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Water – Handbook of the Anthropocene in Latin America IV

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Water in Mesoamerica in the Colonial Period

Ecological Emergence and the Impact of Colonization (1492–1820)

Diana Birrichaga

In the Anthropocene, in which human influence has left an irreversible mark on the terrestrial landscape, it is essential to reflect on how Mesoamerican civilizations managed their water resources. The practices of these pre-Hispanic civilizations reflect a deep respect and understanding of water's importance.

Some researchers argue that 1610 may have marked the beginning of the Anthropocene due to a decrease in atmospheric carbon dioxide concentrations. This change is linked to the European colonization of Mesoamerica, which resulted in a drastic reduction of the Indigenous population due to disease and conflict. As a consequence, large areas of agricultural land were abandoned, facilitating the recovery of vegetation. This resulted in a decrease in CO_2 levels in the atmosphere, a phenomenon proposed as a possible indicator of the beginning of the Anthropocene owing to its clear presence in the geological record and its direct relationship to human activities. However, it should be noted that this proposal has been the subject of debate by other scholars (Trischler 2017).

This chapter proposes that the cultural concept of the Anthropocene can be established from the arrival of Europeans in Mesoamerica in 1520. The period of colonization until 1820 radically transformed both the Indigenous populations and the environment, significantly impacting the essential resource of water. This chapter contextualizes the ecological water crisis in Mesoamerica during European colonization, highlighting how this alteration transformed land use systems, exploited natural resources, and left a lasting imprint on water's existence and quality in the region. In addition, intrinsic links between colonial processes and the transformations in the society-nature relationship are explored (Castro 2021).

Colonization immediately transformed land use and the landscape. European agricultural techniques introduced export crops such as wheat and sugar cane, causing deforestation and transforming extensive forests into agricultural areas and pastures. In addition, the expansion of cattle ranching intensified these changes, directly affecting regional hydrological cycles. The reduction in the soil's

capacity to retain water led to an increase in runoff and erosion, making rivers more susceptible to floods during the rainy season and to decreases in their levels during the dry season (Musset 1992: 58).

During colonization, mining, as a form of natural resource exploitation, exacerbated the water crisis in Mesoamerica. The search for precious minerals such as gold and silver led to the excavation of large-scale mines, directly impacting local aquatic ecosystems. The extraction of these materials required large quantities of water to wash and process the minerals, which depleted nearby water sources. In addition, toxic chemicals released into the surrounding rivers and streams contaminated the water supply and damaged aquatic life.

However, the pre-colonization relationship of Mesoamerican societies with their natural environment should not be idealized. It is clear that all human activities, including those of Mesoamerican societies, had environmental impacts. Although these impacts were minor compared to those caused by Spanish colonizers, they existed and should not be ignored. For example, the construction of *chinampas* (floating gardens where vegetables and flowers were grown) allowed the Indigenous people to develop intensive and highly productive agriculture. However, this practice also altered natural water bodies by transforming large lake areas into agricultural land. Similarly, dams and canals modified the natural flow of lakes and rivers, affecting aquatic and terrestrial ecosystems. Artificial river channels were also created (Musset 1992: 66). While these structures facilitated transportation and commerce, they also required constant maintenance to prevent floods.

However, these methods contrasted with the policies implemented by the Spanish, who opted for more drastic solutions such as draining lakes. The European invasion not only altered the environment but also transformed the relationship between society and nature in Mesoamerica. Land and water ownership systems were reconfigured with the arrival of the colonizers, resulting in the concentration of land and resources in the hands of European settlers and the dispossession of local Indigenous populations. This reorganization had profound implications for water access and distribution, as Indigenous populations lost control over water sources they had used for generations. In addition, colonization introduced new institutions and regulations that influenced water management and use in the region.

