradation continues in terms of deforestation (see Chapter 3) or water pollution increases. Meanwhile Costa Rica has adopted a green growth state policy, resulting in 26% of its territory being designated as areas for nature conservation and the implementation of a ban on open cast mining for heavy metals. In order to provide (financial) sustainability to these political measures, a series of economic instruments have been generated, such as a tax on fuel which is paid to environmental services producers in exchange for carbon. Meanwhile, 25% of the water tax (see Chapter 14 for more detail) is dedicated to the protection of public protected areas, and 25% for a payment of water environmental services on private lands.

In recent years, economic growth has been linked in many ways to high commodity prices (see Chapters 4 and 5), achieved at the expense of the intensification in the use of land, energy and water resources, leading to an increase in the levels of pollution and the loss of ecosystems and biodiversity (UNEP, 2009; UNEP, 2011; UN-Water, 2012a). A different development model based on a green growth approach ought to rely on a more efficient use of resources that decouples GDP growth from environmental degradation (UNEP, 2011). In LAC there has been an effort to transition towards IWRM as a framework that could help overcome this challenge (UN-Water, 2006; UN-Water, 2008; UNEP, 2012a). More generally, and as explained in Khan (2010), as countries shift to a greener set of economic arrangements, the costs of more traditional hard engineering approaches to water management become less profitable. In contrast, the cost of operating ecosystem payment schemes are much less likely to increase, providing that property and use rights and governance arrangements can ensure water-supply utilities whilst maintaining access to ecosystem services (Khan 2010; UNEP, 2011; UN-Water, 2012a). Clearly, some level of relative decoupling levels is already happening, meaning less environmental impact per unit of production (UNEP, 2011).

However, there are still challenges to achieving a 'greener' IWRM in the region (Scott and de Gouvello, 2013) (see Figure15.8 and Table 15.4.). There is no blueprint: for countries with similar Human Development Indices (HDI), some have higher footprints than others. For instance, the three footprints of Brazil are higher than those of Peru while having the same HDI. Some countries have comparatively higher ecological footprint than others in relation to their HDI, like Costa Rica, Mexico, Argentina or Chile. On the other hand, other countries have a higher water footprint like Colombia and Peru, and Brazil has the highest carbon footprint in relation to its HDI and of all the other countries. As discussed in Chapter 3 this could be explained by changes in land use. Agriculture tends to represent 2/3 of the total water footprint (e.g. see Chapter 7), so it is key for decoupling human footprints (carbon, water and ecological), HDI and IWRM. Galli et al., (2012) propose a combined used of the three footprints in what is called the 'footprint' family, arguing that it shows a more rounded vision on all three aspects. Footprint HDI monitoring could provide a preliminary diagnosis or early indicator of the achievement of the three key elements – economics, social equity and sustainability – which can help flag up areas where further analysis is needed. In many cases, countries with a high HDI have a high ecological footprint, yet this is not the same for the carbon or water footprints.

