

Environmental education in the context of sustainable water resource management

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Abstract

The population covered by the hydrographic basins of the Piracicaba, Capivari, and Jundiaí rivers is exposed to continuous episodes of water scarcity. The imbalance of supply to demand could have originated in the increase in consumption, reduction in the volume of rainfall and water stocks in the reservoirs, or even in the confluence of these with other factors. Achieving sustainability and water security, therefore, depends on efficient management plans. In this article, the authors propose to evaluate the contribution of Environmental Education in the context of sustainable management of water resources. Based on the data analysis collected in the Reports of the Hydrographic Basins of the Piracicaba, Capivari, and Jundiaí rivers and Law 9433/97, which instituted the National Policy on Water Resources, they search evidence of the correlation between values, education, and awareness regarding the use of water resources. However, although foreseen, Environmental Education practices are not part of the list of measures to mitigate water scarcity in the analyzed context.

Keywords: Environmental education; Water resources management; Sustainability; Climate change.

1. Introduction

The historical combination of exponentially increasing population growth rates and the accelerated concentration of population in urban areas has resulted in the deterioration and even total depletion of natural resource sources. Symptomatically, on July 29, 2021, the "Earth Overload Day" was reached. So named in allusion to the moment when more natural resources were consumed than the planet can provide in a year (WWF-BRASIL, 2021). This situation is a disaster, if compared to the planet's previous situation when there was still a balance between the supply and demand of natural resources only three decades ago. The growing environmental depletion, worrying worldwide since the beginning of the 1970s, puts society on alert, especially regarding the issue of water. Since this is fundamental for the maintenance of life on the planet, guaranteeing the survival of the human species, the conservation and balance of biodiversity, and the relations of dependence between living beings and natural environments.

The United Nations Organization (UNO) established an event to address environmental issues globally. Thus, in 1972, the United Nations Conference on the Human Environment, held in Stockholm, Sweden, produced the Declaration on the Human Environment, or Stockholm Declaration, where principles involving international environmental issues were defined, including managing natural resources and pollution prevention, among others.

In addition, in 1972, the report produced by researchers from renowned universities, at the request of the Club of Rome member countries, documented the environmental risks that would have to be faced immediately by humanity (MEADOWS, 2013). Meadows' (2013) study revealed the significant challenges to achieving global sustainability, relating it to the interaction of five global economic subsystems: population, food production, industrial production, pollution, and consumption of non-renewable natural resources. In addition, it unprecedentedly correlated the world economy to the environment through a computational approach, suggesting that there would be no resources able to keep up with the continued growth of the global economy, possibly resulting in a collapse in the 21st century. Nevertheless, the study also pointed out that this tragedy could be avoided by combining some appropriate actions, of which the importance of changes in political and behavioral patterns stood out.

In 1987, the Brundtland Report, or Our Common Future, consecrated the concept of sustainable development as "that which meets the needs of the present without compromising the ability of future generations to meet their own needs" (CMMAD, 1991, p. 46). Thus, in 1992, the UN held the United Nations Conference on Environment and Development (UNCED), Rio 92, where 179 participating countries agreed and signed the Global Agenda 21, which in chapter 18 provides for the protection of the quality and supply of water resources, as well as in chapter 36, provides for the promotion of education. This guideline is corroborated by Brazilian Law 9.433/97, which institutes the National Water Resources Policy, creates the National System for the Management of Water Resources, and, in its second article, item I, its goal is to "ensure the current and future generations the necessary availability of water, with quality standards that are adequate for their respective uses" (BRASIL, 1997). Thus, it demonstrates the commitment to searching for sustainable development based on intergenerational equality of access to natural resources.

Linked to the management and sustainable development mechanisms, an approach that has been strongly considered, especially in the last decade, concerns education and the strengthening of practices and attitudes directed to the conservation, protection, and preservation of the surroundings, the landscape, and the natural resources. The Committees that manage the Watersheds also sought an Environmental Education focused on water sustainability, which educates to prevent water waste, raising awareness about its importance for human survival on the planet (COMITÊ DAS BACIAS PCJ, 2020).

There is still no definitive solution or clarity as to the best way forward. Attempts to reduce environmental pressures in one sector of the global system through technological means generally increase pressures in other sectors. As exemplified by Turner (2008), increased demand for water resources is linked to soil nutrient depletion; maximizing forest destruction is directly linked to increased biofuel production. Shemer and Semiat (2017) highlight the correlation between water recycling or desalination processes to increased energy use, further increasing the demand for resources and Greenhouse Gas (GHG) production. Silveira et al. (2015) complemented several critical factors regarding global water resources, such as pollution and depletion of rivers, groundwater extraction, salination after significant inter-basin transfers, and excessive basin use. They failed flood control, competition between nations for limited resources, over-pumping by megacities, and leakage.