The Conquest and the Ecological Water Crisis

Before the conquest, various Indigenous groups such as the Mexica (central Mexico), Mixtec (Oaxaca, Mexico), Maya (southeastern Mexico, Guatemala, Belize, and parts of Honduras and El Salvador), Pipil (El Salvador), Lenca (Honduras), Nicarao (Nicaragua), Bribri (Costa Rica), and Cabecar (Costa Rica) had settlements with advanced hydraulic infrastructure. In Tenochtitlán (now Mexico City), the supply

of water was crucial, with systems that included transport from sacred springs and a wooden aqueduct built between 1415 and 1427 by Chimalpopoca. The groups settled in Central America also developed small irrigation systems, using canals and *acequias* (irrigation ditches) to ensure water supply for crops such as cocoa. The Pipil, Lenca, and Nicarao implemented advanced irrigation techniques, directing water from rivers and springs to their corn and bean fields (Fowler 1989). The Bribri and Cabecar also developed irrigation systems adapted to their geographical conditions, integrating water management into their social and cultural organization and building small dams and canals for agricultural use (Bozzoli 1986).

In Tenochtitlán, however, a major human intervention occurred regarding water. In this city, water had a wide range of uses, with irrigation standing out as one of its most important applications, with use in buildings and green areas, as well as a botanical garden. In households, water played an essential role in domestic chores, human consumption, cooking, and personal hygiene (Rojas 2009). People of higher economic status received water directly to their homes through an underground distribution system that could even supply swimming pools and gardens in the central courtyards of their residences (Jiménez and Birrichaga 2012). The inhabitants of this region had developed various engineering works, such as *chinampas*, irrigation canals, *diques-calzadas* (diked canals), piers, aqueducts, and *acequias*, to manage and control the lakes. Since they experienced constant changes between wet and dry seasons, the population was forced to create ingenious techniques to adapt to and master this particular natural environment (Rojas 2009). To bring water from its source, they built aqueducts of impressive scale that tapped into springs, running along high walls made of mortar that stretched from one mountain range to the next. Canals were built in these walls to channel the water. The construction of these hydraulic works was based on the use of materials such as stone and sand mixed with grass, sod, and silt. In addition, they were lined with lime or even *tezontle* (very light porous volcanic stone), and the water conduits, known as *canoas*, were mainly made of wood.

Other communities, such as the Mixtecs who inhabited the Pacific coast, had developed a technological model that responded to the ecological changes caused by the implementation of various agricultural techniques and methods, including the construction of works to regulate river systems (Fernández, Endfield, and O'Hara 2009). Based on archaeological evidence, Indigenous historical records, conquistador chronicles, and official documents, it can be affirmed that the Indigenous communities of Mesoamerica actively took advantage of the available water resources. This chapter will discuss these aspects in more detail below.

The military conquest of Mesoamerica marked a clash between two worlds with radically different social, technological, and economic perspectives on water. The conquistadors destroyed hydraulic systems as a military tactic to force the Indigenous to surrender. In 1520, Hernán Cortés, with a contingent of 800 soldiers,

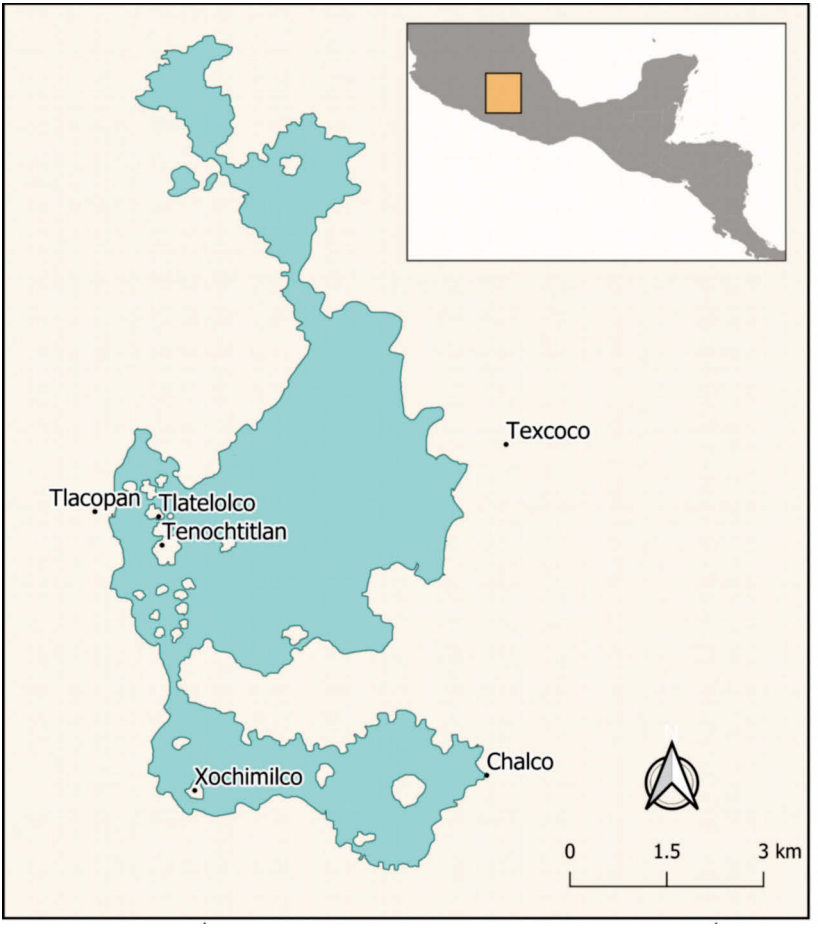
ordered the destruction of the aqueducts that supplied the city of Tenochtitlan (Jiménez and Birrichaga 2012).