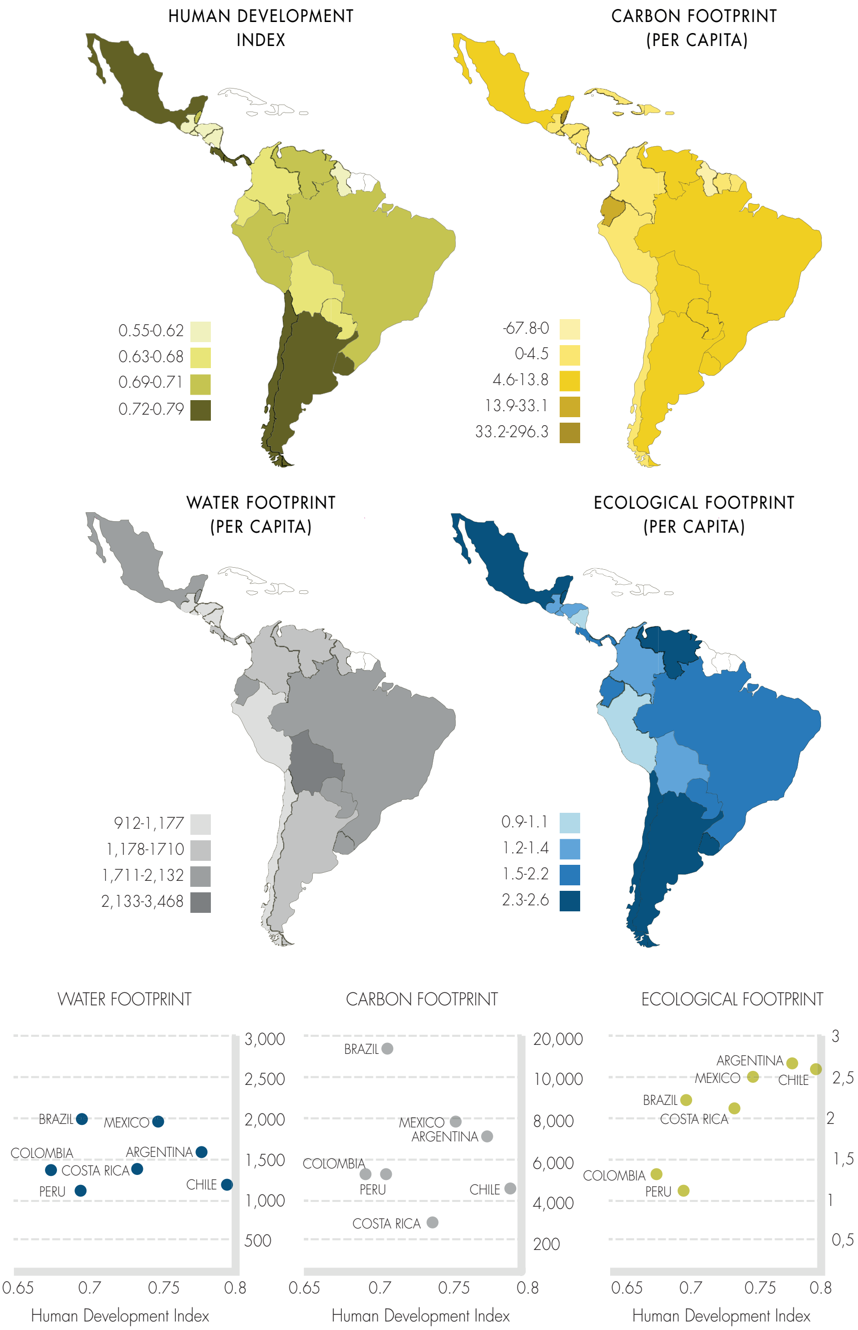


Figure 15.8 United Nations Human Development Index versus Carbon Footprint (tons C per capita per year), Water Footprint (cubic metres per capita per year) and Ecological Footprint (global hectares per capita per year). *Source: UNDP (2005), Mekonnen and Hoekstra (2011) and Ecological Footprint (2004).*

Table 15.4 United Nations Human Development Index versus Carbon Footprint (CF), Water Footprint (WF) and Ecological Footprint (EF)

COUNTRY	HUMAN DEVELOPMENT INDEX	CARBON FOOTPRINT (tC/cap/yr)	WATER FOOTPRINT (m^3/cap/yr)	TOTAL ECOLOGICAL FOOTPRINT (global ha/person)
	2005	2000–2010	1996–2005	2004
ARGENTINA	0.77	6,438	1,607	2.6
BOLIVIA	0.65	5,612	3,468	1.2
BRAZIL	0.70	10,628	2,027	2.2
CHILE	0.79	3,852	1,155	2.6
COLOMBIA	0.68	4,595	1,375	1.3
COSTA RICA	0.73	2,175	1,490	2.1
ECUADOR	0.68	33,151	2,007	1.8
EL SALVADOR	0.66	1,884	1,032	1.2
GUATEMALA	0.55	-1,704	983	1.2
HONDURAS	0.58	1,990	1,177	1.4
MEXICO	0.75	7,135	1,978	2.5
NICARAGUA	0.57	-0.814	912	1.1
PANAMA	0.75	3,249	1,364	1.8
PARAGUAY	0.64	13,864	1,954	2.2
PERU	0.70	4,588	1,088	0.9
SURINAME	0.67	10,479	1,347	-
URUGUAY	0.74	7,884	2,133	2.6
VENEZUELA	0.69	7,214	1,710	2.4

Source: UNDP (2005), Mekonnen and Hoekstra (2011) and Ecological Footprint (2004)

15.4 The 'M' in IWRM

15.4.1 Integration and institutional coordination: allocation of tasks and responsibilities

This final section will look at integration in organizational terms. It draws on a recent study published by the OECD (2011) on multi-level water governance and a brief review of the main tenets of the IWRM paradigm. With a population of 596 million and growing faster than the world average, LAC countries are experiencing increasing pressure on their natural resources due to population growth, intensification of land use, increasing urbanization, climate change and natural disasters. The OECD (2012) argues that achieving water security in the LAC region is not only a question of hydrology and financing, but also equally a matter of good governance. In that framework, institutions and their coordination are essential to designing and implementing efficient, fair and sustainable water policies in the region.