The main challenge to the sustainable planning and management of water resources is the growing water demand, considering all its potential uses and the many different purposes for which it is used, both in terms of the quantities offered or available, and the quality standards required to meet human needs. Water scarcity generates instability in activities vital to sustaining life, such as farming and livestock raising, industrial production, drinking water supply, basic sanitation, and public health.

This study proposes to discuss the possibility of incorporating valorative, behavioral, and awareness content aimed at the protection and sustainable management of water resources. Jacobi (2003, p. 196) suggests that "the relationship between environment and education for citizenship assumes an increasingly challenging role" because it demands "the emergence of new knowledge to apprehend social processes that become complex and environmental risks that intensify." With the aid of the assumptions of Environmental Education, it is sought, thus, the development of a critical consciousness throughout society, so that it is the driving force of changes in habits, principles, and values that enable greater integration and harmony of human activities with the environment, since nature is not an inexhaustible source of resources, and its reserves are finite.

The article 1 of FEDERAL LAW 9795/1999 (BRAZIL, 1999) defines Environmental Education as "[...] the processes by which the individual and the community build social values, knowledge, skills, attitudes, and skills aimed at the conservation of the environment, good of everyday use of the people, essential to a healthy quality of life and its sustainability." With this definition and purpose, Environmental Education is a vital tool to educate, sensitize and raise awareness for the correct use of finite natural resources. It would be possible to build an ecological culture to understand how nature and society are interconnected. Moreover, it is not possible to think separately or independently of the actions of both governments and the most diverse social agents, aiming at sustainable development.

According to Leff (2015), the sustainable development goals, as outlined in the UN 2030 Agenda (UN, 2015), advocate a change in the values that guide the behavior of economic and political agents and society.

Furthermore, the paradigm shift is necessary and urgent. The awareness of society, incorporating emerging environmental knowledge in the educational system, and training high-level human resources are considered fundamental processes to guide and instrumentalize environmental policies (LEFF, 2015).

Since the beginning of the industrial revolution in the 18th century, production has been subject to an economic model. By continuing with the current pace of production and consumption and keeping limited the vision that much of the global society holds about the principles of sustainability, it is possible that very soon we will find severe difficulties for the maintenance of human life. What prevails is the extraction and exploitation of natural resources as if they were infinite and the production and encouragement of consumption in an endless crescendo.

The research of Graham M. Turner (2008) compares data and contemporary issues, 21st Century, with those published in 1972 in work "The limits of Growth" (MEADOWS, 2013). The author concludes by pondering that the global system is on an unsustainable course and that what remains to be done is to change behavior concerning the way we consume. This change of attitude combined with technological innovations may be the only way to reverse the current trajectory. To do so, however, he stresses that actions require agility, or they will become obsolete with potentially irreversible consequences.

After that, we justify this study by the possibility of bringing immediate light to the theme of sustainable change in habits, behaviors, and ways of thinking. Such competencies are not obtained quickly but can be achieved through education if adopted by governments, productive activities, and the population in general. Thus, reducing the repetition of degrading environmental practices, where significant portions of society often privilege immediate profits and other personal and selfish benefits in a very short-term view.

We consider that Environmental Education is crucial to achieving a more rational, efficient, and socially fair water consumption. Thus, the present work aims at analyzing the conceptual parameters with which Environmental Education is treated by the Management Committees of the Piracicaba, Capivari, and Jundiaí River Basins and in Law 9433/97, which established the National Water Resources Policy, and how its practices could help achieve water sustainability.

