DISCUSSION PAPER

# 262

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## ABSTRACT

This paper aims to report the construction process of Environmental Economic Accounts for Water in Brazil and its institutional articulation between national and international public and private institutions, who participated in this construction effort. It also presents the current stage of construction of the Environmental Economic Accounts for Forest in Brazil.

**Keywords**: SEEA; water; forest; Brazil.

## 1 INTRODUCTION

Brazil's Environmental Economic Accounts represent a multi-year effort to incorporate the use of natural resources theme through the country's economic activities. The strong connection between SEEA (System pf Environmental-Economic Accounting: Central Framework) and the SNA (System of National Accounts) provides an important information base for the extraction of different sets of basic macroeconomic statistics that allow indicators focused on the environment to be seen within a context more oriented towards the economy and, therefore accessible to a wider audience. Understanding the relationship between economy and environment came to help decision-making processes of policy makers.

The construction of a System of Environmental Economic Accounts in Brazil represents a step forward in the sense of incorporating essential elements that reflect the contribution of the use of natural resources in each territory to the economic activity of that space.

Attributing a value to natural resources, such as water, forest, or carbon stock, has always proved to be extremely difficult and complicated. The valuation of natural capital is an instrument that seeks to estimate an economic value or, in other words, to price the goods and services provided by nature. For this it is necessary to stipulate a plausible economic value, this is done through the relationship between what the environment can provide and the value of other goods and services already existing in the economy. With the economic valuation of natural capital, it is possible to attribute a monetary value to the resources of the environment.

The Environmental Economic Accounts are a form of measurement and analysis structured by a set of tables, which allows understanding the interactions between the environment and the economy, supporting planning and decision-making for public and business policies. This structured set of information is designed in an integrated manner with the National Accounts System, which allows planners and decision makers in a country or region to monitor the extent to which economic activity mobilizes resources in the generation of monetary wealth.

This paper aims to report the construction process of Environmental Economic Accounts for Water in Brazil and its institutional articulation between national and international public and private institutions, who participated in this construction effort. It also presents the current stage of construction of the Environmental Economic Accounts for Forest in Brazil.

The first section consists of this brief introduction. The second section presents the historical background of the implementation of Environmental Economic Accounts in Brazil and how studies and initiatives that have been carried out in Brazil have evolved since environmental accounting and its relationship with GDP gained importance. The third section brings the construction of an institutional platform for the implementation of SEEA in Brazil, as well

as bottlenecks and challenges transposed in this process. The fourth section shows the relevance of the Environmental Economic Accounts for Water (SEEA-Water) to the National Water Resources Policy (PNRH). The fifth section presents the Environmental Economic Accounts for Water (SEEA-Water) in Brazil: First Results (2013-2017). In the sixth section, the process of building the Environmental Economic Accounts for Forestry in Brazil is discussed. The seventh and final section ends with a brief conclusion.

## 2 HISTORICAL BACKGROUND TO THE IMPLEMENTATION OF ENVIRONMENTAL ECONOMIC ACCOUNTS IN BRAZIL

Since the approval of the United Nations Statistics Committee at its 43rd session in March 2012, Brazil systematized efforts for the applicability of the United Nations Statistics Division (UNSD) methodological guidelines in the country through the construction of Environmental Economic Accounts. However, it must not be forgotten that efforts for national environmental accounting, as well as for the use of natural resources accounting by different sectors that are part of the Brazilian economy, were already the focus of attention and efforts with a greater or lesser degree of organization since the Rio 92 Conference, as we will see below.

The start of the development of Environmental Economic Accounts in Brazil dates back to the 1990s, in which the first efforts were made to build Environmental Economic Accounts in Brazil, which were carried out within the scope of the SNA-93 satellite accounts and the UNSD's Integrated System of Environmental Economic Accounts (SICEA) and also the Matrix of National Accounts including Environmental Accounts (NAMEA) as theoretical framework. Researchers and technicians from several Brazilian Public Administration bodies (IBGE and Ipea) and important universities (UFRJ, UnB, Unicamp, USP, FGV, among others) participated in these contributions, which is exemplified in the work done by Young and da Motta (1995). Based on the structure of the SNA, the SICEA aimed to identify economic transactions related to natural resources (conspicuously defensive expenses) by relating environmental variables (expressed in physical units) to economic variables (expressed in monetary units).

At IBGE, at that time, the efforts to methodologically incorporate the environment into the country's economic statistics led the Research Directorate to create an area focused on this issue in the late 1990s. The environmental dimension in the national accounts system was addressed by IBGE in the discussion text 47/May 1991 (Mueller, 1991). At the same time, Ipea incorporated the methodological advances in case studies in Brazil (da Motta, 1995). According to de Carlo (2000), as a first step, IBGE created an environment nucleus at the National Accounts Department with the purpose of developing Environmental Accounts, satellites accountings of the current national system focused in demonstrating, straight forwardly, the

relationship between economic development and depletion of natural resources/degradation of the environment.

This nucleus already had contact with the recent manuals of the System of Integrated Environmental Economic Accounts – SICEA (version 1993), showing its historical context and structure, the main experiences and discussions related to its implementation, as well as its application in the measurement of the Sustainable Development. In relation to ecosystem accounts, works on natural capital and ecosystem services stands out (Andrade and Romeiro, 2009).

Despite having a qualified technical staff and willingness to carry out the challenge of preparing Environmental Economic Accounts, the theme didn't advance much until September 2009, when IBGE organized the International Seminar on Environmental Statistics and Environmental Economic Accounts in Rio de Janeiro. At that Seminar, IBGE proposed that the environmental accounts should start with the Environmental Economic Accounts for water. This decision was motivated in large part by the country's progress in the production of information on water resources and was essential to become possible an institutional partnership with the National Water Agency (ANA) and the Ministry of the Environment (SRHU/MMA).