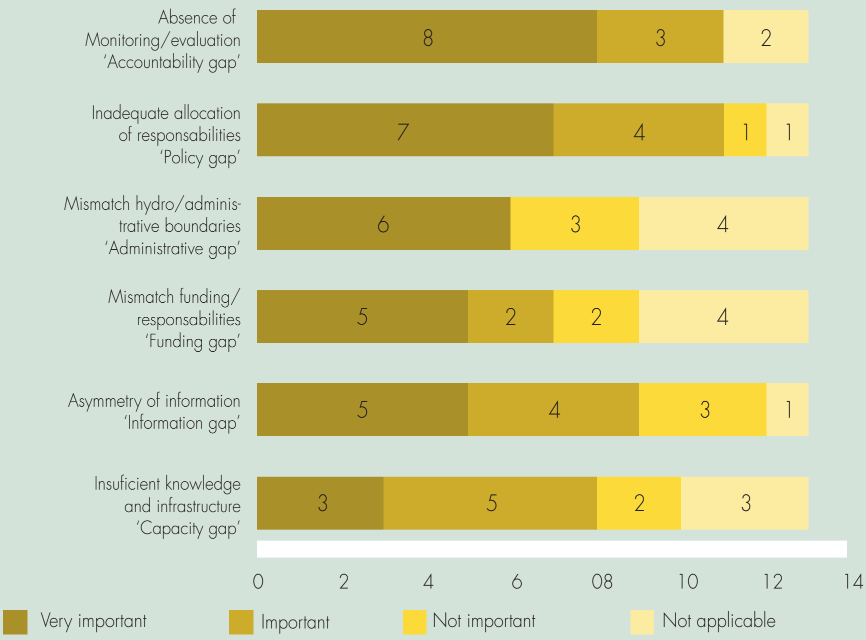
Analyses on water governance are not new to LAC. The first studies on the topic date back to the end of the twentieth century. They highlighted the lack of governance strategy in the LAC water sector and revealed why most LAC countries lag behind in sustainable water management. Such reasons included the lack of political leadership, inadequate legal frameworks, poor utilities management structures, insufficient stakeholder involvement and limited financial resources. In most LAC countries, decentralization of water policies has resulted in a dynamic and complex relationship between public actors across all levels of government. To varying degrees, LAC countries have allocated increasingly complex and resource-intensive functions to lower levels of government, often in a context of economic crisis and fiscal consolidation. Yet, despite these greater responsibilities, sub-national actors were not given the financial resources to carry out their duties properly and hence coordination failures between sub-national and national governments and sub-national budgetary constraints have led to policy obstruction in several countries of LAC.

In 2011–2012, using the Multi-level Governance Framework 'Mind the Gaps: Bridge the Gaps' (OECD, 2011), the OECD carried out a survey on water governance across thirteen LAC countries (Argentina, Brazil, Chile, Costa Rica, Cuba, Dominican Republic, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and Peru) in order to identify key governance obstacles to effective water management, as well as good practices for managing vertical and horizontal coordination of water policy (see Box 15.3). These countries cover a wide spectrum of options in terms of institutional settings (federal, unitary), the organization of the water sector (centralized, decentralized), water availability (water-rich and water scarce countries) and economic development (least advanced, developing and emerging countries). The survey had a particular emphasis on multi-level governance in order to analyse how public actors articulate their concerns, decisions are taken and policy makers are held accountable. The OECD defines multi-level governance as the explicit or implicit sharing of policy-making authority, responsibility, development and implementation at different administrative and territorial levels, i.e. i) across different ministries and/or public agencies at central government levels (upper horizontally); ii) between different layers of government at local, regional and provincial/state, national and supranational levels (vertically); and iii) across different actors at sub-national level (lower horizontally).