2. Methodology

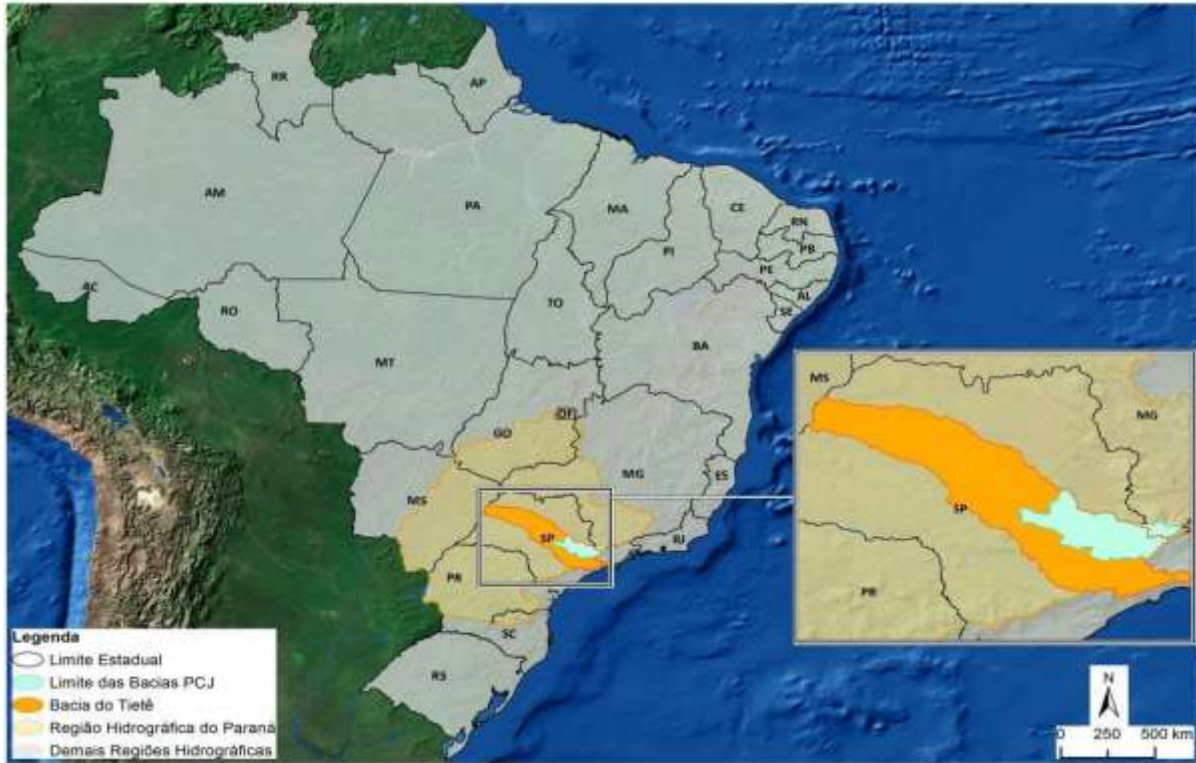
The methodological approach of this study is qualitative, descriptive, and exploratory, based on data collection and information of bibliographic and documentary nature. Richardson (2017) emphasizes that study of descriptive nature aim to investigate the characteristics and aspects of a phenomenon, considering a specific reality, the behavior of a group or individual. Gil (2008) calls exploratory research to promote knowledge and understanding of a problem that interests the researcher, assisting in elucidating relevant issues for a theme still little explored. As for the election of the main themes, as teaches Fonseca (2002), the bibliographical research is conducted as a survey of theoretical references already analyzed and published by written and electronic means, such as books and scientific articles web pages and sites.

This work seeks to analyze how Environmental Education is treated in the Reports of the PCJ Watersheds and Law 9433/97, which established the National Policy on Water Resources, from elements presented in the reports produced by the Committees Piracicaba, Capivari, and Jundiaí Rivers - PCJ Basins.

2.1 Contextualisation of the study area

The PCJ Basins comprise Brazil's most dynamic economic and urban territories. Occupying an area of 0.18% of the national territory, it concentrates around 2.7% of the population and around 5% of its Gross Domestic Product. They encompass, totally or partially, territories of 76 municipalities, 71 of which belong to the State of São Paulo and 5 to the State of Minas Gerais, according to Figure 1.

Figure 1. Location of the Piracicaba, Capivari and Jundiaí Rivers - PCJ Basins



Source: CONSÓRCIO PROFILL-RHAMA PCJ (2020, p. 27).

Table 2 contains relevant information about the PCJ Basins for administrators regarding the hydric resource management unit. Since it considers the population reached, urban and rural territorial area, protected areas, main economic activities developed, and the availability of hydric springs to meet the current demand.

Table 2. General characteristics of the UGRHI - Water Resources Management Unit

General Features			
Population (SEADE,2018)	Total (2018)	Urban (2018)	Rural (2018)
	5.585.706 pop.	96.8%	3.2%
Area	Territorial area (SEADE,2018)	Drainage area (São Paulo, 2006)	
	13.918,7 km ²	14.178 km ²	
Major rivers and reservoirs (CBH-PCJ, 2016)	Rivers: Atibaia, Atibainha, Cachoeira, Camanducaia, Capivari, Corumbataí, Jaguari, Jundiaí and Piracicaba. Reservoirs: Barra Bonita, Salto Grande, Jacareí, Jaguari, Atibainha and Cachoeira plant. The last four reservoirs are part of the Cantareira Production System		
Free aquifers (CETESB, 2016)	Guarani, Pre Cambrian, Serra Geral and Tubarão.		