The database of the Water Resources Situation Report in Brazil, prepared annually by ANA since 2009, that was presented at the referred Seminar, was adopted as the main source of information on water resources for the SEEA-Water. Following the event, IBGE proposed the creation of a Committee for Environmental Economic Accounts for Water, initially involving the Ministry of the Environment (SRHU and ANA) and the Ministry of Planning, represented by IBGE. The proposal was reinforced by ANA at the International Seminar on Water Accounting Methodologies, held in November 2011 in Brasilia.

## 3 THE CONSTRUCTION OF AN INSTITUTIONAL PLATFORM FOR THE IMPLEMENTATION OF WATER ACCOUNTS IN BRAZIL: BOTTLENECKS AND TRANSPOSED CHALLENGES

After the first attempts at the institutional arrangement for the Environmental Economic Accounts for Water (WATER ACCOUNTS), Brazil institutionalized the coordination of IBGE in 2012, together with a partnership between ANA and the Secretariat of Water Resources and Urban Environment of the Ministry of the Environment (SRHU/MMA) that was formalized as a framework for the preparation of the Accounts.

The trajectory of the development of the WATER ACCOUNTS in Brazil, since then, can be briefly divided into three stages, each with different specific objectives: i) the first stage was the project proposal and institutional arrangement for its development; ii) the second stage

focused on training and interinstitutional technical exchange; and iii) the third stage was the preparation of the first results including hybrid tables.

The first stage was concluded with the signing of an interministerial ordinance[1] in 2012, between the Ministry of Planning, Budget and Management (MPOG) and the Ministry of Environment (MMA), which created the Committee for Economic Environmental Water Accounts, which objective was the preparation of the EEA (WATER ACCOUNTS) in Brazil, with observations and adaptations to the international recommendations and good practices on the subject, as they were recommended by the United Nations Statistics Commission (UNSD). At this stage, it was essential to build a structure with two forces: the executive group and the management committee. The executive group was in charge of adapting the UNSD methodology to the Brazilian reality and the availability of data, while the management committee was in charge of the project's feasibility through institutional agreements, cooperation and financing.

The second stage involved training and technical exchange between IBGE, ANA and MMA. The stage started in September 2012, when the first meeting took place to discuss the participation of each institution in the development of the Accounts. IBGE itself needed greater integration between the area of geoscience, which took care of the stocks of natural resources, and the directorate of economic research, which accounts for GDP and other economic indicators. In the following years, the National Seminar on the Implementation of Environmental Economic Accounts (2013), the Course on Environmental Economic Accounts for Water (UNSD) (2013), the International Seminar on Environmental Economic Accounts for Water (2014) with UNSD/UN and the Environmental Kangaré Course, focusing on WATER ACCOUNTS, taught by IBGE in 2014. In this stage, technical knowledge was harmonized among the technicians of the institutions involved: teaching economics to hydrologists and hydrology to economists. Technicians from IBGE, MMA and ANA participated in 2015 in the Training Program on the Central Structure of the Economic-Environmental Accounting System for Latin America and the Caribbean, in Santiago (Chile), organized by the Economic Commission for Latin America and the Caribbean (ECLAC).

Also, in 2015, the TEEB Regional-Local Project organized a workshop to discuss the proposal of a component in the Project aimed at supporting the process of preparing Environmental Economic Accounts in Brazil. The proposal, addressed to the German government, was approved in 2016 for implementation until May 2019. The completion of the second stage was marked by technical assistance provided by ECLAC in November 2016, which was attended by two international experts[2] invited for technical assistance on doubts of national technicians aiming at the correct filling of a first national version of the Tables of Resources and Uses Physics and

1. Interministerial Ordinance No. 236 (updated by IBGE Ordinance – 597/2015).

2. The following training courses were offered in SEEA-Water by Ricardo Martinez Lagunes and Michael Vardon.

Stocks of Brazil, base year 2013, which had been prepared by technicians from ANA, MMA and IBGE. The technical assistance report (Martínez-Lagunes, 2017) ended the stage in May 2017. On this stage there was also made efforts to disseminate the knowledge obtained by preparing the edition of SCEA in Portuguese, which was coordinated by Kristina Taboulchanas (ECLAC).

The third stage, initiated after the technical assistance (May 2017), involved the general review of the tables (Physical Supply and Use Table – PSUT[3] and Hybrid Supply and Use Table – HSUT[4]), identification of existing gaps and the preparation of a historical data series, aiming at the consolidation of WATER ACCOUNTS results. The work was carried out by the technical team of ANA, MMA and IBGE in 2017, with the support of short and long-term consultants from the "TEEB Project". These technical contributions to the process occurred with the combined efforts of SBIO/MMA and German Cooperation (GIZ GmbH) with IBGE and the other institutions that were part of the process of preparing WATER ACCOUNTS in Brazil.

This third stage ended in March 2018 when the publication "Environmental Economic Accounts for Water in Brazil" (WATER ACCOUNTS) was launched in the World Water Forum. This publication, institutionally signed by MMA, ANA and IBGE, was the result of the articulation and collaboration of these institutions, which for five years (2013 to 2017) allocated material and human resources so that this important achievement was accomplished.

It is important to highlight the participation and promotion of several public and private international organizations that made it possible to build the Environmental Economic Accounts for water in Brazil, namely: UNSD/UN, ECLAC, GIZ, GITEC/Universität Wien/EcoConsult and UFRJ consortium.[5]

The box below summarizes the main challenges and the respective solutions found for the effective implementation of the Water Accounts in Brazil.

3. The different physical flows – natural inputs, products, and waste – are placed within the framework of a table of resources and uses; and from that starting point, the measurement of physical flows can be expanded and reduced to allow focus on a variety of different materials or specific flows.

