

This country profile was compiled by the OECD Secretariat and reflects information available as of March 2015. Further information and analysis can be found in the publication: OECD (2015) [Water Resources Allocation: Sharing Risks and Opportunities](http://www.oecd.org/fr/publications/water-resources-allocation-9789264229631-en.htm), OECD Studies on Water, OECD Publishing. Country profiles for all of the 37 allocation regimes in 27 OECD and key partner countries surveyed for this project are available for download at: <http://www.oecd.org/fr/publications/water-resources-allocation-9789264229631-en.htm>.

BRAZIL

Overview and highlights

In terms of water resources, Brazil is renowned as one of the most water abundant countries. However, adjacent to water abundant Amazon river basin, the Eastern Northeast Atlantic region is chronically afflicted by water shortages. The climate and rainfall patterns are the determining factors for Brazil's water resources.

Concerns about water shortages, deteriorating water quality, economic development and equity in access to water led to several water reforms since the establishment of the National Water Agency (ANA) in 2000 and the National Water Resources Council (CNRH) in 1998. Reforms included the institutionalisation of water allocation and permits for hydropower plants and fish farming complexes. Water charges were established in several basins and massive regularisation campaigns were conducted. In specific basins, water resources "compacts" were established, which changed existing rules of water allocation.

Key characteristics of the prevailing allocation regime for São Francisco River Basin include:

- The major water user is irrigated agriculture, accounting for 68% of total water demand. The current and future sustainability of water use within the basin is considered to be very important for the Brazilian economy;
- There is significant non-consumptive use, with six hydropower plants contributing to the national integrated energy system;
- Entitlements can be lost if not used in the given period;
- At present, the system is neither over-allocated nor over-used. However, there but there are local water conflicts in specific watersheds;
- Water entitlements are legally defined. However, there are still a large number of users without entitlements. Regularisation campaigns have been conducted;
- Water permits cannot be traded or leased, but can be transferred;
- An estimated 92% of all water users in the São Francisco river basin are considered "insignificant" and are not required to hold a permit to use water. However this use corresponds to only a small fraction of total water demand.

Key characteristics of the prevailing allocation regime for São Marcos River Basin include:

- Monthly mean streamflows vary from 40 m³/s in the dry season to 208 m³/s in the rainy season;
- Irrigated agriculture accounts for 91% of the total water demand;
- The limit in change in energy production was a key parameter in establishing the cap in water use;
- Water resources in the basin are currently considered "over-used". Rapidly increasing consumptive use for irrigation is generating tensions with hydropower production;
- Water entitlements are legally defined. However, there are still a large number of users without entitlements. Regularisation campaigns have been conducted;
- Only hydropower is charged for water use;
- In the case of droughts the order of priority uses comes into effect. Human and livestock consumption have the first priority. Highly efficient irrigated agriculture has second priority. Hydropower is the third priority use.

Legal and institutional setting for water allocation

Institution	Scale	Main Responsibilities
National Water Agency (ANA)	National	Implementation of the national water resources management system and regulation of water uses in federal water bodies. Planning, hydrologic monitoring, regulation (definition of rules and enforcement), issuing water permits in federal water bodies.
National Water Resources Council (CNRH)	National	Definition of general rules, deliberation on water conflicts.
State Water Agencies (OGE)	State	Regulation (definition of rules and enforcement) and issuing water permits in state water bodies.
State and Federal District Water Resources Councils (CERHs)	State	Consulting and deliberative bodies instituted by the States, with the duty of formulating the water resources policy on the respective federative unit level.
River Basin Committees (RBC)	River basin	To debate issues related with water resources management at the water basin level. Definition of water use priorities, approval of river basin plans, articulation among several institutions.
River Basin Agencies (RBA)	Basin	Technical and executive bodies that also act as the Executive Secretariat of the respective Basin Committee. Planning and technical studies to support the RBC.
Association of Water Users	River basin	Representation of water users.