Main surface water sources (CBH PCJ, 2014)	Large size: Corumbataí River, Capivari River, Atibaia River (Transposition UGRHI 06), Jaguari River, Jundiá River. Regional Interest: Headwaters of the Jaguari and Corumbataí rivers; Capivari-Mirim, Quilombo, Camanducaia, Pinhal, Passa Cinco, Atibainha, Jundiá-Mirim, Claro; Ribeirão Pirai, Caxambu, Bom Jardim, Toledos, Fregadoli, Moinho, Água Branca; João Paulino, Onofre, Santa Rita and Limoeiro Reservoirs.		
Surface Water Availability (São Paulo, 2006)	Average Flow Rate (Q average)	Minimum Flow Rate (Q 7,10)	Flow Rate (Q 96%)
	172 m ³ /s	43 m ³ /s	65 m ³ /s
Underground water availability (São Paulo, 2006)	Exploitable Reservoir		
	22 m ³ /s		
Key Economic Activities (CBH-PCJ, 2014)	The main economic activities are agriculture and industrial production. Highlight in Paulínia, the petrochemical complex composed by Planalto Refinery; in Americana, Nova Odessa and Santa Bárbara d'Oeste, the textile park; in Campinas and Hortolândia, the high-tech hub; in Piracicaba, sugar and alcohol industries and the metal-mechanic sector; in Jundiá, park industrial with more than 500 companies operating in various sectors; in Limeira, veneer production; in Rio Claro, industries sugar-alcohol mill; in Santa Gertrudes and Cordeirópolis, a national ceramic center.		
Remaining vegetation (IF, 2010)	Features 1.911 km ² of remaining natural vegetation, which occupies approximately 13.5% of the UGRHI area. The categories of greater occurrence are the Dense Ombrophilous Forest and the Seasonal Semideciduous Forest.		
Protected Areas (MMA, 2018, FF, 2018)	Integral Protection Conservation Units		
	Esec from Ibicatu; Esec Valinhos; MoNa of Pedra Grande; Campo Grande PNM; PNM of the Jatobás; PE of the ARA (Advisory of Agrarian Reference); PE of Itaberaba; Itapetinga PE; RB of Serra do Japi.		
	Conservation Units for Sustainable Use		
	APA Cabreúva; APA Corumbataí-Botucatu-Tejupá - Corumbataí Perimeter; Campinas APA; APA of Campo Grande; APA Jundiá; APA Piracicaba/Juquerí-Mirim - Areas I and II; APA Dam Bairro da Usina; APA Cantareira System; ARIE Mata de Santa Geneva; ARIE Matto of Cosmopolis; FE Edmundo Navarro de Andrade; FE Serra D'Água; RPPN Caete; RPPN Two Waterfalls; RPPN Ecoworld; RPPN Estancia Jatobá; RPPN Fazenda Boa Esperança; RPPN Fazenda Serrinha; RPPN Lafigueira Naturarte; RPPN Springs Park; RPPN Parque dos Pássaros; RPPN Reserva do Dadinho; RPPN Reserva do Jacu; RPPN São Elias; RPPN Sítio das Pedras; RPPN Sitio Sabiuna; RPPN Solar da Montanha Site.		

Source: Water Resources Status Report 2019 (COMITÊ DAS BACIAS PCJ, 2020).

Considering that the PCJ Basins are in a region that has considerable economic development indicators, it is necessary to invest in Environmental Education actions. We must make the population aware of the responsibility of each one in the use of water resources. That is essential for the survival of humanity.

2.2 Sources and documents selected for the study

The analysis on the contribution of Environmental Education for the Management of Hydric Resources presented here is circumscribed to the text of Law 9433/94, which established the National Policy on Hydric Resources, and the elements presented in the reports produced by the Committees for the Piracicaba,

Capivari and Jundiá River Hydrographic Basins - PCJ Basins: 1). Synthesis Report: Water Resources Plan for the Hydrographic Basins of the Piracicaba, Capivari and Jundiá Rivers, 2020 to 2035; 2) Water Resources Status Report: the simplified version-base year 2019.