4. The integration of resource and usage tables in physical and monetary terms is centered on the common use of classifications and terminology for measuring product flows and on the use of common boundaries between the economic system and the environment. Consequently, flows recorded in monetary terms that focus on the exchange of products between economic units are, in general terms, the same set of flows of products measured in physical terms.

5. Federal University of Rio de Janeiro (UFRJ).

## BOX 1

### Challenges and solutions of water accounts in Brazil

| Challenges | Solutions |
|---|---|
| Lack of knowledge about SEEA-Water methodology among decision makers in Brazil. | International seminar held by UNSD in 2009 to raise awareness among Brazilian authorities. |
| Definition of which Economic Environmental account should start the process. | Seminars to disseminate methodologies to institutions and agents in which it was decided that water theme would start. |
| Awareness of the need to implement SEEA-Water by decision makers. | Participation in RIO + 20. |
| Construction of an institutional platform involving several Federal Public Administration bodies. | Interministerial ordinance between MMA and MP. |
| Lack of coordination between the Management Group (with decision-making power, but without technical knowledge) and the Executive Group (with technical knowledge, but without decision-making power). | Informal participation of technicians in the management group and strategic presence of some directors in the executive group. |
| Need for technical harmonization between knowledge of Hydrology and Economics (National Accounts). | Teaching basic knowledge of Hydrology to economists (through workshops and work meetings) and teaching Economics to Hydrologists (workshops and courses like Kangaré). |
| Internalization of SEEA Water methodology. | Meetings, workshops and seminars. |
| Difficulty in conceptual understandings: different methodological perspectives of flow and stock in the SEEA-Water manual and the engineer's approach. | Exchange of international experts to resolve doubts when filling out the physical and hybrid tables. |
| Institutional setbacks within the MMA due to management changes in the middle of the process of preparing the Environmental Economic Accounts. | Performance of the executive group to raise awareness of the need to continue the process with arguments about the importance of the SDGs, the proximity of the World Water Forum and the performance of other MMA secretariats. |
| Institutional setbacks at IBGE: shared coordination between two directorates Economic Director and Directorate of Geosciences. | Presidency decision and progress on filling the tables with the help of international consultants and ECLAC. |
| Institutional challenges at the National Water Agency (ANA): Incorporation of SEEA-Water into a specific board. | At ANA the accounts were under the responsibility of the Presidency. |
| General Institutional challenges: lack of synchrony about the importance, periodicity and allocation of human and material resources, to define priority in actions due to different perceptions about the benefits of results for each organization. | Commitment of the technicians involved, the existence of an institutional framework (interministerial ordinance) and the translation of the manual to disseminate the importance of building the SEEA for the PNRH and PPA. |
| Lack of consensus on the form and source of financing. | Dialogue between technicians and decision makers in the institutions involved. |
| Lack of human resources and project budget fully dedicated to tasks. | Participation of GIZ that financed and coordinated the process of selecting technicians to work at IBGE. |

Authors' elaboration.

## 4 RELEVANCE OF ENVIRONMENTAL ECONOMIC ACCOUNTS FOR WATER (SEAA) TO THE NATIONAL WATER RESOURCES POLICY (PNRH)

The institutional effort to build SEEA in Brazil resulted from the diagnosis made by the managers involved of the important links and uses of Water Accounts in the National Water Resources Plan (PNRH). Examples of these linkages include the management of water scarcity and the monitoring of indicators for Sustainable Development Goal – 6 (SDG 6).

The WATER ACCOUNTS will enable the development of analytical instruments aimed at establishing quantitative scenarios of water resources and the analysis of the impact of relevant changes posed by public policies: such as the development of models that will allow assessing the macroeconomic consistency of the quantifications to be undertaken and the impacts on natural resources associated with the country's national/regional development.

The construction of these models that were implemented and/or provided with information derived from the SEEA (and used for the evaluation of public water resources policies) will enable: i) Construction of a Computable General Equilibrium Model (CGE), for the set of national macro-regions and for products intensively using more of the country's water resources; ii) Analysis of the location pattern of the main water-intensive activities; and iii) Study on the impacts of macroeconomic and sectoral policies on water resources.

## 5 ENVIRONMENTAL ECONOMIC ACCOUNTS FOR WATER (SEEA-WATER) IN BRAZIL: FIRST RESULTS (2013-2017)

The SEEA for the 2013-2017 period presented the following tables:

- *Stock Tables* for the period from 2013 to 2017: showing the additions and subtractions to the country's water resources stocks;
- *Physical TRU* for the period from 2013 to 2017: which present water catchment withdrawals and water flows from the environment to the economy, from the economy to the environment and between economic activities;
- *Hybrids TRU* for the period from 2013 to 2017: which relate the monetary values of water production and consumption with the respective physical volumes, in addition to explaining the water flows that do not have direct correspondence with monetary values, such as water catchment for own use; and
- *Table of Indicators* that summarizes the data presented in the previous tables in stock, physical and hybrid indicators such as: i) Total Renewable Water Resources per capita; ii) total use of water; iii) household water use per capita; and iv) supply water cost per volume of treated water supplied.

The reader will find the complete tables of the Environmental Economic Accounts for Water (WATER ACCOUNTS) in Brazil: First Results (2013-2017) on the IBGE website.[6]

## 5.1 Environmental Economic Accounts for Water (WATER ACCOUNTS) in Brazil (2013-2017)

The economic activities considered in the TRU include the entire sections of the National Classification of Economic Activities – CNAE 2.0 which is equivalent to the Section level of the *Clasificación Industrial Internacional Uniforme de Todas las Actividades Económicas* – CIIU (International Standard Industrial Classification of all Economic Activities – ISIC). However, due to the availability of data on water use for some economic activities such as Services and Commerce, the following grouping between Sections of CNAE 2.0 was adopted in this publication:

- agriculture, livestock, forestry, fishing and aquaculture (Section A);
- extractive industries (Section B);
- transformation and construction industries (Sections C and F);
- electricity and gas (Section D);
- water and sewage (Section E except Divisions 38 and 39 which comprise "Material recovery and the collection, treatment and other waste management services"); and
- other activities (Sections G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U and Divisions 38 and 39 of Section E).