Legal context for water allocation: Roman/ Statutory Law

Legal definition of ownership of water resources: Ground and surface water is publicly owned. Rivers crossing or serving as state or national boundaries, by Constitution, are considered under federal domain, while groundwater and all other surface water (except reservoirs built by the federal government) are considered under state domain.

Tracking water scarcity

A mapping exercise has been undertaken to identify areas where water scarcity is becoming a problem. The most recent studies include:

- *State of Water Resources in Brazil (2013)*
- *Atlas of Urban Water Supply (semi-arid region (2006, 2009), metropolitan regions (2009), southern region (2009), national (2011))*
- *Joint Technical Note no 2/2012/SPR/SRE-ANA(2012)*
- *National Water Resources Plan (2005)*

Allocation Regime Example: São Francisco River Basin

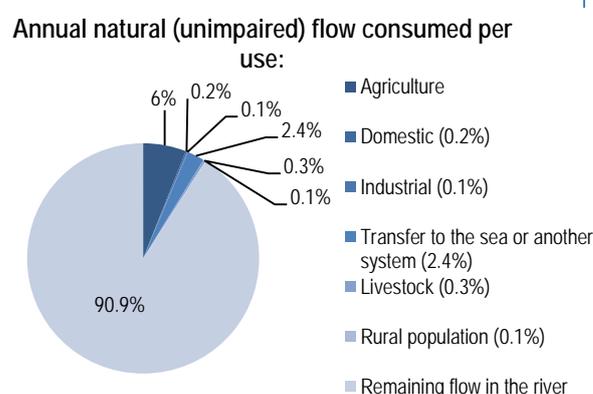
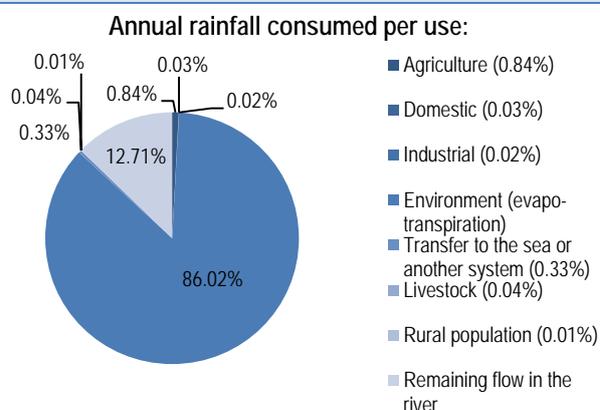
Physical features of the water resource

The Basin covers 636 920 km² (8% of Brazil), where more than 13.3 million people live. It spans 503 municipal zones in six states and the Federal Districts of Minas Gerais, Bahia, Goiás, Distrito Federal, Pernambuco, Alagoas and Sergipe.

The current and future sustainability of water use within the basin is very important for the Brazilian economy.

The flow rate is **partially managed or controlled**, as the flow rate can be controlled to some extent.

There is **significant non-consumptive use** in this water system since there are six hydropower plants, which supply a significant portion of the Brazilian electricity demand integrated to the national energy system. There is also a regional waterway system that depends on regularised flows from the Três Marias hydropower plant reservoir, located at the upstream portion of the São Francisco river.



Defining the available resource pool

Are limits on consumptive use defined? Yes

- In terms of the volume of water that can be abstracted, linked to a river basin management plan prepared by the river basin agency. The plan is primarily a guiding document, although it can define the priorities for water allocation and that definition is statutory.

Are environmental flows clearly defined? Yes

- Estimated with the Tennant method in most parts of the river (10% of long term average flow) and by an old environmental requirement of 1 300 m³/s at the mouth of the São Francisco river. Flow requirements for freshwater and territorial biodiversity are not considered.

Are there arrangements to deal with impacts of climate change? Under development

- The water resources plan will be reviewed soon by the river basin agency and it might consider potential impacts of climate change on water availability. ANA and Funceme established technical co-operation called "Adaptation of planning and water resources operation to climate change and variability in the São Francisco river basin". The study provides evaluations of the impacts of climate change in the basin.