There was interest in identifying vulnerabilities, as controlling water was necessary for the success of the conquest. Several conquistadors provided information on the functioning of the Indigenous hydraulic systems. Hernán Cortés mentioned the existence of advanced irrigation systems in the territories between the coast and the Mexica capital; he pointed out that all these territories were irrigated by carefully planned and well-maintained canal systems (Cortés 1985). An archaeological study classified the crops cultivated through irrigation or in the humid, warmer regions of Mesoamerica, identifying crops such as maize, chili, cotton, chia, and squash (Armillas 1984). However, as will be explained below, the arrival of the Spanish brought changes to the agricultural landscape as they introduced new crops, such as wheat and sugarcane.

After the defeat of the Mexica, the Spanish proceeded to restore the aqueducts using European methods. This hydraulic system consisted of three main elements: the aqueducts that transported the water from the springs, the "*cajas de agua*" in charge of distributing the water to the pipes, and the final phase that allowed the supply of water to public fountains and some markets. The Indians quickly acquired technical skills from the Spaniards to build this linear system, which involved detailed considerations of the topography of the terrain and the capacity of the conduits (Celestino, Valencia, and Medina 1985: 291–292). Meanwhile, the Spanish developed water channeling methods adapted to the characteristics of the terrain, which played a fundamental role in the design and development of these hydraulic systems. Also of note was the maintenance of the pre-Hispanic irrigation system, which was based on an efficient network of canals that were vital for the Spanish farmers. This system underwent renovation and expansion, and innovations such as *cajas repartidoras* installed in the *acequias* were introduced to improve water distribution (Gibson 1991).

Once the city of Tenochtitlán and its vassal towns had been conquered (Map 1), the military conquest of other territories began in order to establish Spanish cities. The colonizers needed to identify the operation of the hydraulic systems of the subjugated peoples. Thus, they found that Indigenous groups in Central America, particularly the Pipil-Nicarao, had hydraulic systems – albeit on a smaller scale than those of the Mexica – to ensure constant water supply to their crops, especially cacao, an agricultural product of great economic and cultural importance. Similarly, the Lenca developed irrigation techniques to maximize water use in agriculture. They used irrigation canals to direct water from rivers and springs to their fields, allowing for more efficient cultivation of corn, beans, and other agricultural products (Fowler 1989).

Map 1: Map of Vassal Towns of Tenochtitlan (Texcoco, Chalco, Xochimilco, Tlacopan, and Tlatelolco)



Source: Author's Elaboration

After the conquest, the Central American Indians were grouped into several provinces and governorships, which formed part of the Captaincy General of Guatemala and the jurisdiction of the Viceroyalty of New Spain. Unlike Tenochtitlan, the conquistadors showed little interest in dominating the lands discovered in Central America. The main reasons were the complex topography that included mountains, jungles, and rivers (Musset 1997), as well as the dispersed presence of numerous communities. These geographical conditions and the lack of a unified political system made effective control and unified administration of these territories

difficult. The Spaniards who arrived there adapted the small water management systems for agricultural productivity and the sustainability of their settlements. The relationship with the environment in Central America was characterized by a more harmonious integration, respecting the pre-existing ecosystems to a certain extent.