The Stock Tables depict the inflows (additions) and outflows (subtractions) of water from the environment that affect the existing volumes of surface water, groundwater or soil water between the beginning and the end of a year. Incoming flows are composed of precipitation, return from economic activities, inflows of water from other countries upstream, inflows of other resources into the territory and inflows from other regions. Output flows include fresh catchments, evaporation and evapotranspiration, as well as outflows to other countries and regions downstream, to the sea and other resources in the territory.

## 5.2 Evolution of water stocks in Brazil

The evolution of water stocks (in millions of $hm^3$) in Brazil from the period between 2013-2017 is presented below. From table 1 (obtained from the IBGE SEEA inventory table from 2017), it can be noted, for example, that the catchment in 2017 was 3.7 million $hm^3$, that were allocated for household consumption and economic activities. This number shows the high availability potential of Brazil, estimated at about 12% of the availability of fresh water on the

6. Available at: <https://bit.ly/3GsrAzd>.

planet. However, due to the country's geological hydro diversity, the natural distribution of water resources is not spatially homogeneous: the North Region concentrates 80% of the available water but concentrates only 5% of the total population while the regions close to the Atlantic Ocean have more than 45% of the population, however, less than 3% of the country's water resources. It is also noted that in 2017 the total inflows in the country's water stocks (precipitation, returns to the environment, inflows from countries upstream and other resources into the territory) were approximately 27.2 million $hm^3$, while the total output (evapotranspiration, capture, output to downstream countries, output to the sea and output to other resources in the territory) was 33.3 million $hm^3$, which accounts for only 11.1% of water's total that was "consumed" by the Brazilian economy.

**TABLE 1**

**Evolution of inflows and outflows in the country's water stocks (2013-2017)**

| | Water stocks in Brazil in millions of $hm^3$ | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Input in the country's water stocks | Precipitation | 15.15 | 14.92 | 13.49 | 13.14 | 13.87 |
| | Return | 3.09 | 3.10 | 3.27 | 3.31 | 3.39 |
| | Inflow of other countries upstream | 2.59 | 2.95 | 3.07 | 2.60 | 2.71 |
| | Inflow of other resources into the territory | 8.35 | 8.87 | 8.19 | 7.40 | 7.17 |
| | **Total inventory additions** | 29.18 | 29.85 | 28.04 | 26.46 | 27.16 |
| Output of water stocks in the country | Evapotranspiration | 9.24 | 9.25 | 9.09 | 9.06 | 8.99 |
| | Catchment | 3.39 | 3.41 | 3.59 | 3.62 | 3.69 |
| | Outflow to other downstream countries | 0.74 | 0.72 | 0.90 | 0.79 | 0.86 |
| | Outflow to the sea | 8.03 | 9.14 | 8.26 | 6.49 | 7.54 |
| | Outflow to other resources in the territory | 14.42 | 14.69 | 12.77 | 11.66 | 12.19 |
| | **Total inventory reduction** | 35.82 | 37.21 | 34.62 | 31.32 | 33.29 |

Source: WATER ACCOUNTS-Brasil 2013-2017 (IBGE, 2018).

## 5.3 Inputs and outputs of water stocks in 2017 (by type of water resource)

Table 2 below shows that in 2017 the total inflows for surface water (in millions of $hm^3$) was 13.3, while the total outflows was 18.9, that corresponds to a variation of 5.6 million $hm^3$ of surface water that did not return to the environment.

**TABLE 2**

**Inventory inputs and outputs by type of water resource (2017)**

(In millions of hm³)

| | Surface water | Groundwater | Soil water | **Total** |
|---|---|---|---|---|
| Input | 13.3 | - | 13.8 | **27.16** |
| Output | 18.9 | 0.009 | 14.4 | **33.29** |
| Balance | -5.592 | -0.009 | -0.535 | **-6.137** |

Source: WATER ACCOUNTS-Brasil 2013-2017 (IBGE, 2018).

## 5.4 Household water uses and economic activities in 2017

The analysis of the data contained in table 3 shows that in 2017:

- total water consumption (water used and subtraction of the water that returns to the environment) was 30.6 thousand hm³ while the total output was 12.599 mi hm³ (table 1), that corresponds to a variation of only 0.002 million of hm³; and
- the total return of water to the environment (through water and sewage activities or released directly by economic activities) was 3,002 thousand hm³.

**TABLE 3**

**Consumption and non-consumption of water (2017)**

(Flows in 1,000 hm³/yr)

| | Economic activities | | | | | | Household | **Total** |
|---|---|---|---|---|---|---|---|---|
| | Non-consumptive use | Consumption use | | | | Total use by activities | | |
| | Hydroenergy | Industry: mining, transformation and construction | Agriculture, forestry, fishing and aquaculture | Water and sewage | Other activities | Total activities | | |
| Withdrawal | 3,098 | 6.01 | 571 | 49.6 | 0 | 3,732 | 0.71 | **3,733** |
| Used | 3,098 | 6.25 | 574 | 55.9 | 1.8 | 3,743 | 8.79 | **3,752** |
| Returned | 3,098 | 2.99 | 253 | 55.3 | 1.5 | 3,416 | 6.75 | **3,422** |
| Consumed | 0 | 3.2 | 321 | 2.6 | 0.3 | 327 | 2.04 | **329** |

Source: WATER ACCOUNTS-Brasil 2013-2017 (IBGE, 2018).