What is the status of resource pool? Neither over-used nor over-allocated.

- Overall, the water system is neither over-allocated nor over-used, but there are local water conflicts in specific watersheds where the local water systems are over-used. Moreover, although water availability is sufficient to meet all water demand projected until 2025 (and probably well beyond), there are a number of legally approved entitlements which are not currently used. Those entitlements refer to large irrigation districts which are at various stages of development. The approved entitlements for 23 large irrigation districts were revised in 2010 in order to match the current water use with water permit conditions. Local water conflicts in federal water bodies have been managed through water resources compacts and negotiated water allocation processes.

Factors taken into account in the definition of the available resource pool

Factor	Taken into account?	If taken into account, how?
Non-consumptive uses (e.g. navigation, hydroelectricity)	✓	Flow requirement for navigation were considered where commercial navigation occurs. The cap of 260 m ³ /s was defined in order to limit impacts over hydropower production, among other reasons.
Base flow requirements	✓	Environmental flow requirements were considered in all river portions based on the Tenant method (10%-30% of long term streamflow).
Return flows (how much water should be returned to the resource pool, after use)	✓	Current and future water demand was estimated considering return flows as a fraction of water abstractions (80% for urban and industrial water supply systems, 10% for irrigation, 50% for animal consumption).
Inter-annual and inter-seasonal variability	✓	The water allocation plan was evaluated through a comprehensive simulation of the river basin water system (including all major reservoirs) were undertaken in order to evaluate its adequacy. The simulation considered the entire time series of streamflow records, covering the period from 1931 to 2003, and the average seasonality of water demands. The water allocation plan was defined in terms of annual water availability.
Connectivity with other water bodies	✓	The water allocation plan was defined for the entire river basin and therefore the connectivity of all water bodies was taken into account. The river basin was divided into a network of contributing areas defined by control points.
Climate change		

Entitlements to use water

Definition of entitlements	Characteristics of entitlements
<p>Are entitlements legally defined? Yes. They are defined in water resources plans. However, there are still a large number of users without entitlements. Regularisation campaigns have been conducted.</p> <p>Are private entitlements defined? Yes, to individual users. Water permits or entitlements can be issued to both public and private parties. The water permit does not transfer the ownership of water, but allows the use of water for a specific period of time, under specific conditions.</p> <p>Nature of entitlement: Defined as the purpose that the water may be used for; the maximum area that may be irrigated; the maximum (or total) volume that may be taken in a given period. Water entitlements are unbundled from property titles.</p> <p>Period granted for: A term of a number of years depending on the type of use, with the expectation of periodic renewal.</p>	<p>If the entitlement is not used in a given period, the entitlement will be lost (e.g. "use it or lose it").</p> <p>Are entitlements differentiated based on the level of security of supply (or risk of shortage)? No.</p> <p>Is there a possibility to trade, lease or transfer entitlements? Yes. Water permits cannot be traded or leased, but can be transferred.</p> <p>Are allocations (the amount that can be taken at any point in time) managed separately from entitlements? As a general rule, water allocations coincide with water permit conditions. However, in special situations, water allocation can vary from year to year and from season to season according to the water availability. The variation in water allocation is defined based on direct discussion with water users. The process is referred to as "negotiated water allocation".</p>

- 10 years: irrigation of areas until 2,000 ha; industry with maximum withdraw flow of 1 m³/s; aquaculture; animal consumption; mining; others;
- 20 years: irrigation of areas over 2,000 ha; industry with maximum withdraw flow over 1 m³/s;
- 35 years¹: dams of flood control or hydropower generation and others hydraulic works; public water supply and sanitation.

State agencies have their own rules defining how long entitlements are valid for.

Return flow obligations: Specified. For federal rivers, users are obligated to install measuring devices.

Can entitlements function as a financial instrument? Banks usually require water permits from water users in order to concede loans. This procedure ensures that private parties will have adequate access to water when developing their enterprises. Thus, the water permits associated with loans function as a financial instrument to assure that all investments will have sustainable access to water.