On the other hand, in New Spain, the exploitation of natural resources was much more intensive. Water availability was a crucial factor for the Spanish colonists when choosing locations to establish their settlements in the newly conquered territory. Another was the native technological innovations for the control of this element. This was because water was an essential resource for carrying out various economic activities, such as agriculture, mining, and tanning, in addition to meeting basic domestic consumption needs.

These differential dynamics between Central America and New Spain illustrate how geographic conditions and resource availability influenced the intensity of human intervention in the environment. While Central America maintained a less aggressive relationship with nature, in New Spain, intensive exploitation and radical transformation of the environment reflect an early stage of the practices that today characterize the Anthropocene.

Initially, the Spanish recognized the water rights of the Indigenous peoples, but over time, this perspective changed as the monarch began to consider himself the owner of the resource. Through "*mercedes*" (grants) or privileges, certain families obtained control of the water of the old towns. In other words, the Spanish adopted Castilian legislation, which divided water into two categories: public and private. This change in water distribution led to the commercialization of a communal resource and generated new social problems related to its access (Birrichaga 2004). The transition in water property rights in New Spain from an Indigenous communal system to one controlled by the state and Spanish colonists exemplifies the challenges of the Anthropocene. This process not only affected water availability and management but also reflected a broader trend toward intensive exploitation and commercialization of natural resources.

Beginning in 1524, Spanish settlers began to appropriate land and water resources in the central highlands of Mexico. Initially, they mainly sought water concessions to build mills since wheat production was essential in the region (Margadant 1989). For those acquiring land, having an adequate water supply was essential, whether for agriculture or livestock. Wheat cultivation required fertile land near rivers or with efficient irrigation systems, as in Puebla. In addition, the growth of sugar production in the Cuernavaca-Cuautla Valley motivated the Spaniards to control and monopolize water resources. Spanish settlements were established near watercourses and also made use of pre-Hispanic hydraulic works (Wobeser 1981).

During the first decades of Spanish rule in New Spain, wheat production was promoted through the imposition of taxes based on this crop, which led the Indigenous population to dedicate themselves to its cultivation more intensely. This situation resulted in an increase in areas devoted to wheat cultivation and a reduction in the prices of both wheat and bread between 1529 and 1542. However, in a later period, between 1550 and 1555, there was a shortage of grain related to the decrease in the Indigenous population and the increase in the Spanish population, as well as the growing demand in the cities and mining communities for the product (Camacho Pichardo 1998).

In this context, wheat cultivation was established in the most fertile lands of the region, and corn was displaced. The introduction of this cereal boosted the expansion of Spanish-held property in the Puebla-Tlaxcala area (Mexico), particularly in the Atlixco Valley. During the second half of the sixteenth century, wheat-producing regions emerged, such as the aforementioned Puebla-Tlaxcala Valley, the Valley of Mexico, and, to a lesser extent, the Toluca Valley. Among these areas, the Valley of Tlaxcala and Puebla, which included the Valley of Atlixco, stood out as the main wheat producer. In addition, in the second half of the seventeenth century, the Puebla region was home to the largest number of mills dedicated to wheat processing in all of New Spain (Gibson 1991).

The introduction of sugarcane cultivation, a tropical plant that requires an average temperature of approximately 25 degrees Celsius for optimal growth, had a substantial impact on water use patterns. The need to irrigate sugarcane is mainly due to its root structure, which has a limited capacity to seek water at depth, leading to a strong dependence on surface water supply. The introduction of this crop led to the substitution of cotton planting, which, in turn, resulted in the degradation of the *apantles*, irrigation canals previously built by Indigenous communities for the native cotton crop. Towards the end of the sixteenth century, the landscape in the *tierra caliente* (hot land) regions was dominated by sugar and wheat production. It is essential to highlight the disparity in water requirements between wheat and sugarcane. While sugarcane cultivation required the irrigation of four *surcos* (See Table 1) for each *caballería* (a Spanish colonial agrarian measure whose extension varied according to the country), corn required two or three *surcos* (Camacho Pichardo 1998). In other words, sugarcane production requires more water than other crops.