## 5.5 Regionalization of Environmental Economic Accounts for Water in Brazil: methodological advance

With regard to the main changes in the second publication of the EEA compared to the first, it is important to note that the production process of the second has advanced in three main aspects: review and production of new estimates; construction of regional EEA; and extension of the data's time series.

In the process of reviewing the estimates, the need to improve the methodology employed in the production of some information was identified. Among the main changes, we highlight those employed in the estimates of: the volume of sewage released; the volume of water from the Public Irrigation Perimeters (PPIs); and critical analysis of the database of the National Sanitation Information System (SNIS).

In the new estimates, it is important to highlight the production of information on water use in rainfed agriculture. In the first publication of the SEEA, estimates on the use of water in the agricultural activity referred only to irrigated agriculture.

Two of the important advances made in the construction of the second publication of the EEA are concerned to the production of regional information, which was compiled for the extension of the data's time series and for the five Major Regions that make up the Country: North, Northeast, Southeast, South and Midwest. The first publication of the EEA brought national data for the period between 2013 and 2015, while in the second the data are national and regional and for the period between 2013 and 2017. Finally, indicators derived from the EEA were also calculated.

The results of SEEA-Water by Major Regions of Brazil (North, Northeast, Southeast, South and Midwest), unlike the spatial division traditionally presented, bring a new look at physical data, especially with regard to stocks and flows in the country, which extend the applicability of the Accounts. The regionalization of WATER ACCOUNTS is the first step towards greater application of public policies and management of water resources in Brazil. It is understood that for greater optimization in the construction of policies that balance the economy and the environment in the case of water, it would be in the hydrographic basin record.

Originally, the idea that the National Water Agency and the Ministry of the Environment had when proposing the regionalization of the Economic Environmental Water Accounts in Brazil was to use the division by hydrographic basins, in this case, for practical reasons, given the continental dimensions of the Brazilian territory, the use of hydrographic regions would be used, according to the definition of the National Water Resources Council in 2003. However, due to the statistical criteria of the availability of economic and population information for the

states and municipalities, it was agreed that the division to be used in the regionalization of Brazil's Environmental Economic Accounts would be that of geographic macro-regions.

The division of the territory of Brazil into macro-regions consists of the grouping of States and Municipalities in regions with the purpose of updating the country's regional knowledge and enabling the definition of a territorial base for the purpose of collecting and disseminating statistical data. The current division was elaborated in 1970, according to the criteria that aspects of economic articulation and urban structure prevail in the organization of the Brazilian space, which resulted in the following denominations: North Region, Northeast Region, Southeast Region, South Region and Midwest Region, which have remained in force for 50 years.

Among the results of the Stock Tables in 2017, the region that most contributed to the inflow of water in the country's stock was the North, corresponding to 98.8%, given the participation of the inflow of water from upstream countries in the Amazon Basin. The main region responsible for the outflow of water in the country's water supply was also the North (80.6%), followed by the South (11.1%) and the Midwest (5.4%).

If only the uses in which water is consumed (consumptive uses) are considered, the largest volume of total water withdrawal becomes that of the Midwest Region with around 30%, followed by the Southeast (26%), South (25%), Northeast (12%) and North (7%). In this case, the Midwest, the main grain producer in Brazil, becomes the region with the largest share of water withdrawals, mainly because of rainfed agriculture, characterized by using soil water, resulting from rains.

Regarding the use of water for distribution, the region with the largest approximate participation, in 2017, was the Southeast (45%), followed by the Northeast (29%), South (14%), Midwest (6%) and North (6%). This result is influenced by the water flows from the Public Irrigation Perimeters (PPIs), in which around 75% are concentrated in the Northeast Region. If only the distribution of treated water from the supply companies is considered, the Southeast will be responsible for more than half of the total distribution water used in the country.

In 2017, Brazil's per capita water use by Families was 116 liters daily. Among the Major Regions, the Southeast registers the highest use per capita, with 143 liters, while the lowest use is registered in the Northeast, with 83 liters per inhabitant/day.

Still considering the Families, the share of the volume of sewage collected by the sewage network in relation to the volume of water used is higher, in 2017, in the Southeast Region with 71%. In the North Region, only about 14% of the water used by Families returns to the environment through the collection network.

### 5.5.1 Environmental Economic Accounts for Water in Goiás state (WATER ACCOUNTS-GO): first steps

Located in the Midwest of Brazil, the State of Goiás is part of the Brazilian Central Plateau and occupies an area of 340,086 km², which represents about 4% of the national territory. Goiás has a wide range of natural resources, which gives it comparative and competitive advantages in the economic context. The aptitude for agribusiness, the surface and underground water availability and the strategic mineral reserves shows the State as relevant in environmental and economic matters, having a notable participation in the agricultural and mineral commodities market. The outcome of this dynamic economy in the state of Goiás can be assessed in the demand for water (table 4).