Box 15.3 Gaps to achieving effective water governance based on OECD multi-level governance challenges

Key findings were published in the report 'Water Governance in Latin America and the Caribbean: A multi-level approach' (OECD, 2012) which shows that despite a variety of situations, LAC countries share common governance and institutional challenges:

1. Sectorial fragmentation of water-related tasks across ministries and between levels of government is considered a policy gap, an important challenge to integrated water policy in 92% of countries surveyed;
2. The lack of public participation and limited involvement of water users' associations in water policy generates an accountability gap in 90% of the countries surveyed;
3. The funding gap remains a significant challenge in ten of the thirteen countries surveyed, due to unstable and/or insufficient revenues of sub-national actors in order to build, operate and maintain infrastructure;
4. In two-thirds of LAC countries surveyed, the capacity gap is a major obstacle for effective implementation of water policy at central and sub-national levels, which refers not only to the technical knowledge and expertise, but also to the lack of staff and obsolete infrastructure;
5. The information gap remains a prominent obstacle to effective water policy implementation in two-thirds of the countries, in particular regarding inadequate information generation and sharing amongst actors, as well as scattered water and environmental data;
6. Half of the countries surveyed see the mismatch between the administrative and hydrological boundaries (administrative gap) as a significant challenge to effective water management, despite the existence of river basin organizations in some of them;
7. Several LAC countries struggle to strike a balance between the often conflicting financial, economic, social and environmental agendas for the collective enforcement of water policy (objective gap).



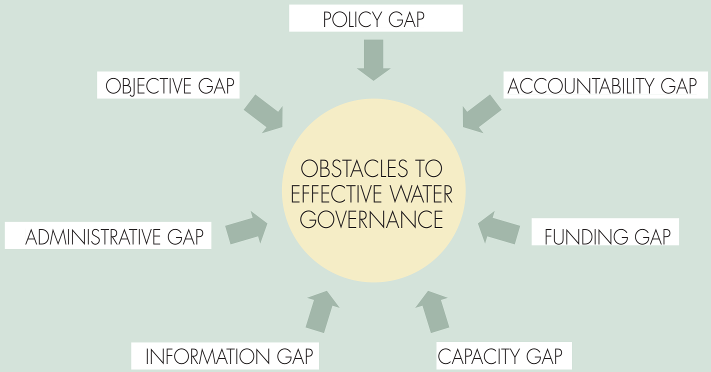


Figure 15.9a and 15.9b Multi-level governance gaps in LAC countries' water policymaking.
Source: based on the results from OECD (2012).

LAC countries have a set of policy instruments for addressing coordination and capacity challenges, but progress remains to be made in order to achieve IWRM. Meeting water governance challenges calls for more synergies to mutually reinforce actions across government, departments and agencies, as well as between researchers and decision-makers to forge science-policy dialogues (Regional Process of the Americas, 2012; Scott et al., 2012). An overview of LAC countries' experiences shows that there is a wide variety of mechanisms and instruments for integrating water policy. All LAC countries surveyed had adopted institutional mechanisms for upper horizontal coordination of water. These tools mainly consist of ministries (e.g. the Ministry of Environment in Brazil, the Ministry of Public Works in Argentina, etc.), inter-ministerial bodies or mechanisms, or specific coordinating bodies. Most countries have also engaged in efforts to coordinate water with other policy areas including regional development, agriculture and energy (see Table 15.5).

In recent years, river basin organizations have also been proposed in LAC countries as tools for effective governance, though their missions, constituencies and financing methods vary across LAC countries. While all LAC river basin organizations have functions related to planning, data collection, harmonization of water policies and monitoring, none have regulatory powers, contrary to OECD ones. The maturity of river basin organizations also varies across LAC countries especially in terms of managing competing water uses, which requires conflict resolution mechanisms in the political and legal arenas. In Brazil, the 1997 National Water Resource Strategy established river basin committees to promote multi-actor dialogues on water and arbitrate conflicts of use and implement basin management plans. In 2010, Peru started to conduct pilot exercises in six river basins. Two river basin councils have been implemented thus far and the National Water Authority (ANA) is carrying out programmes to stimulate the creation of ten additional ones, while tackling remaining challenges such as financial sustainability, capacity building, civil

Table 15.5 **Ministries and institutions responsible for the management of water, energy and food resources in different Latin American countries**

COUNTRY	WATER	AGRICULTURE	ENERGY
MEXICO	National Water Commission (CONAGUA) Department of Environment and Natural Resources.	Department of Agriculture, Livestock, Rural Development, Fishing and Feeding	Department of Energy Secretary of Energy
BRAZIL	National Water Agency	Ministry of Agrarian Development Ministry of Agriculture, Fishing and Supplying	Ministry of Mining and Energy
ARGENTINA	Department of Public Works Sub-department of water resources	Ministry of Agriculture, Lvestock and Fishing	Ministry of Federal Planning, Public Investment and Services Department of Energy
COSTA RICA	Ministry of Environment and Energy Water Direction	Ministry of Agriculture and Livestock	Ministry of Environment and Energy
PERU	Ministry of Agriculture. National Water Authority	Ministry of Agriculture	Ministry of Energy and Mining
CHILE	Ministry of Public Works Water Department	Ministry of Agriculture	Ministry of Energy

Source: own elaboration.

society representation and the long-term contribution of the river basin councils to national development.