For its part, the mining industry posed significant environmental challenges related to mine water management, and the solutions adopted had different implications in terms of environmental impact. Natural factors such as geographic location, depth of excavations, soil composition, and climatic conditions contributed to this environmental problem. In smaller-scale mines, miners used cowhides or metal containers to dispose of water, which had a limited impact on the environment. However, larger mines adopted European technology, such as inclined pits for drainage and *malacates* (a winch to move or lift objects). This drainage

technique, although efficient, was costly and demanded considerable infrastructure that negatively affected the local environment, mainly due to land disturbance and pollution resulting from the construction and operation of these facilities (Trabulse 1980). Around 1575, the first report of the use of a hydraulic pump for drainage was recorded, and after this fact, numerous *mercedes* were given for mine drainage devices. Complaints about contamination from mine waste were brought to the New Spanish courts, but requests not to damage Indigenous lands and forests went unheeded (Guardián 1982).

In the context of the Anthropocene, the Spanish implemented an innovative water measurement system to exert more effective control over this resource to benefit their productive activities, which included agriculture and mining. In colonial times, water measurement involved a combination of Indigenous and Spanish measurement systems. The Indigenous communities used human references to measure, referencing body parts such as the leg or finger as one-dimensional units of measurement. When larger quantities needed to be measured, the expression "*tamaño de buey*" (size of an ox) was used. Although this method was practical in allowing each individual to have their own reference for these measurements, it lacked standardized units. Thus, the Spaniards measured water in terms of its practical applications, such as the amount needed to operate a mill or use it in milling processes. Over time, more precise measurements were developed that were understandable to all. In the sixteenth century, a two-dimensional measurement system was introduced, where the unit of water measurement called *buey* was equivalent to the amount of water flowing in a rectangular surface of 0.702 square meters or in a circular surface with a diameter of one *vara* (rod). In order to standardize these measurements, in 1567, Gaston de Peralta created a system in which each unit was equivalent to 0.038 square meters. The new measures often eliminated the Indigenous expressions that referred to water since pre-Hispanic times. This system was still in use during the twentieth century (Birrichaga 2004).

Table 1: Hydraulic Measurements Used During Colonial Times

1 buey	= 48 surcos = 144 naranjas
1 surco	= 3 naranjas = 24 reales
1 naranja	= 8 reales = 8 limones
1 naranja	= 2 dedos = 144 pajas
1 limón real o 1 limón	= 18 pajas

Source: Jiménez and Birrichaga (2012: 529).

In this early Anthropocene, the Spanish also took advantage of water as a source of energy. The presence of permanent water currents was fundamental in facilitating the construction of numerous "*ingenios hidráulicos*" (hydraulic mill complexes) throughout the Novohispanic region. The control of hydraulic power allowed the milling of wheat and, in some cases, the extraction of minerals using water wheels. These mills were capable of grinding up to 150 kilograms of wheat per hour, in contrast to the approximately seven kilograms of grain that two enslaved persons could grind using a treadmill (Gimpel 1981: 14). The adaptation of European watermill technology played a central role in the economic development of the Novo-Hispanic society, as it transformed the use of water into a source of energy capable of modifying the pre-Hispanic landscape. In later decades, both Spaniards and Indians began to request rights to use the river currents for the purpose of installing hydraulic *ingenios* and fulling mills. Hernán Cortés was one of the first to request permits to establish these *ingenios*, which were mainly for sugarcane processing and the emerging textile industry. An example of this is the Tlaltenango sugar mill, where a "grinding fulling mill and battery current" was built (Birrichaga 2004).

The rush to build watermills in New Spain was due, in part, to financial reasons. The investment in the construction of a mill promised significant short-term returns, especially since these mills could operate continuously throughout the year. In 1528, a concession was granted to Nuño de Guzmán to establish water wheels on the Tacubaya River. In subsequent years, more permits were granted for the installation of wheat mills (Garcia Acosta 1989: 50). It was common to grant permits to the *encomenderos* so that they could build mills on the lands near their property, taking advantage of suitable rivers and springs available in the area.