**TABLE 4**

**Water demand in Water Resources Planning and Management Units in the state of Goiás (UPGRH) by sector**

| UPGRH | Collected urban public supply demand (L/s) | Collected rural public provision demand (L/s) | Cattle raising demand (L/s) | Agricultural demand captured (L/s) | Mining demand captured (L/s) | Industry demand captured (L/s) | Fishing and aquaculture demand captured (L/s) | Total demand captured (L/s) |
|---|---|---|---|---|---|---|---|---|
| Goiás's tributaries of the Alto Araguaia | 435.54 | 52.6 | 1,959.09 | 7,511.95 | 36.4 | 2,197.64 | 27.17 | **12,220.39** |
| Goiás's tributaries of the Médio Araguaia | 429.47 | 62.77 | 2,453.12 | 2,953.04 | 2,845.65 | 869.55 | 153.1 | **9,866.71** |
| Goiás's tributaries of the Médio Tocantins | 341.74 | 30.37 | 351.0 | 6,634.01 | 54.62 | 589.05 | 33.77 | **8,034.56** |
| Goiás's tributaries of the Paraná River | 366.98 | 68.28 | 928.79 | 3,435.85 | - | 927.79 | 100 | **5,827.70** |
| Goiás's tributaries of the São Francisco River | 238.64 | 34.74 | 50.68 | 8,077.56 | - | - | - | **8,401.62** |
| Goiás's Tributaries of Baixo Paranaíba | 736.68 | 40.68 | 1,589.16 | 34,130.80 | - | 5,191.12 | 52.44 | **41,740.89** |
| Corumbá, Veríssimo and Goiás's section of São Marcos | 12,418.19 | 188.41 | 1,847.87 | 59,826.57 | 7,725.82 | 8,021.92 | 6,576.77 | **96,605.54** |
| Meia Ponte | 7,253.49 | 62.02 | 825.06 | 9,129.11 | 515.15 | 1,831.09 | 1,811.55 | **21,427.47** |
| Vermelho River | 157.72 | 16.75 | 676.56 | 3,081.67 | - | 1,045.70 | 52.77 | **5,031.16** |
| Almas River and Goiás's tributaries of the Maranhão River | 1,442.33 | 138.17 | 1,434.72 | 14,453.10 | 71.35 | 2,437.61 | 83,52 | **20,060.79** |
| Bois River | 1,571.24 | 81.87 | 1,556.16 | 58,488.42 | 75.69 | 10,294.63 | 5,773.04 | **77,841.04** |
| **Total** | **25,392.03** | **776.65** | **13,672.22** | **207,722.08** | **11,424.68** | **33,406.09** | **14,664.13** | **307,057.87** |

Source: Water Resources Plan for the State of Goiás (2015).

In the same way that the SEEA in Brazil was developed in three stages, after the signing of partnership between the National Water Agency (ANA), the Brazilian Institute of Geography and Statistics (IBGE) and the Ministry of the Environment (MMA), it is intended develop the SEEA of the state of Goiás (WATER ACCOUNTS-GO). The first stage was the project proposal and institutional arrangement for its development, the second was focused on training and

interinstitutional technical exchange and the third was the preparation of the first results including the hybrid tables.

The State Policy for Goiás was enacted in 1997, but only in 2015 the first State Water Resources Plan was approved by the State Water Resources Council. Authorizations for the use of water resources, through the electronic system Web Outorgas, are in implementation and the water resources plans of the hydrographic basins with greater economic dynamism in the State are under preparation advancing in the monitoring of the Watershed Committees the Corumbá, Veríssimo and São Marcos Rivers, Meia Ponte, the Bois and Afluentes do Baixo Paranaíba. The charge for water use is under discussion and, still in 2020, the mechanisms and amounts to be charged should be defined, hoping to start its implementation in 2021, with an estimated annual collection of around R$ 50 million. The payment for the use of water in hydroelectric generation projects (Financial Compensation for the Use of Water Resources – CFURH) and the Royalties of Itaipu, on the other hand, generated R$ 40.2 million in 2019 for the State.

In terms of institutional arrangement for the development of WATER ACCOUNTS-GO, the Secretariat of Environment and Sustainable Development of Goiás – SEMAD will be responsible for coordinating the process. The Mauro Borges Institute of Statistics and Socioeconomic Studies (IMB), which is part of the structure of the State Secretariat for the Economy, has the task of carrying out research and statistics in the areas of economics, geoprocessing, geography and social sciences, and will be an important partner in development of the WATER ACCOUNTS-GO. Technical assistance will be necessary for training and interinstitutional technical exchange, referring to the second phase, with the partnershiops yet to be defined.

# 6 THE CONSTRUCTION PROCESS OF ENVIRONMENTAL ECONOMIC ACCOUNTS FOR FOREST IN BRAZIL

## 6.1 Contextualization

Since Brazil is a forestry country and its environmental resources have been weakened by anthropic forces, both due to climate change and illegal activities, the country loses economic and environmental value. Therefore, it is a national and international strategic sector. Thus, the objective of this stage was to support partner institutions in the production of information foreseen in the SEEA-F and data availability by biomes, focused on expanding the potential of Forest Environmental Economic Accounts to be used in public policies aimed at maintaining the sustainable use of this resource, since the FOREST ACCOUNTS was planned by biome, it would also assist in the construction of the Ecosystem Service Accounts, provided by the UN, supported by Brazil and headed by IBGE.

FOREST ACCOUNTS in Brazil started in 2018, under the coordination of IBGE, in partnership with the Brazilian Forest Service (SFB). The creation of the Forest Working Group (GT Floresta) was the "axis" that led to the methodological and institutional debates for the creation of the Forest Accountings.

Additionally, it is important to highlight that technical contributions to the process occurred with the joint efforts of the Secretariat of Biodiversity (SBIO)/MMA and a German Cooperation with IBGE and the other institutions that integrated the process of preparing FOREST ACCOUNTS in Brazil (SFB/MAPA, SMCF/MMA, MCTIC/UNDP, INPE).

IBGE began the first debates together with SFB and the National Institute for Space Research (INPE), supported by the Ministry of the Environment (MMA) and the Ministry of Science, Technology, Innovation and Communication (MCTIC), to discuss and build the tables of the FOREST ACCOUNTS. The first phase was related to the proposal of the project and the institutional arrangement for its development, the second focused on harmonizing the institutional databases, the third focused on the elaboration of the first tables format and the fourth was dedicated to the production of FOREST ACCOUNTS. However, FOREST ACCOUNTS and GT Floresta required institutional formalization, requiring to build a technical cooperation agreement (ACT) between IBGE and SFB. This agreement would institutionally protect the FOREST ACCOUNTS, maintaining minimum guarantees for the continuation of the accounts.