LAC countries employ a wide range of mechanisms to manage the interface between actors at the sub-national level and to build capacity. Public participation is also used as a tool to increase transparency and citizen compliance in order to influence environmental protection. In Chile, when several citizens share the same groundwater drilling infrastructure, they can form associations (Asociación de Canalistas) to communally build, operate and maintain aqueducts as well as to fairly distribute water among members. A bi-national management committee was established in the Goascorán river basin between Honduras and El Salvador to engage stakeholders in the development of a basin management plan. Other tools for coordination across sub-national actors include inter-municipal collaboration, metropolitan or regional water districts, specific incentives from central and regional governments, joint financing between local actors, as well as ancestral rules.

By comparing the allocation of roles and responsibilities at the central and sub-national level in the LAC countries surveyed, the OECD has defined three models of water policy organization (Figure 15.10). These categories highlight the different coordination challenges raised by a given institutional organization, related to the frequent trade-off of decentralization; customization of water policy according to territorial specificities; and policy coherence. Within each category, the degree to which governance challenges have an impact on the performance of water policy may vary from one country to another.

In most cases, countries have developed a series of mechanisms to address the institutional challenges in their water sectors, but when other dimensions are added (e.g. capacity gaps, variety of tools in use, etc.) it would be helpful to link each model with policy objectives and desired outcomes.

Figure 15.10 Preliminary categories of LAC countries. *Source: based on results from OECD (2011).*

While many technical, financial and institutional solutions to LAC water challenges exist and are relatively well known, the rate of uptake of these solutions by government has been uneven. No governance tool can offer a panacea or a one-size-fits-all response to water governance challenges in the LAC region, and local policies that take territorial specificities into account can help in many cases. Even if an optimal level of governance cannot be defined, peer dialogue and bench-learning across LAC countries facing similar challenges and with equivalent institutional organizations can help to bridge governance gaps (see Box 15.4).

Box 15.4 IWRM: information flow amongst actors and the influence of their decision-making in Costa Rica's in water policy

One of the characteristics of water management in Costa Rica is the presence of both the public sector and civil society organizations as dominant actors, e.g. the Ministry of Environment and Energy (MINAE), Regulatory Authority for Public Services (ARESEP), the Costa Rican Institute of Aqueducts and Sewage (ICAA), which supplies fresh water for 50% of the population and the presence of approximately 1,542 Associations for Administration of Rural Aqueducts (ASADAS), which are distributed throughout the country and provide drinking water to 26% of Costa Rican people, in areas where the

ICAA cannot provide that service. The diagram in Figure 15.11 displays the analysis for official functions in strategic actors. The characterization of dominance is given by the presence of Power, Interest and the Legitimization (Chevalier, 2006).

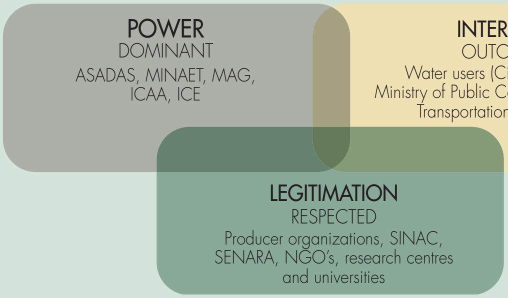


Figure 15.11 Venn Diagram of dominant, outcast and respected actors in Costa Rica's water management. *Source: LA-Costa Rica (2012).*

The decision-making in Costa Rican water management is strongly related to the official information flow amongst actors and thus the influence of these actors in the IWRM process. The result has been a convergence map (see Figure 15.12) with levels of power (high, medium and low). The upper red polygon contains academic institutions. The upper right green polygon contains civil society organizations such as NGOs supervising and executing management plans, i.e. actors with medium power, no actual vote in the decision-making process, but their opinion is taken in account. The purple polygon contains actors that regulate the availability of water for agriculture; and the brown polygon contains a critical mass of decision-making actors at the three levels of power: operators of domestic usage, hydroelectric and other productive activities.