This transformation had a direct impact on regional hydrological cycles. Deforestation decreases the capacity of soils to retain water, increasing runoff and erosion. As a result, rivers were more prone to flooding during the rainy season and diminished flows during the dry season. The Spanish conquest can be seen as a precursor to the Anthropocene, as it was a period when human activities significantly modified the environment and altered local ecosystems. These changes had a profound impact on regional history and the interaction between humans and their environment. The conquest unleashed a socioecological crisis, reflecting a palpable manifestation of a civilizational crisis caused by the destructive interaction between European societies and native peoples. This crisis was characterized by overexploitation of resources, loss of biodiversity, pollution, and climate change – all attributable to human dynamics, especially those driven by the colonialist economic model that focused on growth and capital accumulation (Svampa 2019).

Water, Culture, and Cosmovision

The European colonists arrived in the newly conquered territory with the intention of imposing their ideas of water management but encountered a local culture that had already established its own effective management of the resource. This encounter gave rise to an exchange of practices and uses of water between Western and pre-Hispanic cultures. Although the Spaniards adopted some of the pre-Hispanic hydraulic systems, they made their own adaptations to meet new economic needs that required a more constant and efficient water supply. These adaptations ranged from diverting rivers to digging irrigation canals, as well as constructing new hydraulic infrastructures to meet those economic needs. These interventions had a profound impact on the availability and distribution of water in the colonized regions, which greatly affected the Indigenous populations that depended on access to water for their subsistence.

The existence of water was a fundamental requirement for the Spaniards when selecting a place to establish a settlement, as it was essential for economic activities, such as agriculture, mining, and tanning, and satisfying domestic consumption. All these activities depended to a large extent on access to an adequate water source, which made regulating its use one of the conquistadors' main concerns. In his second *carta-relación* (communication between Cortes and Carlos V), Hernán Cortés referred to the advanced hydraulic technologies of the pre-Hispanic peoples in central Mexico, highlighting the existence of "wells and pools of water" in the residences of the Indigenous rulers (Cortés 1985: 65). His perspective was influenced by his experience in hydraulic technology in the Iberian Peninsula, where significant advances in irrigation and water supply systems for populations and industries had been achieved between the eleventh and fifteenth centuries thanks to the contributions of the Caliphate of Córdoba, who introduced concepts such as the *acequia*, the *aljibe* (a type of cistern), the *azud*, *azuda*, and *noria* (various forms of waterwheels), and the *arcaduz* (water pipe). (Rojas 2009). The Iberian worldview was the opposite of that of the Indigenous people. For example, the Maya had a more magical and mythological perspective of water, related to the creation of the world and its ordering (Sotelo 1988). According to the *Popol Vuh* ("Book of the Council"), the world was created through the magical power of the word at a time when only sky and water existed. The land emerged as the waters withdrew, and geographical features such as streams, mountains, and valleys appeared.

One of the most significant changes introduced by Spanish technology in central Mexico was the creation of hydraulic infrastructures designed to divert rivers and drain lakes, with the purpose of turning Tenochtitlan into a city "on dry land." The new inhabitants did not wish to reside in a city surrounded by water. In other words, unlike the pre-Hispanic perspective that considered the valley's lakes as an invaluable economic source for the subsistence of the population, the Spaniards saw

water as an obstacle to the urban development of Mexico City. The Spanish vision of turning the capital of the kingdom into a city on the mainland quickly materialized. According to Thomas Gage, the Spaniards "filled and drained" the water canals of the ancient city and built numerous mansions in their place (cited in Birrichaga 2004: 97).

In addition, the Spaniards discovered that some pre-Hispanic peoples had replaced slash-and-burn agriculture with artificial irrigation systems, using canals and irrigated terraces. To retain surface water, they promoted a pre-Hispanic technique called "*amanalli*," meaning "still water." This term referred to lagoons or ponds where rainwater could accumulate. The Spanish adopted and adapted these hydraulic techniques, which led to a rapid transformation of the landscape. Water sources were diverted to create irrigation systems. An example of this is an agreement signed in 1596 by the governor of Ixtlahuaca and local farmers to create a lagoon using spring water.

During the early years of the conquest, the term *amanalli* was replaced by *jagüey,* although it retained the same meaning for both Spaniards and Indigenous people. *Jagüey* was also used to describe cisterns or *aljibe*s. The term was derived from the Taino language of Santo Domingo. According to the chronicle of Ciudad Real, the use of *jagüeyes* was widespread in central Mexico. These reservoirs were used to retain rainwater and facilitate the irrigation of agricultural fields. In addition, in central Mexico, the Indigenous people used *aljibes* and cisterns to collect rainwater for their consumption. The 1581 geographical account of the town of Quauhquilpan describes the *jagüeyes* as ponds where rainwater accumulated in low, flat areas of the town (Birrichaga 2004; Rojas 2009).