Type of users not required to hold a water entitlement to abstract water: Water uses considered “insignificant” and small rural settlements are not required to hold water permits in order to use water. The water resources plan defines which water users are considered insignificant. In absence of that definition, ANA and state government agencies have established minimum water abstractions below which the user is considered insignificant. They vary by river basin, according to water availability.

A comprehensive survey estimated that 92% of all water users in the São Francisco river basin are insignificant, yet this corresponds to only a small fraction of total water demand. The increase in water demand from these users is not expected to impact on water availability. The control of these water users through permits would just increase the administrative burden, without any effective improvement of water management.

Requirements to obtain a new entitlement or to increase the size of an existing entitlement: Assessment of impacts on third parties.

Abstraction charges

User category	Abstraction charge?	Basis for charge	Reflects water scarcity?
Agriculture	✓	Annual water volume withdrawn and consumed (metered or declared)	
Domestic	✓		
Industrial	✓		
Energy production (not including hydro power)	✓		
Hydro power	✓	Energy production (6.75%)	
Other. Specify: All water users that are subjected to water permits are required to pay for water use.	✓		

¹ For those without grant or administrative authorisation act. For those with grant or administrative authorisation act, the period matches to the corresponding act.

Dealing with exceptional circumstances

Distinction between the allocation regimes used in “normal” and extreme/ severe water shortage times? Yes, the order of priority uses comes into effect.

How is the amount of water made available for allocation adjusted: In the São Francisco river basin, the amount of water made available for allocation does not vary from time to time since total water demand is far below water availability. In specific river basins (e.g. Verde Grande) and water bodies (e.g. isolated reservoirs) in critical condition, the amount of water made available for allocation varies each year and each month, according to hydrological conditions.

Definition of “exceptional” circumstances: There are not defined.

Legal bodies declaring the onset of “exceptional” circumstances: The President of Brazil has this authority by Law.

Pre-defined priority classes²



Monitoring and enforcement

Responsible authority: ANA.

Types of withdrawals monitored: (above a specified level of usage) agriculture, domestic, industrial, energy production, transfers to the sea or another system.

Monitoring mechanisms: metering for agriculture, domestic and industrial. Hydropower is monitored.

Sanctions: Formal warning, fines, temporary embargo and permanent embargo.

Conflict resolution mechanisms? Yes. Water conflicts are first brought to the river basin committee for resolution. If not resolved, the conflict can be brought to the attention of the state council of water resources or the national council of water resources. Conflicts between state water resources council are resolved by the national council of water resources.

² The river basin committee has defined that water users located inside the river basin have higher priority than water users located outside, except for water demand for human consumption.

Allocation Regime Example: São Marcos River Basin

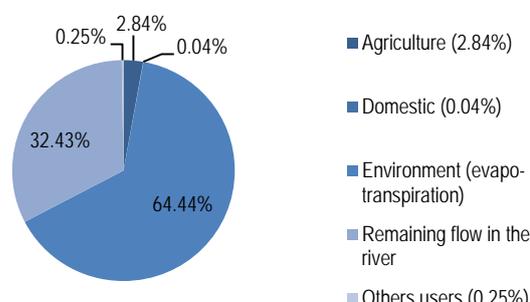
Physical features of the water resource

The Basin drains 6 700 km², spanning areas in the Federal District, Goiás and Minas Gerais. The hydrological cycle runs from October to September and presents a marked dry season from June to September. Monthly mean streamflows vary from 40 m³/s in the dry season to 208 m³/s in the rainy season.

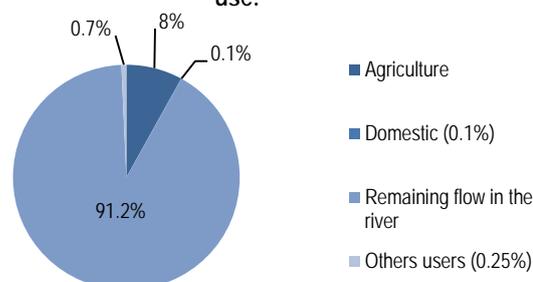
The **flow rate is partially managed or controlled**, as the flow rate can be controlled to some extent.

