

# Integrated Water Resources Management in Colombia: A Historical Perspective

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**Abstract:** The integrated management paradigm proposes dealing with a resource, such as water, considering its interrelationships with other environmental components. This vision has been adopted as a policy in several countries, including Colombia, but its results have not been satisfactory. This article studies the “integrative” approach in previous regulatory arrangements, making a historical review of them to understand how the perception and management of the environment by societies in Colombia have evolved. We show how the notion of a complex and integrated environment is not exclusive from current policies but has been present in the laws for several centuries, so its consideration does not guarantee success. Strategies are proposed to improve the results of recent regulatory arrangements.

**Keywords:** Integrated Water Resource Management, Environmental Legislation, Relationship between society, natural environment, Socio-ecological systems.

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## Introduction

In Colombia, the management and planning of resources with an integrated watershed management approach have been promoted since the 1970s. However, water management continued to be sectoral and divergent (RESTREPO, 2003). According to Blanco (2008), the integrated watershed management plans in Colombia in the first decade of this century did not comply with any integration guidelines, nor were they useful for decision-making or influencing administrative instruments. They were merely descriptive plans. In 2010, the National Policy for Integrated Water Resource Management (PNGIRH) was adopted, with its main objective being to ensure the sustainability of water resources through participatory management integrated with land use planning and conservation of ecosystems that regulate water supply (MAVDT, 2010).

According to the Global Water Partnership (GWP), Integrated Water Resource Management (IWRM) promotes the coordinated management of water, land, and related resources to maximize resulting social and economic well-being without compromising the sustainability of vital ecosystems (GWP, 2000). IWRM encourages the implementation of policies to improve governance, information, and communication among water users and administrators. It involves planning based on understanding the needs and constraints around a finite resource (MORIARTY; BUTTERWORTH; BATCHELOR, 2006). According to Dourojeanni and Jouravlev (2002), an IWRM policy should achieve the integration of four dimensions: i) hydrological, ii) uses and users, iii) management of different natural resources, and iv) water management in economic, social, and environmental development.

Twelve years after the formulation of the PNGIRH and the development of strategic plans for hydrographic regions in Colombia concerns about the fragmentation of management persist. Rubio-Goyes (2019) studied the articulation and institutional capacity to implement the PNGIRH and demonstrated how the operational capacity is currently fragmented, with 22 entities having influence over different aspects of water management. This validates the concerns raised by Restrepo (2003) and Blanco (2008). This questions the effectiveness of integrated management guidelines in achieving effective synergies in natural resource management.

To analyze the advantages or potentialities of the integrated resource management paradigm, and in light of at least five decades of the presence of these ideas in Colombian regulations, this article explores the question: Is the notion of integration or 'integrated' in this new policy approach an advantage in the sustainable management of resources? To do so, the article aims to understand previous regulatory frameworks and contrast what innovations and advantages the current policy presents in achieving its goals. A retrospective review of regulations related to natural resources in Colombia is conducted, seeking clues as to why integration guidelines from past decades failed. Influential political events throughout recent centuries that determined legal frameworks and their evolution are observed, proposing finally an original analysis from a historical perspective.

## Methods

A non-exhaustive thematic review of legislation in Colombia related to natural resources was conducted, spanning from colonial times and based on content analysis techniques. Sampling units included laws, decrees, or legislative acts, while the recording units comprised three defined periods: the colonial era, the republics, and the 20th century. The context was shaped by historical documentation and scientific literature, linking events, trends, or social and economic conditions in the international environment of America and Europe. The review investigated evidence of how societal relationships with the environment were conceived and regulated. Concepts such as the environment, ecosystem, or natural resources are recent and were not considered in legislation several centuries ago. Therefore, the initial analysis categories were economy, exploitation, urban development, industrial development, agriculture, land management, irrigation, and pollution. After the initial review, the emerging themes were water and forests. A reference concept for the analysis was the identification of interrelationships or systemic perceptions of the environment and human communities. The review was conducted on official legislative databases and private online databases with public access. Subsequently, the integrated management policy in Colombia is described, and the main criticisms and concerns of various authors about the scope of this 'integrated' approach are discussed. This is contrasted with what was evidenced in the historical context, concluding with a comparative analysis with control theory.

## Laws and the Society-Environment Relationship

According to Thomas Aquinas, law is the ordering of reason directed towards the common good and promulgated by those who care for the community. However, the idea of the 'common good' changes depending on the time and context. The term 'law' also refers to the faculty to prohibit and permit things, conditioning the freedom of individuals according to the rights of others (RODRÍGUEZ; UNDURRAGA; VODANOVIC, 1998). For Hans Jonas (1995), Kantian ethics arise from the notion that the action of one individual can affect another, but nowadays, human action can impact the entire biosphere, necessitating responsibility in this regard. From the foregoing considerations, to guide the analysis proposed here, law will be considered as: **the means of regulating the relationships between individuals in society and their environment, in a way that such relationships tend towards the common good.**

## Influence of Spaniard colonization

At the beginning of the colonial era, the relationship between the community and natural resources focused on provisions for occupying and exploiting new territories for direct sustenance. Waters belonged to the Spanish crown, which granted exploitation permits known as 'Merced' (ARAYA; MANRÍQUEZ, 2003; TORO, 2011). In 1573, the crown issued the 'Ordenanzas de descubrimiento y nuevas poblaciones' (Ordinances of

Discovery and New Settlements), considered the first Urban Planning Guidelines of the Modern Age and the beginning of the Colonial era. This regulation guided the search for healthy environments with resources, considering needs such as water for consumption, irrigation, and disposal of household waste, forests for firewood, and land for cultivation and livestock. The ordinances explicitly stated their purpose, constituting the common good: “establishing and prospering as a community to expand the kingdom and religion.” The ordinances marked a milestone as Western knowledge began to regulate access and use of natural resources in Colombian territory, influencing social formation up to the times of independence (BLANCO BARROS, 2001; BERNARD; ZAMBRANO, 2014).