3. Results

3.1 Environmental education

Faced with worldwide recognition of the complexity about the growing environmental degradation, Environmental Education arises, from the decade of 1970, in major international events, with the landmark Intergovernmental Conference on Environmental Education held in Tbilisi, Georgia in 1977. Since it was a conference that the definitions, objectives, strategies, and principles for Environmental Education were established. Czapski (1998, p. 30) highlights that:

Yes, because this "first phase" counted on a series of activities fundamental for the success of Tbilisi, such as the organization of regional meetings between 1975 and 77 in Africa, the Arab States, Europe, and Latin America; the promotion of experimental studies on Environmental Education in these regions, besides international research on the subject. The organizers of the Tbilisi event themselves have consistently recognized that it was an extension of the Stockholm Conference of 1972 and that it became the culmination of the first phase of the International Program for Environmental Education (PIEA). This program was suggested in Stockholm but only started in 1975, from the meeting in Belgrade, when Environmental Education was already proposed to be continuous, multidisciplinary, integrated to regional differences, and directed to national interests.

In Brazil, the importance of the theme was highlighted in the 1980s, when, in 1981, Law 6.93/818 instituting the National Environmental Policy was introduced into the legal system. In its article 2, Subparagraph X, provides on Environmental Education and says that it should be available at "all levels of education, including community education, aiming to enable it to participate actively in defense of the environment" (BRAZIL, 1981).

Additionally, the year 1988 was marked by the promulgation of the Federal Constitution, which provides in Chapter VI legal rules for the environment and states in its article 225 that "Everyone has the right to an ecologically balanced environment, an asset for common use by the people and essential to a healthy quality of life, imposing on the Public Power and the community the duty to defend and preserve it for present and future generations." (BRAZIL, 1988). It also states that the Public Authorities must promote "Environmental Education at all levels of education and public awareness for the preservation of the environment". (BRAZIL, 1988).

Likewise, in line with Article 225, item VI of the Federal Constitution, Law No. 9.795 was sanctioned, which created the National Policy on Environmental Education (PNEA). This Law, in its second article, states that "Environmental Education is an essential and permanent component of national education, and should be present, in articulated form, at all levels and modalities of the educational process, in non-formal and formal character." (BRAZIL, 1999).

From the content added to the legal instruments of the Brazilian State, one can infer the importance of Environmental Education in the implementation of an environmental conscience that values the sustainable

use of natural resources. With it, the application of themes related to ecology, the rational use of natural resources, and the discussion and participation of citizens in issues involving their relationship with the environment are studied. Thus, Environmental Education will seek to develop values that lead to harmonious coexistence with the environment and the beings that inhabit the planet.

Environmental Education is also characterized to achieve sustainability in all its dimensions. It preserves natural resources, creates innovative development models with clean and sustainable solutions, and disseminates them throughout society. In this logic, Ferreira et al. (2016, p. 138) points out that:

Environmental Education has been seen as a fundamental instrument to shape a new way of seeing and feeling the world around us. It inserts integrating elements in educational systems within society to make communities aware of sustainable development and its environmental effects. In this context, it should be noted that Environmental Education is not a neutral field of knowledge.

Leff (2015) recalls that Environmental Education fosters new attitudes in social subjects and new decision-making criteria for governments, guided by ecological sustainability and cultural diversity principles. Environmental Education helps form new social actors, as it educates intending to develop critical, creative, and prospective thinking, understanding the ecological and social complexities to have a democratic and sustainable future.

Environmental Education is thus a robust path to sustainability. It should be seen as a process of permanent learning, which enables an educational practice that denounces environmental degradation and related social and economic problems, forming citizens with local and planetary ecological awareness.

3.2 Sustainable management of water resources

In line with the effects of recent climate change, the water supply and sanitation crisis has increased concern. Note that, according to the OECD (2015, p. 15),

Brazil holds 12% of the world's freshwater resources, making water a comparatively abundant resource in the country. However, water resources are unevenly distributed across the territory: while the Northeastern states are predominantly semi-arid, the Amazon region lacks water. This unequal distribution is not unusual in large countries like Brazil, but it poses challenges for water resources management today and in the future.

For Tundisi (2008), this disparity entails several economic and social problems, especially inequality in the territorial distribution of basic sanitation, sewage treatment, infrastructure, and water sources recovery. These demands are fundamental priorities in Brazil and strategic studies on hydric resources and energy, hydric resources and economy, water and human health, water and global changes are necessary to provide long-term visions and scenarios that stimulate consolidated public policies.