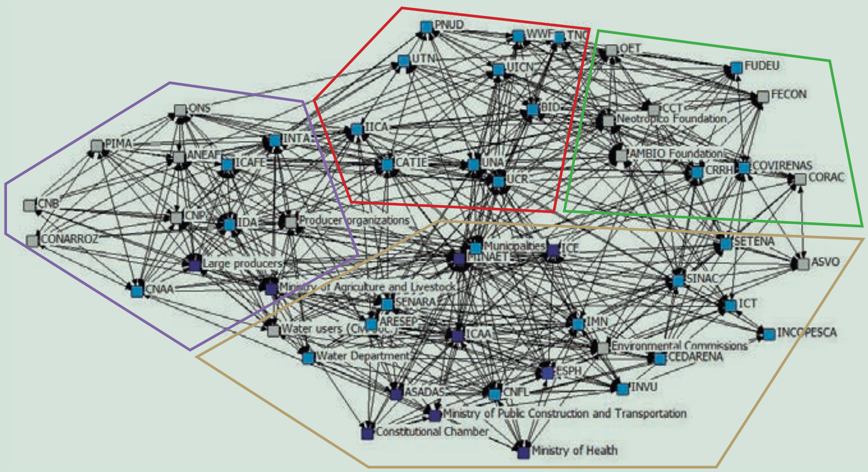


Figure 15.12 Social networks of actors in Costa Rica: connections, level of centrality and ease of access. *Source: Costa Rica FB National Report.*

15.4.2 Information technology for integrated management

Improved and more integrated water management should rely on the collection, provision and dissemination of more reliable and accurate data, to be transformed into better information, which in turn will yield better and more comprehensive water-related decisions. The key constraints and barriers to this approach are: first, the unavailability of systematic and consistent raw data compiled on adequate temporal and spatial scales; second, the lack of transparency of public bodies and private companies for sharing and allowing the open use of water data and finally, a lack of standardized methods for the audit and integration of water data; into more general accounting and decision systems. As a result, this absence of 'transparent' and assessed water information, in most countries, impedes regular reporting and evaluation of water resources and water-use trends (UN-Water, 2012b). The lack of water data and accounting and the asymmetry for different stakeholders remain pivotal issues to be tackled in IWRM. Regular demands for information come from institutions and regulators in the socio-economic, environmental or energy sectors looking for more effective and integrated data flows about water in order to monitor whether related policies are achieving the pursued goals in various dimensions. Further, there is also increasing pressure from private investors and businesses for clear and well-structured information in order to avoid or mitigate risks related to water services and water resources (see UN Global Compact CEO Water Mandate, 2007).

In LAC's least developed countries, the available funds for water activities are usually devoted to basic supply and the costs of data acquisition through conventional techniques are difficult to be met. In these cases, and also for richer countries, technological advancements could help to fill the gaps in water information via an improved cost-utility ratio. The growing availability of low-cost metering devices, the improvement in coverage and affordability of mobile handsets and the development of remote sensing (both in methodologies for generating specific data and an increased number of operating satellites) can help to monitor and record the status and dynamics of water and the environment. The potential applications of these technologies for IWRM include: the estimation of water use (especially for agriculture), the definition of water balances over large basins, the characterization of floods and other natural disasters, the analysis of water bodies' variability, the compiling of supporting information about soil moisture and groundwater levels and the monitoring of water quality (ESA, 2012; SELPER, 2012). Technology – from ground accurate sampling and conventional networks of remote sensing to ICT tools – is making the cost of water information more affordable and is becoming the key driver for a broader integration of water data and the transformation of a monopolistic, business-oriented system into a more transparent, open access and integrated vision of water information, thus benefiting IWRM.

15.5 Conclusion: IWRM as a means to a water security end?

IWRM runs the risk of being perceived as an elusive process – a nirvana (Molle, 2008) – unless the goals and targets are clearly established. Thus it could be useful to link IWRM as a process to the end goal of water security, defined as 'the sustainable availability of adequate quantities and qualities of water for resilient societies and ecosystems in the face of uncertain global change' (Scott et al., 2013). According to Allan (2003) the river basin became the central organizing unit in late modernity, even when there was evidence that global food trading processes were just as important as local hydrology in facing serious local water challenges. Yet IWRM can only be deployed if one aspect is recognized, i.e. that IWRM is seen primarily as a political process to forge and implement effective water sharing. To succeed, IWRM has to engage with what is politically feasible, thinking beyond the watershed and out of the water box, which in fact opens the realms of possibilities beyond the basin to address problems across many scales. This final concluding section will thus look at the six key policy and political ingredients for the IWRM process to succeed in the pursuit of water security.

First, one of the aspects relates to integrated planning and in particular to coordination with land use and urban planning. This was discussed in relation to footprints and HDI. For example,in the case of Brazil there is no forum for discussion of land use planning at the local level which generates serious problems with water quality, erosion and flooding. Here for example river basin authorities could provide a framework for management and planning. There is a similar case in Peru, where water councils formed on basin lines could become a permanent mechanism for coordination and dialogue between the different actors and stakeholders involved in the planning processes.