In the later stages of the Colonial era, the *Encomienda* (Feudal System in Americas) granted land management to a privileged minority, with the aim of agricultural, mining, and forestry exploitation, using a natural reserve to strengthen the Spanish empire (MORELLO; RODRÍGUEZ, 2009). With the issuance of the Royal Decree of 1754 and the San Ildefonso Decree of 1780, economic possession of the land defined ownership, favoring the establishment of large estates as a social institution (ORTIZ GUERRERO; PÉREZ MARTÍNEZ; MUÑOZ WILCHES, 2006). Local lordships economically empowered Creole hegemonies, leading to independence movements and the establishment of a republic with diverse interests in the organization and exploitation of its resources (DURAND ALCANTARA, 2009).

### 19th Century: The Republics

Bolívar, influenced by European enlightenment ideas (UMAÑA, 2001), among others by Alexander Von Humboldt (MONGE, 2000), showed a broad vision of the environment in the Chuquisaca Decree of 1825. In this decree, he showed a clear understanding of the hydrological cycle, and observed the interrelationships between society, water, and forests as a source of energy for the economic development of communities. This vision aligned with the new goals of the state and available technologies at the time. There is limited documentation regarding water management regulations or actions in the second half of the 19th century in Colombia. Toro (2011) asserts that the first relevant act was Law 55 of 1886, which allocated 8,000 cubic meters per day for populations in the Sogamoso Valley. In 1887, the Civil Code was enacted, based on the Andrés Bello Code, which in turn was influenced by the Napoleonic Code (GALINDO, 2011; TORO, 2011). This code, which established the ownership and nature of natural resources, defined water, the course, stream, or body of water, and its channel or bed as a single indivisible entity. It further defined water as a public asset of the Union (Republic), for the benefit of individuals and under state control, which must regulate its use (IICA, 1972).

The government of Gran Colombia collected and issued exploitation licenses for resources to strengthen the centralist state, sparking conflicts with regions and exacerbating widespread social and economic inequalities. Following the dissolution of Gran Colombia in 1831, during the Republic of Nueva Granada, internal conflicts strengthened a liberal movement that promoted the Rionegro Constitution (1863) and the creation of the United States of Colombia, a federal and liberal political entity. Private exploita-

tion was encouraged as a model of progress, a concept which, in this context, was an amalgamation of philosophies including Enlightenment ideals, evolutionary theory, and positivism (TINOCO-GUERRA, 2006). The government implemented policies for the exploitation of territories, especially in the warm lands, which were practically uninhabited and considered vacant, as 70% of the country's population lived in cold zones (PALACIO, 2006), following the legacy of the 1573 Ordinances.

Delgado (2012) provides an overview of the forest regulations during the patrimonialist or Nature liberalization period (1850 – 1920), highlighting the doctrinal shift in policies. Around 1870, policies leaned towards the free exploitation and colonization of forests by private individuals. However, after the 1886 Constitution, characterized by a centralist approach, these liberties were restricted. The liberal directive to stimulate forest colonization and exploitation drove the Antioquian colonization, although the extent of its impact on the natural landscape by the end of the 19th century is debated (PALACIO, 2000). The restrictions imposed after 1886 also failed to curb the effects in the first quarter of the 20th century when resource pressure increased due to demographic growth and a half-century of agricultural development inertia (PALACIO, 2000) (DELGADO, 2012).

Throughout the 19th century, political transformations did not improve the precarious social conditions of the population, customs and institutions inherited from the colonial era, such as slavery, sharecropping, and colonial estates, persisted until the mid-century (ORTIZ GUERRERO; PÉREZ MARTÍNEZ; MUÑOZ WILCHES, 2006). Timber extraction and concentrated land ownership favored the strengthening of estates with plantations of sugarcane, cocoa, plantains, and extensive livestock in the valleys of the Magdalena and Sinú rivers (FALS BORDA, 1979). Social asymmetry and liberal ideas accentuated opposing interests, keeping the country in continuous conflicts.

### Regulation in the 20th Century

As the 20th century progressed, new actors and regulations emerged, responsibilities were delegated to local authorities, and community participatory action was promoted. New government entities such as the Ministry of Finance and Treasury, the Ministry of Agriculture and Commerce, and the Ministry of Development reflected the developmental spirit of the state. On the other hand, the Land Law and the Antioquian Colonization Law diversified the nature of land ownership and exploitation.

At the beginning of the century, legislation on renewable natural resources was issued in a disorderly manner without clear criteria (UCROS, 2009). Subsequently, legislation began to prioritize responsibilities and rules regarding the use and exploitation of resources defined in the civil code. The regulation of water use was the responsibility of municipalities according to decrees 1662 of 1902, 574 of 1905, and Law 5 of 1905. For hydroelectric use, also known as hydraulic power, Law 113 of 1928 reserved the granting of licenses to the government (IICA, 1972).

Law 119 of 1919 regulated the exploitation of vacant land and forests and their forms of lease or concession. Article nine prescribed conservation measures for special

forest areas extending 50 to 100 meters on each side of springs, streams, and any natural deposits of usable water (CONGRESO DE COLOMBIA, 1920), laying the groundwork for what is now known as the '*ronda hídrica*' or water buffer zone. The same law established participatory action as a surveillance mechanism and defined municipal responsibilities in the conservation of plant wealth for the protection and use of water resources (VILLEGAS; AMERICANO, 1977), intertwining the protection of water and forests.

Law 71 of 1917 and Law 200 of 1936, known as the Land Law, granted property titles to settlers (MACHADO; VIVAS, 2009), and Law 93/1931 regulated forest exploitation. Decree 1381 of 1938 expanded the concepts related to the use, conservation, and distribution of water. Later, in 1940, Decree 1382 established guidelines on water concessions and their distribution, using technical criteria associated with flow and users. The aim was to achieve the best distribution for each watercourse, considering current and future needs (REPÚBLICA DE COLOMBIA, 1940).