This topic will present the institutional and statistical bottlenecks faced by Brazil in the construction of FOREST ACCOUNTS. And also, the future prospects, opportunities and gains that Brazil will have with the construction of the accounts.

## 6.2 Statistical and institutional bottlenecks of Environmental Economic Accounts for Forest

In this topic, some institutional and statistical issues will be raised that hindered the good progress and completion of FOREST ACCOUNTS. Being the first bottleneck, the institutional one, as in the Water Accounts at the interministerial ordinance was essential for the first steps, the forest accounts were not so easy going. Without having the legal instrument for the institutionalization of the accounts, the different federal institutions that would need to work together, IBGE, SFB and MMA, even if they had finalized the accounts would not be able to publish it.

But the obstacle caused by the non-institutionalization affected the beginning of the work, even though the team of technicians was committed to the construction of the accounts. However, without formalization, the statistics already produced could not be homogenized and data, microdata and metadata could not be shared. As for the formation of FOREST ACCOUNTS, it is

necessary to work with data from more than one federal institution, that is, IBGE alone could not build FOREST ACCOUNTS completely without the assistance of SFB and MMA.

Statistical bottlenecks start with the existence of yet another official land cover and use statistic criteria, which adopts different methodologies and legends. Therefore, the Working Group for the construction of FOREST ACCOUNTS decided that the IBGE's Land Use and Land Monitoring Survey responds better to the existing demands of the accounts compared to other national official surveys due to its biannual periodicity, national coverage with subdivision into federative units (UF) and biomes, and total adaptation to the SEEA-F. However, there are some criticisms about this product, such as a spatial unit of 1: 1,000,000, the statistical grid and the clipping of the legend mosaic.

It is necessary to emphasize that the comparison between the research methodologies carried out does not indicate whether one study is better than the other, or if one data is more accurate than the other. This comparative exercise served to better visualize which database would respond more adequately to the needs that the FOREST ACCOUNTS tables needed to be built.

Thus, the group GT Floresta understood that, in the future, if there is a research with better technology and/or a more accurate and official database, the accounts will be redone with this new database; that is, FOREST ACCOUNTS are not linked to the research chosen for the first publication. It should be noted that IBGE presented its biannual publication on land cover and usage already in a format compatible with FOREST ACCOUNTS, with data time series, where there is a jump from 2000 to 2010, and then updated every two years until 2018. It can be observed in the table below the Physical Account of Coverage and Land Use for the years 2016 to 2018.

Another bottleneck is the lack of information on restoration, ecosystem services, biodiversity, income generation, in addition to the difficulty or lack of access to information on the performance of state and municipal units, taking, for example, deforestation authorizations. It is also necessary to reconcile databases prepared by different entities, such as the land use change databases of INPE, MCTIC and IBGE. Among the data currently consulted by decision makers, we highlight the research on Production of Vegetable Extraction and Forestry (PEVS), Agricultural Census, National Accounts of IBGE, as well as information from ICMBio on protected areas, the national forest inventory of the SFB , INPE deforestation and land use data, CONAB market price information, MapBiomas project coverage and land use data, which need harmonization and statistical improvements for micro data, focused on forest products.

## TABLE 5

**Physical accounts for coverage and land use**

(In 1 km² cells)

| | | Artificial area | Agricultural area | Pasture with management | Mosaic of occupations in forest area | Forestry | Forest vegetation | Wet area | Country vegetation | Mosaic of occupations in countryside | Continental body of water | Coastal body of water | Discovered area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Openning stock (2016) | | 37,773 | 643,769 | 1,118,893 | 843,927 | 83,646 | 3,719,801 | 34,282 | 1,661,058 | 254,463 | 128,749 | 222,461 | 3,744 |
| 1. Stock addition | Artificial area | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| | Agricultural area | 28 | 0 | 2,172 | 144 | 298 | 0 | 0 | 191 | 369 | 22 | 0 | 0 |
| | Pasture with management | 49 | 14,039 | 0 | 2,820 | 1,751 | 0 | 0 | 319 | 695 | 20 | 0 | 0 |
| | Mosaic of occupations in forest area | 206 | 3,110 | 12,897 | 0 | 373 | 10,959 | 0 | 0 | 0 | 13 | 0 | 0 |
| | Forestry | 2 | 257 | 191 | 192 | 0 | 0 | 0 | 42 | 76 | 0 | 0 | 0 |
| | Forest vegetation | 89 | 758 | 4,116 | 13,617 | 70 | 0 | 0 | 0 | 0 | 52 | 0 | 0 |
| | Wet area | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| | Country vegetation | 58 | 4,744 | 5,579 | 0 | 443 | 0 | 0 | 0 | 2,549 | 36 | 0 | 5 |
| | Mosaic of occupations in countryside | 118 | 1,331 | 1,038 | 0 | 130 | 0 | 0 | 1,381 | 0 | 1 | 0 | 0 |
| | Continental body of water | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Coastal body of water | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Discovered area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total additions** | **550** | **24,239** | **25,994** | **16,797** | **3,065** | **10,959** | **0** | **1,933** | **3,689** | **153** | **0** | **5** |
| 2. Stock reduction | Artificial area | 0 | 28 | 49 | 206 | 2 | 89 | 0 | 58 | 118 | 0 | 0 | 0 |
| | Agricultural area | 0 | 0 | 14,039 | 3,110 | 257 | 758 | 0 | 4,744 | 1,331 | 0 | 0 | 0 |
| | Pasture with management | 0 | 2,172 | 0 | 12,897 | 191 | 4,116 | 1 | 5,579 | 1,038 | 0 | 0 | 0 |
| | Mosaic of occupations in forest area | 24 | 144 | 2,820 | 0 | 192 | 13,617 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Forestry | 0 | 298 | 1,751 | 373 | 0 | 70 | 0 | 443 | 130 | 0 | 0 | 0 |
| | Forest vegetation | 0 | 0 | 0 | 10,959 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Wet area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Country vegetation | 0 | 191 | 319 | 0 | 42 | 0 | 0 | 0 | 1,381 | 0 | 0 | 0 |
| | Mosaic of occupations in countryside | 0 | 369 | 695 | 0 | 76 | 0 | 0 | 2,549 | 0 | 0 | 0 | 0 |
| | Continental body of water | 5 | 22 | 20 | 13 | 0 | 52 | 4 | 36 | 1 | 0 | 0 | 0 |
| | Coastal body of water | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Discovered area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 |
| | **Total reductions** | **29** | **3,224** | **19,693** | **27,558** | **760** | **18,702** | **5** | **13,414** | **3,999** | **0** | **0** | **0** |
| Final stock (2018) | | 38,294 | 664,784 | 1,125,194 | 833,166 | 85,951 | 3,712,058 | 34,277 | 1,649,577 | 254,153 | 128,902 | 222,461 | 3,749 |