Significant non-consumptive use in this system is related to two hydropower plants, Batalha (under construction) (52MW), and Serra do Facao (210MW). Although Batalha represents only 0.06% of the total hydropower capacity in the country, there is a cascade of 9 hydropower dams downstream from Batalha that represent 22.2% of the total capacity (including Batalha).

Annual rainfall consumed per use:



Annual natural (unimpaired) flow consumed per use:



Defining the available resource pool

Are limits on consumptive use defined? Yes

- This is a limit on the volume of water that can be abstracted. The definition of water availability in allocation plans varies by river basin and water body (in the case of state rivers and groundwater, each state has specific procedures to define the available resource pool). In the São Marcos basin, water availability for consumptive use was set by the water resources compact at 8.7 m³/s for the entire basin upstream of Batalha. This limit was established based on projections of future water demand and requirement flows for hydropower production.³ The limit in change in energy production was a key parameter in establishing the cap in water use consumption upstream of Batalha. There is a planning document produced by the river basin agency, which is primarily a guiding document, but it can also define the priorities for water allocation (this definition is statutory).

Are environmental flows clearly defined? No.

Are there arrangements to deal with impacts of climate change? No.

- This is still a challenge to be considered, however no climate change impacts are foreseen in the near future.

³ By Law, the assured flow for energy production can only vary by 5% every five years and by 10% for the entire period of the concession contract.

What is the status of resource pool? Over-used.

- The water resources compact established a maximum irrigated area of 63 500 ha, which would correspond to the cap of 8.7 m³/s of water consumption. However, in 2013, the total irrigated area was estimated at 70 852 ha and has been growing at a rate of 2 634 ha/year. There have been reports of local conflicts between farmers, but the major conflict is the impact of this rapidly growing consumptive use on hydropower production.
- Planned measures to address this over-use, include the improvement of the water permit systems, the improvement of hydrologic and water demand studies, the regularization of water users, the improvement of interactions among state agencies and ANA, incentives to use water efficiently and a review of the water resources compact.

Factors taken into account in the definition of the available resource pool

Factor	Taken into account?	If taken into account, how?
Non-consumptive uses (e.g. navigation, hydroelectricity)	✓	The cap of 8.7 m ³ /s was defined in order to limit impacts of consumptive uses on hydropower production at Batalha.
Base flow requirements		
Return flows (how much water should be returned to the resource pool, after use)	✓	Return flows are considered in the estimates of water consumption (80% for urban and industrial water supply systems, 20% for irrigation, 50% for animal consumption).
Inter-annual and inter-seasonal variability	✓	The estimate of water demand for irrigation considers its inter-seasonal variability.
Connectivity with other water bodies	✓	The water allocation plan was defined for the entire river basin upstream of Batalha and therefore, the connectivity of all water bodies was taken into account.
Climate change		

Entitlements to use water

Definition of entitlements	Characteristics of entitlements
<p>Are entitlements legally defined? Yes. All entitlements are legally defined, but there are still a large number of users without entitlements.</p> <p>Are private entitlements defined? Yes, to individual users. Water permits or entitlements can be issued to both public and private parties. The water permit does not transfer the ownership of water, but allows the use of water for a specific period of time, under specific conditions.</p> <p>Nature of entitlement: Defined as the purpose that the water may be used for; the maximum area that may be irrigated; the maximum (or total) volume that may be taken in a given period. Water entitlements are unbundled from property titles.</p> <p>Period granted for: A term of a number of years depending on the type of use, with the expectation of periodic renewal. 10 years: irrigation of areas until 2,000 ha; industry with maximum withdraw flow of 1 m³/s; aquaculture; animal consumption; mining; others; – 20 years: irrigation of areas over 2,000 ha; industry with</p>	<p>If the entitlement is not used for 3 years, it can be suspended (e.g. "use it or lose it").</p> <p>Are entitlements differentiated based on the level of security of supply (or risk of shortage)? No.</p> <p>Is there a possibility to trade, lease or transfer entitlements? Yes. Water permits cannot be traded or leased, but can be transferred.</p> <p>Are allocations (the amount that can be taken at any point in time) managed separately from entitlements? As a general rule, water allocations coincide with water permit conditions. However, in special situations, water allocation can vary from year to year and from season to season according to the water availability. The variation in water allocation is defined based on direct discussion with water users. The process is referred to as "negotiated water allocation".</p> <p>Can entitlements function as a financial instrument? Banks usually require water permits from water users in order to concede loans. This procedure ensures that private parties will have adequate access to water when developing their enterprises. Thus, the water</p>