### Second Half of the 20th Century

In the 1950s, entities such as the Autonomous Regional Corporation of Valle del Cauca (CVC), introduced the policy of 'multipurpose' water management (TORO, 2011). The Autonomous Regional Corporation of Valle del Magdalena and Sinú (CVM) was established in 1960, and the Autonomous Regional Corporation of Cundinamarca (CAR) in 1961. In 1953, the creation of the Institute of Colonization and Immigration and Decree 2278 for the regulation and use of forests preceded the promulgation of Law 2 of 1959, whose purpose is still relevant: 'The development of the forestry economy and the protection of soils, waters, and wildlife.' 'Protective Forest Zones' and 'Forests of General Interest' were established, implementing the new 'conservation' approach. The law demonstrates an understanding of the interrelationships of the environment in its second article: 'Forest Reserve Zones are declared on vacant lands located in the hydrographic basins that serve or may serve as a water supply for internal consumption, electricity production, and irrigation.'

In line with the principles of the Stockholm Conference on the Human Environment in 1972, Law 23 of 1973 aimed to 'prevent and control environmental pollution and seek the improvement, conservation, and restoration of renewable natural resources to defend the health and well-being of all inhabitants of the national territory' (CONGRESO DE COLOMBIA, 1973). Two important doctrinal elements are evident: 1) a direct relationship between the environment and human health or well-being, and 2) the prevention and control of pollution. While the term 'pollution' is common today, at the time, it was a step forward to hold society accountable for disposing of substances or forms of energy that alter the natural environment and ultimately threaten human health and well-being.

Law 23 laid the foundation for Decree 2811/1974, or the National Code for Renewable Natural Resources and Environmental Protection, which became the guiding norm in environmental matters. It consolidated scattered provisions and organized environmental

institutions around the Institute for the Development of Natural Resources – INDER-ENA (UCROS, 2009). This regulatory framework, a first in Latin America, marked a turning point by considering the environment as a common heritage (CONGRESO DE COLOMBIA, 2014). It maintained the legal nature of water, formulated measures for the conservation and control of water bodies' pollution, and established the collection of usage and retributive fees, discharge permits, among other guidelines (ZAMUDIO-RODRIGUEZ, 2012). It also defined the watershed as a special management area and a key consideration for water administration. Subsequent legal arrangements, such as Decree 1594 of 1984, focused on water uses and responsibilities for pollution. Decree 1729 of 2002 provided guidelines for watershed management, although many watershed management plans still remained in the formulation phase with limited practical effects (BLANCO, 2008).

Building on Decree 2811 and the guidelines of the Rio Summit, the Political Constitution of 1991 adopted the concept of Sustainable Development, redirecting the Colombian State toward that common good. Law 99 of 1993 organized the National Environmental System – SINA - a political and institutional renewal for environmental management. Among other contributions, it introduced the principle of compensation, environmental impact assessments, environmental management plans, and a robust institutional structure. It also established the definition of sustainable development as one that ‘... leads to economic growth, improves the quality of life, and enhances social well-being without depleting the base of renewable natural resources on which it relies or deteriorating the environment or the rights of future generations...’

Gallopín (2003) proposes a systemic approach in which the socio-ecological system (SES) is central. He argues that Sustainable Development is a directional change process through which the system improves sustainably over time. The improvement or development of the SES is a challenging notion to address because it does not necessarily imply economic growth. The idea of improving ecosystems can be proposed, reinforcing their mechanisms of redundancy in the flow and distribution of matter, energy, and information (CARDONA-ALMEIDA; OBREGÓN; CANALES, 2019), increasing their resilience. On the other hand, directional change means a goal-oriented shift, with strategies guiding that change. This conception of Sustainable Development insists on recognizing that these are non-static, dynamic, and evolving processes, or using a suitable term: adaptive. In the 20th century, the perception of the environment became increasingly complex, as did institutional and regulatory arrangements. The discourse shifted from discussing marginal resources to understanding the interactions between society and the environment in a systemic manner, all of which were also the result of global advances and events.

### **The global context**

Events in the fields of science, technology, ethics, economics, and politics have an impact on the public administration of each country. For example, the French Revolution and the Industrial Revolution would drastically transform the relationship between individuals and their natural environment. Both revolutions motivated changes in social

and economic order, triggering processes of independence and changes in government systems, the concept of the state, progress, and capital. Table 1 summarizes some of these events in parallel with the management of natural resources in Colombia.

**Table 1 – Parallels between international and local contexts, and impacts on natural resource management**

	Europe, North America	Colombia	Observations on the Management of Natural Resources in Colombia
1700— —1800	Enlightenment, Bourgeoisie Growth, <i>liberalism</i> , Industrial Revolution, U.S. Independence, French Revolution	Encomienda (Feudal Servitude), Mining and agricultural exploitation. Spanish commercial monopoly	Non-technified and non-intensive mining. Agricultural economy based on colonial haciendas. It did not cause strong impacts on the environment, but it did cause a concentration of land and wealth.
1800— 1850	Urban densification, industrial technical development. Specialization of labor. Liberal economy of capital and commerce. <b>Public education</b>	Independence, hegemony of colonial haciendas. Poor commerce. Concentration of power based on land tenure. Low technification and commerce.	Poverty and weakness of the state do not achieve social or economic transformations. Use of natural resources continues to be mediated by the colonial hacienda. Popular unrest exacerbates internal conflicts.
1850— 1900	Health idea. <i>Electrical development</i> , capital surpluses and investment in foreign assets. Scientific growth. Proletarian nonconformity.	Internal conflicts. Social asymmetry. <i>Liberal policies</i> as a development mechanism. Plantations, cattle raising. <i>Education delegated to the church</i>	Freedom of resource exploitation is encouraged. The inertia of the economic powers concentrated in land tenure promoted traditional hegemonies to benefit. There is no infrastructure.
1900— 1950	Expansion and capitalist strengthening of industrial countries. World wars. Communist revolutions. Economic crises.	Colonization of Antioquia, <b>public primary education</b> system. Land law. <i>Hydroelectric generation</i> policies.	Incipient technical development. No transportation infrastructure. Antioquian colonization and land law allow for dispersion in land tenure, but increase deforestation. Internal conflicts delay development.
1950— 2000	Welfare states. Industrial and infrastructure development. Monetarist and market policies. Globalization.	Armed conflict, drug trafficking. Industrial growth. Protectionism - Opening. Monetarist policy. Specialization of labor. Infrastructure.	The armed conflict restricted rural development and expansion to some extent, but accelerated migration and urban growth.