Second, from a more technical and functional perspective, a clear allocation of roles and responsibilities is very important. This must be accompanied by having the right means – financial and human – to implement policies and by fostering stable jobs, less exposed to political changes. In Peru, for example, the national and local water authorities at the moment have a lack of sufficient qualified personnel to deal with both technical and administrative issues. Brazil is similar: there is scope for additional training and institutional strengthening at all levels.

Third, in terms of economic and financial means, the case of Mexico shows there is scope for the introduction of incentives for the modulation of consumption patterns for all sectors (primary, secondary and tertiary). Furthermore, there is a need to think more deeply about the anthropo-hydrogeological cycle and the potential cost savings from internalizing ecosystem services such as storage provided by aquifers. Thus the logical sequence for IWRM could be based on strengthening the knowledge and capacity to fully record and monitor water uses, as well as to develop a holistic set of incentives targeted at the different uses.

Fourth, it is essential to play on one of the strengths of Latin America: its civil society, which at present might not be fulfilling its full potential and yet it is the key piece in the puzzle for strong political will. In a deepening of democratization processes, civil society is the cornerstone to strengthening the local population and giving a voice to local actors in shared management. Yet this also means looking at who are the main policy beneficiaries, as highlighted by levels of vulnerability to extreme events or political decisions when there are potential trade-offs e.g. in the case of food/energy. In Brazil, for example, as discussed in Chapter 14, a greater presence of local actors means a deeper questioning of inertias. Equally in Costa Rica the participation of different actors is low since there are no adequate or clear mechanisms that favour effective public participation. Oftentimes the public is informed but do not actually partake in decision making. Meanwhile in Peru the increased level of awareness about water scarcity – on the Peruvian Coast where most of the population lives – combined with clear signals of global warming, have contributed to strengthening conscience that freshwater is a scarce resource that has to be protected.

Fifth, a deeper level of institutionalization implies a modern water law, which includes key areas like the human right to water (see Chapter 11), economic instruments for a green economy and its full implementation (thus again political will). Political will could be reflected, for example, in a clear and explicitly stated water policy that identifies financial resources to be allocated (e.g. to water infrastructure) and presents clear policy and political goals at national level in order to incorporate other elements, beyond a purely technological paradigm, thereby acknowledging the resource base and its environmental functions as discussed in the section on green growth. Inevitably this will mean, on occasions, confronting vested interests, like for example in Mexico, where discussions with big users like livestock and industry need to occur in order to negotiate a reduction in their privileged incumbent position in terms of water consumption, towards more equitable use. In other cases, such as in Costa Rica would imply greater transparency, improved governability and further involvement of users in the decision on the balance of allocations, through the elimination of *Juntas Directivas* – made up by businesses to be replaced by a competition commission.

Finally, when IWRM is seen as a process it is fundamental to identify clear goals or targets as well as the sequencing or prioritization of reform (see Box 15.5). Along the lines of 'good enough governance' (Grindle, 2007; López-Gunn et al., 2012), it is about setting priorities with a clear commitment to follow through, with political priorities based on real problems with clear sequencing (Saleth and Dinar, 2004). For example, water quality and sanitation, in Brazil 21% of the population does not have access to basic sanitation (see Chapter 6). Meanwhile in Costa Rica only 4% of wastewater receives treatment. Yet the implementation of a legal decree on wastewater discharges could generate the resources needed to increase the level of treatment; an example of a virtuous circle mentioned above which relies on political will and the approval of a National Policy on Wastewater and Sanitation. Equally in Mexico a major step forward would be to expand the coverage for drinking water and sewerage. Therefore the anticipated SDGs (Sachs, 2012) in relation to water offer a golden opportunity for clear political goals and prioritization.

Political will, which comes from healthy public participation from the base of civil society and a broad civic culture, supported by outside pressure from multilateral organizations are two fundamental elements needed for IWRM to be fully implemented. It is about taking action in areas that have already had their problems diagnosed and which centre on three axes: issues of governability (institutionality, coordination, laws), infrastructure (both hard and soft), and sustainable and equitable use.

For IWRM to succeed in achieving the multiple goals of water security there must be a political will to take strong decisions that may upset the status quo and 'break away' from the traditional instated ways, facing obstacles from sectors and interests which are currently benefiting at the expense of society at large. The way forward is clear: water security through IWRM with a particular focus on social equity and environmental quality – the two pillars required for a resilient, robust future.