At the same time, to face the challenges posed by the instability and variability of supply of this precious resource, the management of hydric resources has undergone adjustments and reforms in the legal and judicial provisions that regulate it. In 1997, Law 9.433/97 was created, establishing the National Policy on Hydric Resources (PNRH) and creating the National System for the Management of Hydric Resources.

Regarding the general action guidelines for the implementation of the National Water Resources Policy, Article 3 of Law 9.433/97 defines them as follows (BRASIL, 1997):

- i. Systematic management of hydric resources without dissociating quantity and quality aspects.

- ii. The adequacy of hydric resources management to the physical, biotic, demographic, economic, social, and cultural diversities of the Country's different regions.
- iii. -Theintegration of water resources management with environmental management.
- iv. The articulation of water resources planning with that of the user sectors and with regional, state, and national planning.
- v. The articulation of water resources management with land use management.
- vi. The integration of watershed management with estuarine systems and coastal zones.

Thus, the foundations established in the PNRH state that water is an asset of the public domain and a natural resource, limited and endowed with economic value. It defines priorities: the law states that, in case of scarcity, water resources have as priority human consumption and animal watering. Moreover, it is concerned with intergenerational sustainability since one of its objectives is to "ensure the current and future generations the necessary availability of water, with quality standards appropriate for their respective uses" (BRASIL, 1997).

There is an ethical and value-based factor to guide managers' decision-making concerning this last aspect. It was considering that, in practice, if there are not sufficient stocks of water in quantity and quality to meet all uses and users, what would be the guideline in case of scarcity? Would water use be prioritized for human consumption and animal feeding, or would it be directed to other uses, such as industrial uses, for example?

Leff (2015, p. 86) asserts that:

Environmental ethics proposes a system of values associated with alternative productive rationality, new potentials for development, and a diversity of cultural lifestyles. This supposes the need to see how the ethical principles of environmental rationality oppose and amalgamate with other value systems: how environmental values are translated into new behaviors and meanings of economic agents and social actors. It is about seeing the ethical principles of environmentalism as systems that govern individual morality and collective rights, their instrumentation in production, distribution, and consumption practices, and in new forms of appropriation and transformation of natural resources.

The ethical approach presupposes a system of values that guides the lives of human beings based on social solidarity. In this perspective, environmental values are opposed to a culture of power established in technological reasoning and economic rationality. For the manager, the objective is, first, to increase the availability and quality of water to meet essential functions and guarantee human life and survival. As well as reducing non-essential consumption by improving user processes. In fact, the environmental crisis in which water resources are inserted has as its generating source factors such as the development model adopted, the lack of awareness of individuals regarding the excessive use of this natural resource, and the high level of pollution that affects groundwater. As society became more economically developed and more complex in its activities, the different uses of water also diversified. It is, therefore, necessary to adopt a specialized water management system of high technical value to optimize the use of this resource, making it more efficient, sustainable, and economical.

Tudisi et al. (2020, p. 39) highlight that:






The intense urbanization that has occurred on a global scale (as well as in Brazil) has introduced other scales of water demand, waste, and contamination. Large urban concentrations require vast volumes of treated water - thousands of cubic meters per hour - and produce large-scale waste, polluting and contaminating groundwater, rivers, lakes, and reservoirs.

The survival of humanity is closely linked to the way it uses natural resources, so its management should be based on science and innovation guidelines to be sustainable and intelligent. According to Jimenez-Cisneros (2015), scarcity is the main challenge related to water in many regions, often limiting social and economic development. The availability of water depends not only on the volume but also on its quality and the timely and affordable access to an efficient distribution service with adequate and sustainable management.

3.3 Environmental education in the context of sustainable water resource management

According to the Water Resources Situation Report in 2019 (COMITÊ DAS BACIAS PCJ, 2020), it is possible to verify that, although the UGRHI (Water Resources Management Unit) has a high quantity of springs. There was a reduction in the per capita availability of water, going from 1,014.13 m³/hab.year, in 2014, to 971.08 m³/hab.year, in 2018, represents a reduction of 4% in five years, as can be seen in Figure 03.

Figure 3. Evolution of annual averages of per capita water availability in the PCJ Basin area
Summary Table 1- Availability of Water.