Source: Authors, 2023.

The industrial booms of the 18th and 19th centuries, along with their labor re-



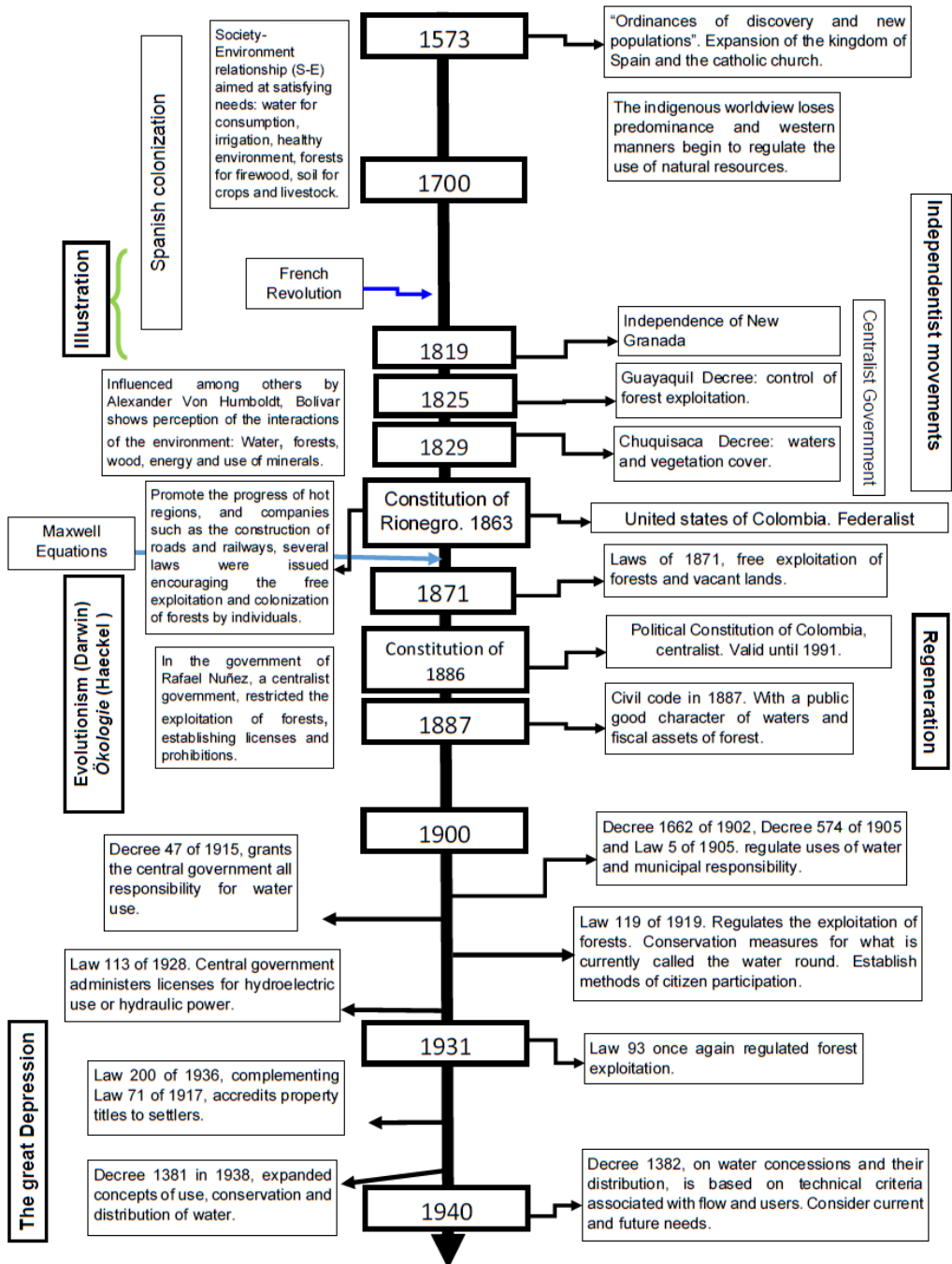
quirements, transformed individual freedoms and natural resource demands. During this time, public education systems were organized in countries such as the United Kingdom, Germany, France, Italy, and Spain. Cities grew rapidly, and overcrowding, highlighting human vulnerability to environmental disruptions (SZRETER; MOONEY, 1998). The unhealthy environment reduced the quality of life, and by the second half of the 19th century, led to the sanitation model developed in Liverpool, Manchester, and London, promoting waste management measures to prevent infectious diseases such as cholera (MACKENBACH, 2007). By the end of the 19th century, the construction of thermo-electric and hydroelectric plants in France and the United States marked the second industrial revolution. On the other hand, Darwin's theory of evolution and Haeckel's ecological idea permeated thought beyond the natural sciences. In the following century, magnified industrial and technical capacity unleashed severe impacts on the environment. Rachel Carson's texts, "Silent Spring" in 1962 and Garrett Hardin's "The Tragedy of the Commons" in 1968, spurred ecological movements in the 1960s and 1970s, along with scientific and political interest in environmental issues.