Box 15.5 Reflections on IWRM and water security

'IWRM in Costa Rica is understood as: comprehensiveness in resource management, economic value of water, equity in the distribution and sustainability in the use that does not compromise the future for Costa Ricans. IWRM would strengthen institutionality since it clarifies and defines a single institution as a front-runner thus defining leadership and policies. It also raises the different roles of other institutions (SENARA, ICAA, Ministry of Health, etc.) whilst additionally establishing legal, economic instruments (water charges) for resource management, monitoring, protection. Furthermore it also takes into account other areas such as capacity building, research, monitoring and the control of pollution. IWRM is a process by which ecosystems are administered, assigned, and protected and all sectors are integrated into coordinated management, from the local to the national level, from the business to the community level and from the public to the private sector, so as to ensure that every drop of water can be maximized and generate the greatest economic, social and environmental benefits. IWRM is a means to achieve water security. It is likely that there are other water management schemes that also target water security, but they will take more time, more resources, and more effort. Moving towards water security also means directing our steps towards food security, energy security, a reduction in poverty and ensuring growth with environmental sustainability, all of which are fundamental aspects of IWRM. IWRM and water security share the principles of efficient, sustainable and equitable water, thus fostering development, the eradication of poverty and the quality and quantity of the resource.' (Maureen Ballestero, Costa Rica)

'One of the major issues to be resolved is the quality of river water; the other is the need to generate resources for the management and the strengthening of local actors. It is also a strategic issue considering the key elements for water management: water as a human right, the importance to legislate on groundwater, economic instruments towards a green economy and so on. Water security is about meeting basic needs, ensuring food supply and protecting ecosystems. There is a great crossover between policies on water and sanitation, land use and urban planning and so in order to complete the planned cycle for water policy in terms of institutional and management aspects, such as quantity and quality, an essentially political solution is required alongside the political will to enforce it.' (Pedro Jacobi, Brazil)

'IWRM is not a specific action but a public administrative will for a better use of water resources, with or without considering other contexts. They are two different things: water security is a social concept with implications for the overall economy and the rights of citizens. IWRM is a set of rules and techniques for certain objectives, one of which may be water security, but water security, for what? With what priorities? To what degree? At what cost?' (Emilio Custodio, Spain)

'Water security is part of integrated water resources management. Water Security tries to establish a correct balance in the use of resources in terms of quality and quantity for the future, in a way that does not endanger sustainability. IWRM would also seek to maximize economic and social benefits to water users in harmony with the environment.' (Julio Kuroiwa, Peru)

'IWRM is a methodology and water security is a human need. Water security can be seen as an indicator for IWRM. Water security is a specific application that requires appropriate information.' (Maria Josefa Fioriti, Argentina)

'IWRM is a broader concept that, in a way, includes water security. In principle, IWRM must include issues related to water security. Water security traditionally has been treated without regard to the possibilities currently offered by virtual water trade, especially in the food sector. Both IWRM and water security should have many points in common. However, nowadays almost all water security plans only take into account the resources of the region in question, forgetting the great effect that virtual water import could have.' (Ramon Llamas, Spain)

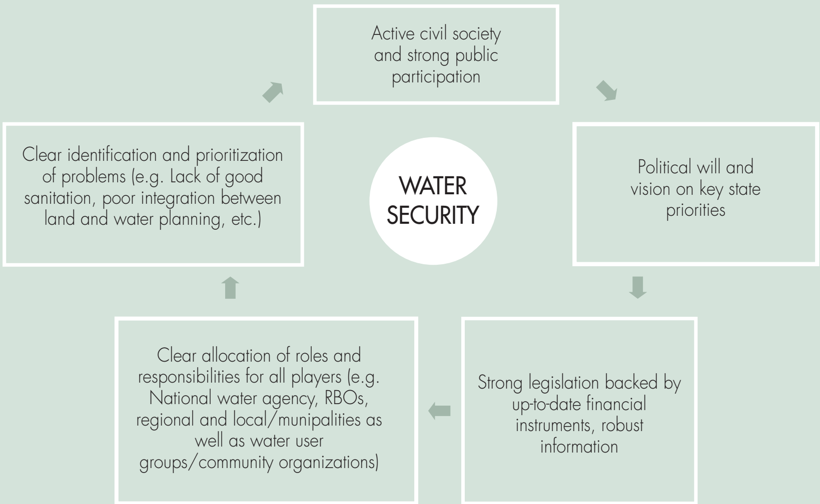


Figure 15.13 The WRM cycle to achieve water security. *Source: own elaboration.*

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