Source: IBGE (2020).

## 6.3 FOREST ACCOUNTS opportunities and perspectives

FOREST ACCOUNTS can be used in decision-making processes and at any stage of the public policy cycle: from identifying problems, designing policy responses, evaluating implementation processes, to monitoring and feedback, to ensure that decisions are taken and which decisions should be better informed. In addition, FOREST ACCOUNTS provide information and produce useful indicators to measure the costs and benefits of forest management, allowing the identification of potential conflicts between policies in different sectors, assisting in the coordination and standardization of the databases used by different organizations and providing key elements for the formulation of integrated plans. FOREST ACCOUNTS also serve to monitor Brazilian progress in meeting the goals of the Sustainable Development Goals (SDGs), in particular SDG 15 (Terrestrial Life).

GIZ in collaboration with MMA, in the TEEB – Regional and local project, was a fundamental addition for the methodological consolidation of Economic Accounts in Brazil, built a notebook[7] that tried to present the synergy that exists between FOREST ACCOUNTS and Brazilian public policies focused on forests, that was launched in 2019. This publication seeks to explain how Forestry Economic Environmental Aaccounts (FOREST ACCOUNTS) – whose central framework was adopted as an international standard by the UN Statistics Committee in 2012 – can support the development, monitoring and evaluation of public policies, allowing to recommend appropriate strategies for its elaboration in the Brazilian context. The methodology used combines a literature review with the perspectives of sector stakeholders gathered in a workshop day and interviews with 18 managers of public forest policies or with an interface in the sector, and with representatives of the private sector and non-governmental entities working in the forest sector. Identifying the most relevant national forest public policies that would be subsidized by FOREST ACCOUNTS inputs. Each policy addressed, an assessment was made on the use of FOREST ACCOUNTS, indicating the relevance of its various inputs, such as information on inventories, increments, losses and economic value (GIZ, 2019).

The GIZ document noted that FOREST ACCOUNTS has the potential to be used as a tool capable of qualifying the effects of public policies, assessing effectiveness and clarifying bottlenecks in the implementation of Conservation Units, and also subsidizing statistics to optimize tourism in these areas, measuring the existing economic strength in forests, which are not accounted for by traditional methodologies. It is also capable of identifying potential conflicts and managing trade-offs between competing forest uses, supporting better decisions between alternative uses of forests, which enables the use of forest information in the formulation of integrated plans of land development and use, assessing the effects of land regularization over time and assisting in monitoring of legal compliance with demarcated areas for protection.

7. The contribution of environmental economic accounts to public policies in Brazil: forests.

An opportunity for them to finalize and use FOREST ACCOUNTS is to raise awareness among stakeholders, both policy makers, landowners and civil society. In this sense, coordination between ministries and national agencies involved in monitoring public policies in all spheres is indicated in the regulation proposal for the Green GDP Law (Law No. 13,497/2017). With the existence of tools such as Green GDP and FOREST ACCOUNTS, they will supply public policies and their agents with arguments and statistics capable of presenting the information in a manageable and appropriate way, that will be able to convince based on information about income generation, improvement of productive processes and the perception that it is possible to develop a sustainable forest-based sector. The planted forest sector has already become convinced of this importance and is increasingly transparent with its data, as long as it does not expose strategic commercial information.

## 7 CONCLUSION

The construction process of Environmental Economic Accounts in Brazil showed that, on the one hand, there is a need to learn the methodology of preparing accounts according to what the UNSD discloses in the world, on the other hand there is a need for statistics and environment related institutions of the country to accomplish the necessary adaptations to what is most important. In the case of Brazil, water and forests were the elements considered essential to start the process. This experience in Brazil has also shown that even though there is a lot of information available about the physical stocks of the evaluated natural resources, as well as, even if there is maturity and quality of the statistical data provided by the official statistical institution, in this case, IBGE data, the Accounts will only be effectively developed if there is institutional articulation between those directly involved, both in accounting for the stocks of natural resources and the institutions that accounts for national economic activity.

### 7.1 Questions to London Group

After carrying out the narrative of the process of building the environmental economic accounts for water, as well as the accounting of forest stocks, according to the methodology of environmental economic accounts, there are still questions that we would like to clarify with the London Group's specialist colleagues.

1) How to efficiently make the connection between what has already been built for water accounts in Brazil and Environmental Ecosystem Accounts?
2) In relation to Accounting for Forest stocks in Brazil, what would be the most efficient way to link issues related to the annual loss of forested area due to deforestation and the consequent loss of ecosystem services associated with this loss?

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