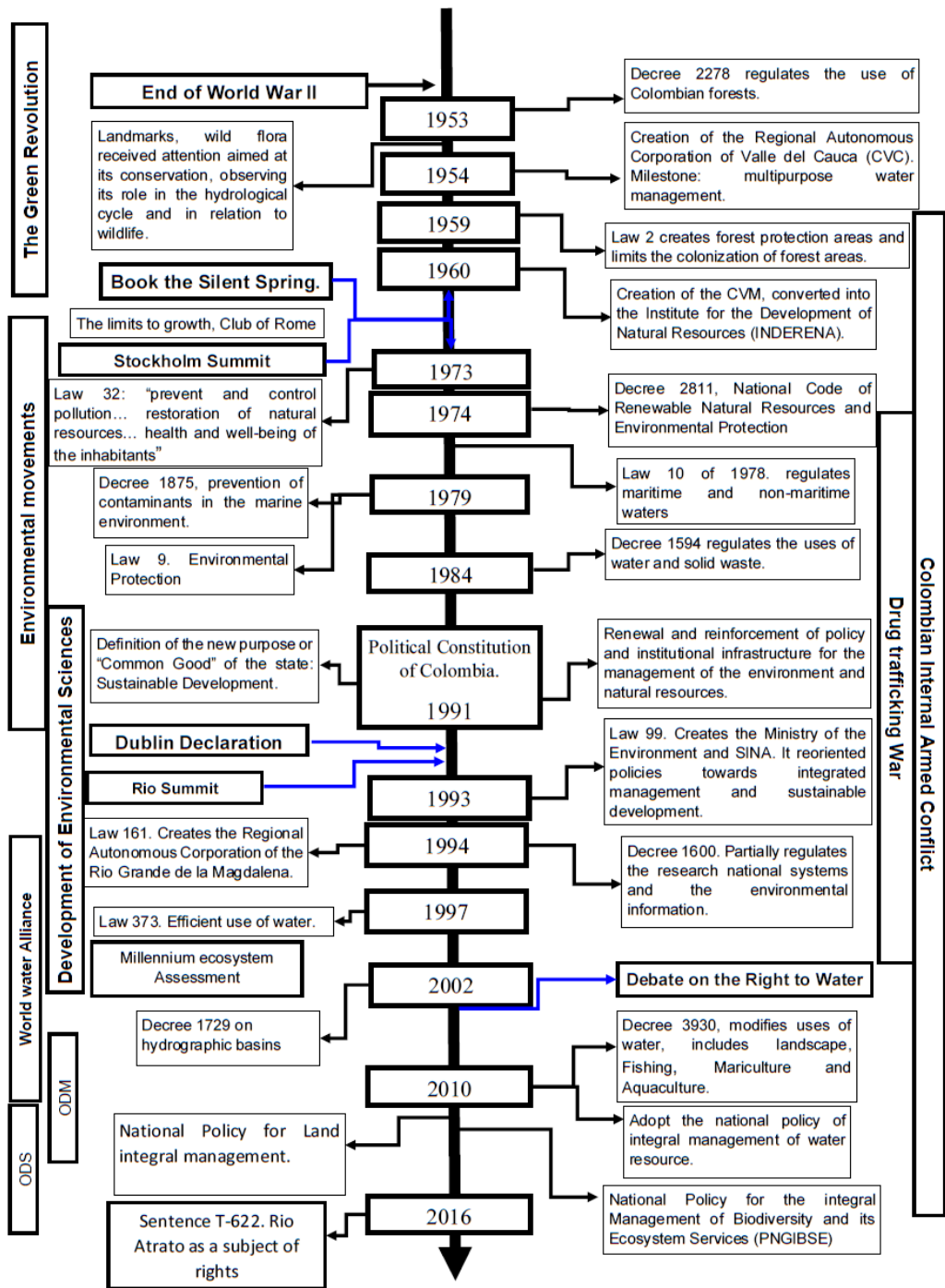
The industrial boom and economic growth did not occur in Colombia, where capitalism was not fully implemented, at least not during the 19th century when the colonial estate prevailed (ORTIZ GUERRERO; PÉREZ MARTÍNEZ; MUÑOZ WILCHES, 2006). Faced with a weak state, it relied on the church to maintain a poor and submissive population (RAMÍREZ, 2008). The land hegemonies, and the limited education of the peasantry in Colombia sustained an economy incapable of absorbing technological advances, hindering autonomous progress in infrastructure or natural resource exploitation. The exploitation of forests, banana plantations, Magdalena River navigation, and oil exploitation in the early 20th century were carried out with foreign labor, relinquishing control of resources and sacrificing benefits. This lag in the country during the first half of the 20th century kept it away from global conflicts but fueled the reasons for the Colombian internal conflict (UNDP, 2011).

One consequence of the conflict has been the massive migration to urban areas, fostering a middle class that is not oblivious to global consumption habits. By the first decade of the 21st century, Colombia achieved improvements in technical, industrial, educational, and governmental development (OECD, 2015). The current Colombian society, with increased capacities and resource demands, is fully capitalist, making strategies toward sustainable development increasingly urgent. This is evidenced by Document 3918 of 2018 from the National Council for Economic and Social Policy – CONPES- which outlines strategies for the implementation of the Sustainable Development Goals (SDGs) in Colombia.

The Colombian legislation has reacted increasingly quickly to political, economic, and scientific trends, reshaping the notion of the common good, aligning with global conventions and protocols, and consequently modifying regulations related to natural resources. In Figure 1, significant global events are presented along with their temporal connection to milestones in the management of natural resources in the country.

Figure 1 – Timeline of the normative development of the Society-Environment relationship, from the beginning of the Colony to the present day





Source: Authors, 2023.

## Integrated Water Management

Despite the policy orientations towards integration from the Natural Resources Code and the SINA, these and their regulatory arrangements were not operational (AFD, 2015). There was no clear idea of how to implement integrated water management or how to translate that concept into practice (RESTREPO, 2003), a situation accentuated by a lack of technical capacity and knowledge in past decades (BLANCO, 2008) in both academic and administrative institutions. The ineffectiveness of the integrative vision, among several other reasons, resulted from the fragmentation of management; water management in Colombia has been scattered across various institutions, some of which did not even acknowledge their relationship with water resource management (RESTREPO, 2003).