<p>maximum withdraw flow over 1 m³/s; – 35 years⁴: dams of flood control or hydropower generation and others hydraulic works; public water supply and sanitation.</p> <p>State agencies have their own rules defining how long entitlements are valid for.</p> <p>Return flow obligations: Specified. For federal rivers, users are obligated to install measuring devices.</p>	<p>permits associated with loans function as a financial instrument to assure that all investments will have sustainable access to water.</p>
<p>Type of users not required to hold a water entitlement to abstract water: Water uses considered “insignificant” and small rural settlements are not required to hold water permits in order to use water. The water resources plan defines which water users are considered insignificant. In absence of that definition, ANA and state government agencies have established minimum water abstractions below which the user is considered insignificant. They vary by river basin, according to water availability. There are no estimates available, but “insignificant” uses are thought to represent only a fraction of the total water demand.</p> <p>Requirements to obtain a new entitlement or to increase the size of an existing entitlement: Assessment of impacts on third parties. The current procedures adopted by ANA and state agencies do not allow any impact of new water permits on existing ones. Exceptions occur when regularization campaigns are conducted, which result in revisions of all current water permits and in the issuing of collective permits for all existing users. Also, new water users requiring water permits might motivate the development of water resources compacts, which can include revisions of current water permits.</p> <p>Water users can require changes in any aspect of their water permits. The requests for change must be submitted to ANA or state government agencies and must pass through technical and administrative analysis.</p>	

Abstraction charges

User category	Abstraction charge?	Basis for charge	Reflects water scarcity?
Agriculture			
Domestic			
Industrial			
Energy production (not including hydro power)			
Hydro power	✓	Energy production (6.75%)	
Other			

Dealing with exceptional circumstances

<p>Distinction between the allocation regimes used in “normal” and extreme/ severe water shortage times? Yes, in the case of droughts the order of priority uses comes into effect.</p>
<p>How is the amount of water made available for allocation adjusted: In the São Marcos basin, water is allocation on an annual basis and thus, seasonal variations are allowed.</p>
<p>Definition of “exceptional” circumstances: There are not defined.</p>

⁴ For those without grant or administrative authorisation act. For those with grant or administrative authorization act, the period matches to the corresponding act.

Legal bodies declaring the onset of “exceptional” circumstances: The President of Brazil has this authority by Law.

Pre-defined priority classes⁵

According to the Law, water demands for human consumption and livestock have the priority for access to water in the case of droughts. The river basin committee has not defined priorities of water use. However, the water resources compact has implicitly defined the following priority classes:



Monitoring and enforcement

Responsible authority: ANA.

Types of withdrawals monitored: (above a specified level of usage) agriculture, domestic, industrial, energy production, transfers to the sea or another system.

Monitoring mechanisms: metering for agriculture, domestic and industrial. Hydropower is monitored.

Sanctions: Formal warning, fines, temporary embargo and permanent embargo.

Conflict resolution mechanisms? Yes. Water conflicts are first brought to the river basin committee for resolution. If not resolved, the conflict can be brought to the attention of the state council of water resources or the national council of water resources. Conflicts between state water resources council are resolved by the national council of water resources.

⁵ The river basin committee has defined that water users located inside the river basin have higher priority than water users located outside, except for water demand for human consumption.