Availability of water					
Parameters	2014	2015	2016	2017	2018
Availability per capita - Average flow rate versus total population (m ³ /pop.year)	 1.014,33	 1.000,97	 990,92	 980,96	 971,08

Reference Values

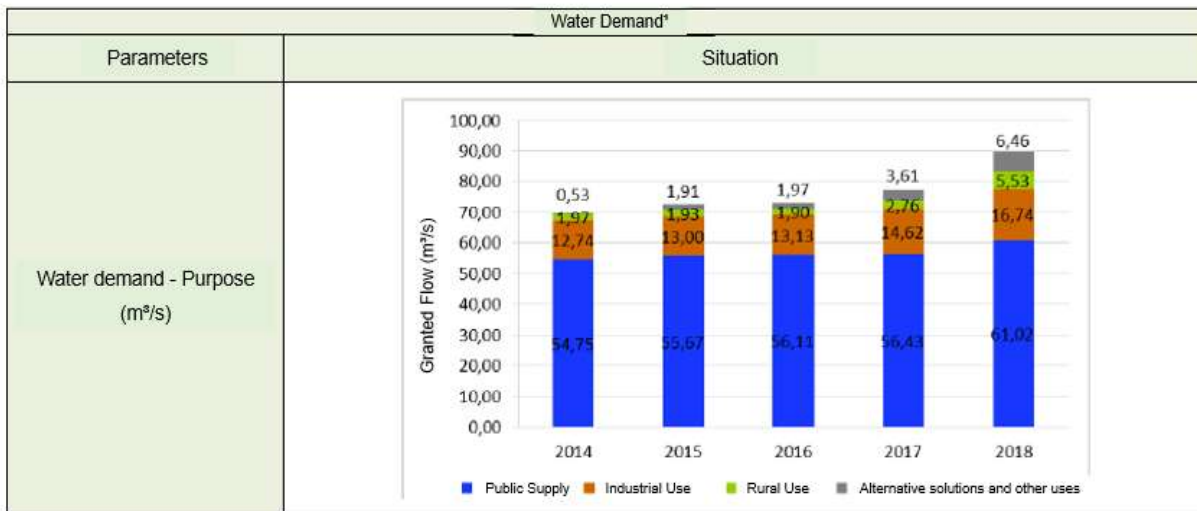
Availability per capita - Average flow rate versus total population	
> 2.500 m ³ /pop.year	Good
between 1.500 and 2.500 m ³ /pop.year	Attention
< 1.500 m ³ /pop.year	Critical

Source: Situation Report on Hydric Resources (2019PCJ BACKS COMMITTEE, 2020).

According to data presented (COMITÊ DAS BACIAS PCJ, 2020), the demanded surface flow showed a significant increase of over 16%, from 68.2 m³/s, in 2014, to 79.6 m³/s, in 2018. It is noteworthy that, when comparing the data of 2018 with the previous year (2017), there was an increase that was higher than 12%, thus generating attention to the fact that the increase in demand has intensified in the last year. Also as pointed out in Figure 4, in relation to the most significant increases, "rural use" stands out, which doubled the flow rate granted in the last year, from 2.76 m³/s in 2017 to 5.53 m³/s in 2018, as well as the "alternative solutions and other uses," which is about twelve times the value of 2014, when it added a flow rate of 0.53 m³/s, reaching the current 6.46 m³/s.

Figure 4. Water demand by purpose in 2014 to 2018, in m³/hab.

Table Synthesis 2 - Water Demand



Source: Water Resources Status Report 2019 (COMITÊ DAS BACIAS PCJ, 2020).

Therefore, to reverse the worsening of water scarcity, part of the population resorted to underground reserves. Since 2016, water abstraction through private artesian and semi-artesian wells has been intensified, giving the false impression that the situation could be remedied in this way.

The issue of the balance between water "consumption" and "production", however, in the scope of the Piracicaba, Capivari, and Jundiaí River Basin Committees, emphasizes the technical apparatus for monitoring and expanding the hydric supply and not on consumer behavioral changes that would lead to a reduction in demand.

From the analysis of the Water Resources Status Report 2019 (COMITÊ DAS BACIAS PCJ, 2020, p. 35), regarding management guidelines, it was proposed that initiatives be taken and strengthened along lines aimed at:

1. To subsidize the Technical Chamber of Hydrological Monitoring (CT-MH) in the operation of the Cantareira System, especially during the dry season.
2. Encourage discussions and adaptation measures to scenarios that consider climate change.
3. Encourage the inclusion of pluviometric and fluviometric monitoring parameters in the Situation Report, which are of great relevance for analyzing water availability in the PCJ Basins.
4. Encourage discussions to update, improve, enhance, and integrate water resources user registries.
5. Boost measures involving studies on water allocation and evaluate the promotion of planned reuse of water resources.
6. Invest in the maintenance of systems for real-time monitoring of water resources.
7. Promote the adoption of systems for the continuous monitoring of the primary uses of water resources, to structure historical series that are fundamental for planning.
8. Follow up and propose discussions regarding studies on the guarantee of water supply.
9. Monitor and evaluate the growth in demand, given the evolution observed in the series; Encourage Technical Cooperation Agreements to expand hydrological monitoring.
10. Monitor and propose alternative studies to expand the hydric supply, in line with the Basin Plan's

Hydric Supply Guarantee Booklet discussions.