The PNGIRH of 2010 sought to address this ineffectiveness by adopting conceptual frameworks and integration strategies. It carried out a comprehensive review of the existing regulations on water management and conducted an in-depth analysis of water supply and demand in the country. Based on this foundation and through participatory methodologies, it formulated principles, purposes, and strategic priorities under the paradigm of integrated water management. From these priorities, the Policy established six specific objectives for management: supply, demand, water quality, risk associated with water resources, institutional strengthening, and governance. Each objective defines strategies (19 in total), and from there, specific goals (29 in total). To achieve these goals, it defines 37 indicators and 62 strategic lines that constitute the National Water Plan.

To synthesize the critical analysis of the PNGIRH in this article we propose, illustratively, two dimensions of integration: horizontal and vertical. “Horizontal integration” represents water management based on the analysis of aspects that interact with the water resource at the same geographic scale, such as territory, ecosystems, economic activities, and social well-being. On the other hand, “vertical integration” prioritizes management tools and organizes existing regulations within its principles and strategies, seeking to coordinate purposes at different geographic and policy scales.

The PNGIRH has, as one of its purposes, horizontal integration, considering the effects and implications of management decisions on other resources and water users. For regional and local actors, this creates challenges of great technical complexity because it involves understanding interrelationships and interdependence of components such as communities, water systems, ecological supply, biodiversity, territory, government structures, among others, aggravated by the uniqueness of each system. This happens independently of the requirements of vertical integration, which are more oriented towards aligning government plans and land management or territorial planning. For these local decisions, the Policy tangentially mentions terms or concepts that guide towards considering, studying, modeling, analyzing, investigating, or generally understanding all phenomena related to water to be considered in management. Thus, the PNGIRH lacks clear guidance for local actors on how to understand in an integrated way the water resource systems within their jurisdiction.

The fourth principle of the PNGIRH establishes: “The comprehensive management

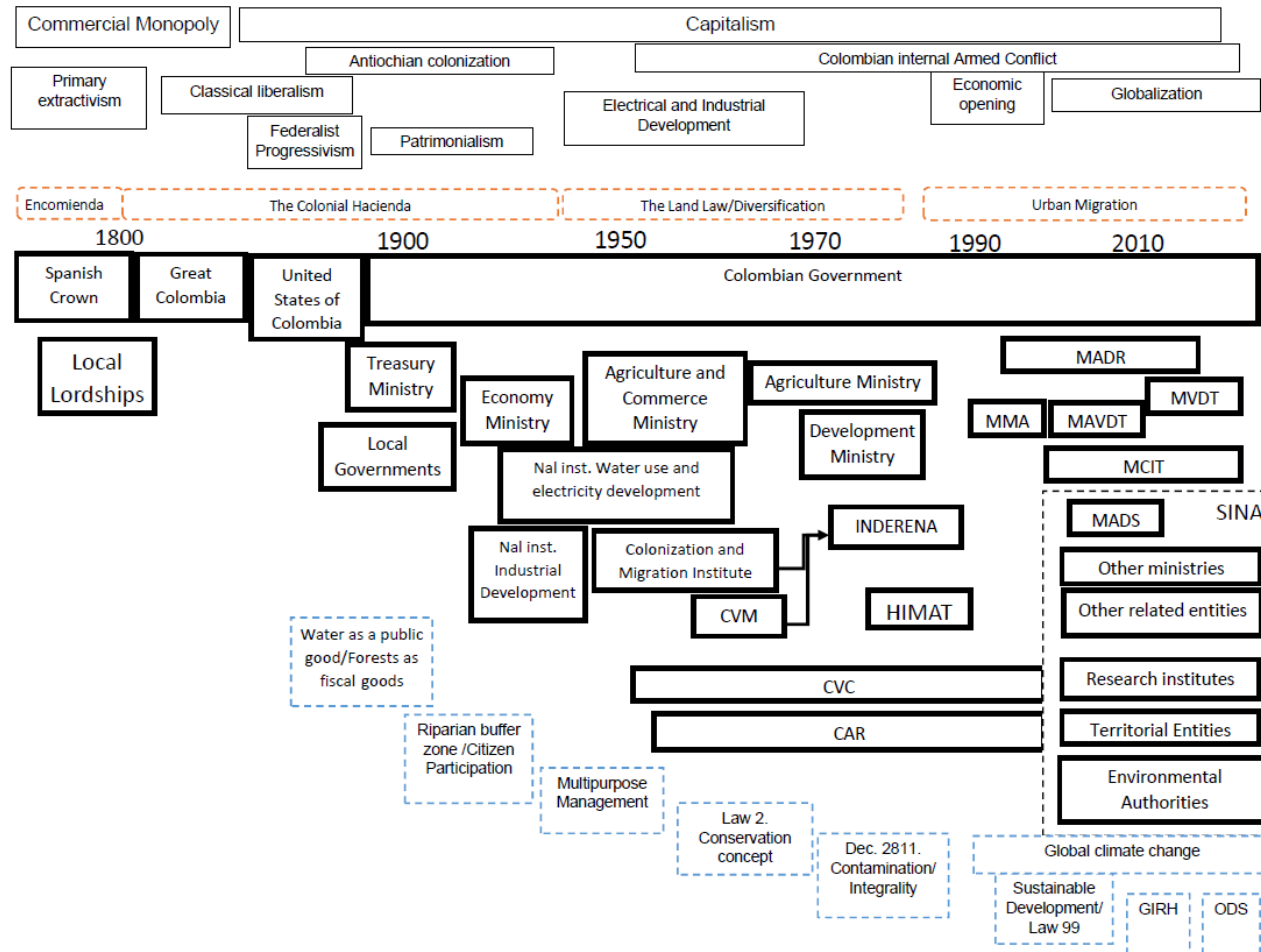
of water resources harmonizes local, regional, and national processes...”. This would be “vertical integration” that frames the National Water Plan, strategic plans for hydrographic regions, watershed planning, territorial planning, among others. However, this vertical articulation is truncated in a documentary dimension, lacks financial resources, and tangible achievements. For example, during the first phase of the National Water Plan completed in 2014, 59% of environmental authorities reported progress results below 35% of the proposed goals, and 34% of entities did not even provide information. Among the reasons highlighted are the lack of economic resources and poor institutional coordination (BAYONA, 2015).

In summary, the PNGIRH organizes, endorses, and prioritizes existing legislation, institutions, and management tools according to IWRM principles. It also establishes national-level priorities related to water management. However, it does not establish or suggest strategies for a local or regional actor to understand and analyze its resources, systems, and communities in an integrated manner. Consequently, decision-making at the local level hardly incorporates the IWRM philosophy, perpetuating dependence on the central order.

The lack of integration in water resources management, as described by Restrepo (2002) and portrayed by Blanco (2008) with the phrase “paralysis by analysis,” does not seem to be resolved in the current structure. On the contrary, the decentralized leadership that delegates efforts and capacities lacks a systemic organizational approach, and the economic instruments for financing management are weak and incapable of conveying the message of water scarcity and economic value (RUBIO-GOYES, 2019). According to Rubio-Goyes (2019), the low effectiveness in implementing the PNGIRH is also a result of the disarticulation of numerous entities with influence over water, which has increased in number in recent decades. Additionally, the participation of various actors and civil society in water management, through instruments such as Basin Councils and Regional Environmental Councils, is regulated by Decree 1076 of 2015, but there are no widespread studies on the effectiveness of this multisectoral participation in water management in Colombia.

The environmental institutional framework inherits practices from the traditional clientelist politics, undermining its governance capacity (CORREA-ASSMUS, 2015). The origins come from the colonial model of land concentration and economic power. Marginalization and poverty on one hand, and agrarian clientelism on the other, became fundamental structures of political parties and government institutions (MEDINA GUTIÉRREZ, 2011). Figure 2 provides an overview of the evolution of environmental institutionalization in Colombia, contextualizing some of the political, social, and economic events discussed earlier.

Figure 2 – Institutional evolution for the management of natural resources (MMA: Ministry of Environment, MADR: Ministry of Agriculture and Rural Development. MAVDT: Min. of Environment, Housing and Territorial Development. MVDT: Min. of Housing and Territorial Development. MADS: Ministry of Environment and Sustainable Development. MCIT: Ministry of Commerce, Industry and Tourism



Source: Authors, 2023.

The number of entities related to natural resources management has increased. In the case of water, hydro-meteorological observation is carried out through IDEAM, attached to the Ministry of Environment and Sustainable Development - MADS, but water management for sanitation falls under the Ministry of Housing and Territorial Development. On the other hand, the Ministry of Agriculture and Rural Development has interests in water use for the agricultural sector, the Ministry of Mines and Energy for electricity generation, and the Ministry of Transportation for navigation. While the PNGIRH is a national-level policy, the proliferation of actors, policies, and plans from different sectors hinders its effectiveness.

### Discussion and Final Considerations

The notion of the “common good” that defines legal doctrines, its purpose, and the relationships between society and the environment can change dramatically. In the case of forests, for example, regulations at times aim to exploit, appropriate, or conserve the resource, reflecting opposing ideas of action. Throughout the history of natural resources legislation, there is an observable change in social needs and, consequently, in the regulatory purpose or “common good” of each era.

The nature of natural resources has also changed, being considered external factors, sources of wealth, public-use goods, or fundamental rights (DÍAZ-PULIDO et al., 2009). Forests, as fiscal assets, were managed according to the state’s progress interests, while water, as a public good, was regulated in its use. Although the doctrine of the “public good” has proven useful, the term “use” seems to represent a limited view of all the interdependencies between society, water, and the natural environment. The transition from viewing water as a means of waste disposal (use) to a public good (common use) and, later, a human right took intervals of a century, illustrating the evolution of the perception of human dependence on the environment. The concept of water as a common good, which is the legal characterization, could not escape the tragedy of the commons. Various solutions from science and politics were developed in response, such as the idea of the economic value of water, one of the principles of the Dublin Convention. The institutional structure resulting from previous legislative doctrines inherits and maintains this incomplete view of water and its uses. Would it be logical to talk about integrated management when all legislation defines the interaction between water and society as “uses” of the resource?

Despite the term “use,” for several centuries, legislation has demonstrated an understanding of the complex relationships between society, the geophysical and biological environment, and water. This is evident from the Ordinances of 1573, as well as the Chuquisaca decree, which shows a holistic perception of the relationship between water, biomass, energy, and economic development. The regulations of 1905 exposed the interrelation of economic, hydrological, and forest aspects, and by 1919, community participation in resource oversight was emphasized. The 1940 decree on water use regulation took into account other uses and users (demands), both current and future, and the application of technical criteria, anticipating the idea of environmental flow and

the guidelines of IWRM by several decades. Similarly, in 1954, the term “multipurpose” referred to management measures that integrated solutions to diverse problems in a regional context. The Law 2 of 1959 explicitly mentioned the relationship between forests and forest reserves with the hydrological cycle, wildlife, and economic processes. Later, the Law 23 of 1973 explicitly conceives the environment as a unit, formed by interacting complex components. Towards the end of the century, Law 99 of 1993 adopted the definition of sustainable development, and in the new millennium, paradigms such as integrated management, ecosystem services, SDGs, among others, have quickly been incorporated into public policy discourse.

It has been repeatedly shown that the idea of interconnection, integration, and interdependence between the environment and society has been present in legislation for centuries, anticipating elements, characteristics, and interdependencies close to what is defined today as a socio-ecological system. Nevertheless, the legislation is repeated, with the aim of updating or complementing it, incorporating trends and external events. However, environmental issues paint a concerning picture, leaving the impression that laws, as tools for the common good, are not effectively functioning.