11. It is also worth highlighting the importance of expanding discussions regarding the Hydrological Monitoring Policy, enabling the definition of rules for monitoring, and encouraging/standardizing the aggregation of different operators.
12. It is essential to mention that a review of the PCJ Basin Plan is currently underway, and among its products, the thematic notebook on Guaranteeing Water Supply stands out, which includes simulations of scenarios in the PCJ Basin Decision Support System (SSD PCJ).

Now, the gap between the quantity offered and the demand required by consumers and users poses important and complex challenges for the water resources manager in the PCJ Basins. If the "generation" of water depends on natural climatic phenomena, its use is pressured, in turn, both by the imperative needs of human and animal consumption and by its use in the most diverse economic activities. This suggests that to achieve balance and even water sustainability in times of scarcity, the participation of the user and consumer community in the rational use of this resource is fundamental.

In this aspect, the practices of Environmental Education appear as an extraordinary instrument to make the population aware, since the participation of the whole society is fundamental for the consolidation of the Politics and System of Hydric Resources Management, especially in the Hydrographic Basin Committees. Law n° 9.433/97, dated January 8, 1997, published in the Federal Official Gazette on January 9, 1997, which established the National Policy on Hydric Resources and created the National System for the Management of Hydric Resources, however, made no mention of Environmental Education, although the theme has been discussed since the 1970s (CZAPSKI,1998).

Thus, by not referring to this topic, the National Policy on Water Resources puts the effectiveness of efficient and sustainable management of water resources at risk. Environmental Education, as a management tool, plays a significant role in actions searching for sustainable development, working in the formation of conscientious citizens, to make water resources management programs and projects more effective, efficient, and efficacious.

In times of water shortage, Environmental Education helps in understanding reality, fostering the construction of new environmental values, and stimulating the critical awareness of citizens about the environmental problems contained in the dynamics of watersheds, thus building a bigger picture of equality and social justice. Moreover, it inserts the local community in the discussion in the search for solutions to environmental problems in exercising citizenship.

4. Conclusions

The reflections proposed in this study suggest a great potential to be explored regarding the use of Environmental Education as a tool for the balanced maintenance of water resources. Faced with reducing the quantity and quality of water available, greater citizen participation is necessary to establish efficient educational programs oriented to water sustainability, since Environmental Education is a valuable tool for creating sustainable solutions.

Law 9.433/97 indicated integrated management of resources from a hydric resources plan to be developed at a national and state level, where the interests of the collectivity prevail, by the Hydrographic Basin

Committees. Furthermore, although the National Hydric Resources Policy does not deal explicitly with Environmental Education, it is part of the awareness-raising process and is a crucial instrument to preserve hydric resources and promote social practices based on rationality and social justice. However, from the analysis of the data established in this research, it is concluded that Environmental Education is not contemplated effectively in the management plans of the PCJ Basins, which generates an excellent risk for the management of hydric resources in this territory.

It is also possible to observe a particular deficiency about the importance of Environmental Education from the Reports of the PCJ Basins and the National Policy on Water Resources. No mention is made of Environmental Education as an instrument through which it will be possible to make the population aware of the rational use of water, that is, to use water resources responsibly, aiming at the sustainable use of such a vital asset for humanity.

The study also allows us to conclude that the actions focused on the "production" of water are neither effective nor sustainable, if not concurred with other actions, mainly related to Environmental Education, which should be both formal, regarding the better training of the various types of professionals and politicians, and informal, regarding the awareness of the population for more rational use of water, thus building new paradigms for the management of water resources.

Environmental Education is crucial to achieving a more rational, efficient, and socially just water consumption. Therefore, the inclusion of the theme "Environmental Education" as a teaching tool has the potential to add knowledge, build new paradigms for the management of water resources, and promote awareness of society for a new vision of sustainability. However, new qualitative and quantitative studies are recommended to correlate education and awareness methods with practical results, thus empirically proving the educational effectiveness for sustainable water management.

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