In light of the aforementioned considerations, the concept of “integration” does not provide guarantees or a historical advantage toward the goal of sustainable development. The vision of integration has been present, albeit implicitly, for centuries, making it not a novelty in itself. However, the paradigm of integrated water management is more complex and robust than a mere perception of environmental holism. By explicitly articulating the concept of integrated management, it calls not only for legislators but also for practitioners to this purpose. In this context, what is the role and relevance of contemporary integrated management policies? If the notion of integration is so ancient, what new contributions do current policies have to offer, and how can they enhance their effectiveness?

### **Feedback, control, and adaptive management**

In 1916, Henry Fayol postulated the basic functions of the administrative process: planning, organizing, directing, coordinating, and controlling, which permeated public administration and laid the foundations for strategic planning. Similarly, Norbert Wiener’s cybernetic theory highlights the idea of control as a fundamental part of system management, a concept also applied by Stafford Beer to the functioning of a government organization. Laws, as means of regulating interactions between individuals and their environment, can be associated with the idea of system control. In this sense, we propose the following postulate: the law is a tool of control that, through the regulation of interactions between individuals and their environment, seeks to steer the society-environment system towards a desirable state of the common good.

The control process involves defining an objective state for the system, implementing management actions, and observing the behavior to assess if it is approaching the proposed objective. Subsequently, corrective management actions are taken (feedback) until the desired state is achieved. In comparison, legislation typically defines actions to condition the performance of the system. A legislator needs a current understanding of



the system and a desirable objective, but it is not common to have observation metrics to evaluate the result of implementing laws in the society-environment system. Nor are feedback mechanisms designed to correct or redirect the system toward the desired objective.

From the historical review, it is evident that while the sense of system and integration was present in legislation, observation and feedback mechanisms were lacking. Institutions were tasked with normative implementation but lacked the tools to understand the system's response and correct it. This feedback and control mechanism resembles the concept of adaptive water management, referring to the systematic process of improving management policies and practices through learning from implemented strategies (PAHL-WOSTL, 2008).

On one hand, norms lacking mechanisms to understand and redirect actions within the system, and on the other hand, the persistence of clientelist habits in institutions focusing on meeting performance indicators (such as annual budget execution), favor environmental deterioration and hinder social and economic development. Thus, without a deep understanding of the results of their management actions or how to improve them, institutions cannot steer the system towards the common good, as stated by Thomas Aquinas, or towards improvement or development, as illustrated by Gallopín. Consequently, institutions wear down and fail in their purpose.

The feedback mechanisms of the PNGIRH are performance indicators that measure, for example, the percentage of project execution, percentage of invested resources, and number of hectares of protected forest, among others. However, these indicators are not useful for understanding the integrated response of the system to the actions taken. Focusing on normative and institutional articulation, the PNGIRH fails to incorporate observation strategies, i.e., integrated analyses. This lack does not empower institutions to correct actions aimed at achieving the development purposes of the system. In terms of adaptive management, this would be equivalent to learning to manage based on the results of implemented strategies.

The PNGIRH has a rigorous diagnosis of the current state and clear purposes built in a participatory way. It has also sought coordination with entities such as the Strategic Plans of Hydrographic Regions and the Hydrological Resource Information System (SIRH), with the aim of improving the comprehensive knowledge of the systems to be managed. Nevertheless, this study proposes improvement strategies focused on feedback, adaptation, or integrated analysis tools, both at the national and regional levels. In other words, moving from performance indicators to system state indicators, aiming to understand the effectiveness of actions and facilitate their reorientation. Paradigms such as water security, water footprint, ecosystem services, food security or autonomy, and the water-energy nexus can complement the PNGIRH as state indicators. Furthermore, to improve governance and operational results, more effective coordination efforts and a cyclical evaluation of the management process are needed. Additionally, political efforts are required to detach institutions from administrative, electoral cycles, and clientelist mechanisms.

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# Gestão Integrada dos Recursos Hídricos na Colômbia, uma Perspectiva Histórica

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**Resumo:** O paradigma da gestão integrada propõe o gerenciamento de um recurso, tal como a água, considerando as suas inter-relações com outros componentes do meio ambiente. Essa visão foi adotada como política em vários países, incluindo a Colômbia; porém, os resultados não têm sido satisfatórios. Este artigo estuda o escopo da “integração” em acordos regulatórios anteriores, fazendo uma revisão retrospectiva deles para entender como têm evoluído a percepção e a gestão do meio ambiente na sociedade colombiana. É mostrado como a noção de um ambiente complexo e integrado não é exclusivo das políticas atuais, mas tem estado presente nas leis das sociedades humanas há vários séculos, mas que esta consideração não é garantia de sucesso. Estratégias de melhoria para regulamentações recentes são propostas com base nos resultados de estudos.

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**Palavras-chave:** Gestão Integrada de Recursos Hídricos, Legislação Ambiental, Relação meio ambiente e sociedade, Sistemas socioeconômicos.

# Gestión Integrada del Recurso Hídrico en Colombia, una Perspectiva Histórica

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**Resumen:** El paradigma de la gestión integrada propone manejar un recurso, como el agua, considerando sus interrelaciones con otros componentes del entorno. Esa visión se ha adoptado como política en varios países incluyendo a Colombia, pero sus resultados no han sido satisfactorios. Este artículo estudia el enfoque de “integración” en anteriores arreglos normativos, haciendo una revisión histórica de los mismos para entender cómo ha evolucionado en Colombia la percepción y el manejo del entorno por parte de la sociedad. Se muestra como la noción del entorno complejo e integrado, no es exclusivo de las políticas actuales, sino que está presente desde hace varios siglos, por lo que su consideración no significa una garantía de éxito. Se proponen estrategias para mejorar los resultados de los arreglos normativos recientes.

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