Significant changes in water management were evidenced in places as far away as Oaxaca and Guatemala. Spanish colonists progressively took control of the primary water sources, using this resource for activities that included the operation of mills, the production of wheat and sugarcane, and the watering of livestock. This dominion over the resource also had an impact on the allocation of land through the "*mercedes*," which not only gave rights to land but also to water (Webre 1990; Fernández, Endfiel and O'Hara 2009).

This transformation in the way water is used had a significant impact on the traditional norms of water ownership and use of Indigenous communities. Initially, the Indigenous *caciques* presented *títulos primordiales,* documents that granted them ownership over and the right to sell lands and waters. However, over time, the allocation of water rights began to affect its ownership, gradually replacing pre-Hispanic principles of water control with Spanish approaches.

In the seventeenth century, a distinctive feature of the Anthropocene in Mesoamerica was the reconfiguration of the environment to adapt to new needs, marking profound changes in the management of water. In this period, human intervention began to have a noticeable impact on nature. The Spaniards priori-

tized the stability of the water supply for their economic activities, while for the Indigenous communities, their access to water was vital for survival and the maintenance of their agricultural methods. This divergence in perceptions and practices surrounding water became a fundamental cause for conflict during the colonial era.

During the colonial period, changes in water and land management had significant impacts on Indigenous communities. Although these communities retained much of their land, they lost control over the most fertile areas suitable for agriculture. In Oaxaca, the introduction of cultivars that did not require irrigation, such as cochineal for red dye, channeled the Indigenous labor force into activities that did not create disputes over water with the colonizers. This forced Indigenous communities to adapt their economic and labor practices to tasks that were less dependent on scarce water resources, such as cultivating species that required little water or engaging in non-agricultural trades, such as handicrafts.

Taken together, these transformations meant that Indigenous communities were obligated to adapt to new circumstances imposed by the colonizers and their demands for access to water for agriculture. The loss of access to more fertile lands and the change in economic activities had a significant impact on the lives and livelihoods of these Indigenous communities in the Valley of Oaxaca during the colonial period (Fernandez, Endfiel, and O'Hara 2009).

In this context, water regulation and distribution became critical issues. These measures reflected the growing interaction between society, represented by the Spanish Crown and the colonizers, and nature, which included the river and aquifer systems. Water control became a critical issue during the colonial period, and the Spanish Crown's issuance of ordinances and regulations evidenced its attempt to control and regulate the use of this vital resource. However, these regulations often generated disputes, as the interests of the colonizers conflicted with the rights and needs of the local Indigenous communities.

In this sense, the presence of conflicts between different groups highlights the critical issue of access to and control of water, demonstrating how water resources became a central issue and a constant source of disputes during the colonial era. To address these conflicts, legal frameworks and water distribution systems were implemented, illustrating how society was adapting to and managing changes in its environment. These developments are characteristic of the Anthropocene, a period in which humans play a major role in altering natural systems.

Tactics and Strategies of Confrontation

Mining and agriculture emerged as two of the most significant economic activities in altering water management during the colonial era. In the case of mining, sub-

stantial volumes of water were required for the extraction and processing of minerals, which led to the construction of hydraulic infrastructures such as dams and canals. These structures disturbed the natural flow patterns of the rivers and had a significant impact on the availability of water for local communities. In terms of agriculture, the colonizers introduced European crops that required different irrigation methods than those used by the Indigenous populations. This often involved the reduction of water sources and the transformation of pre-Columbian irrigation systems, which could result in the overexploitation of water resources and soil degradation.

These changes in water management have had significant environmental consequences, including the alteration of both aquatic and terrestrial ecosystems. They also influenced the cultural and economic practices of the Indigenous populations. These communities witnessed how their way of life, rooted in a balance with nature, was displaced by intensive exploitation models.

Studies by Wobeser (1981), Lipsett (1987), and Camacho Pichardo (1998) have addressed the issue of water conflicts. The aforementioned authors agree that the clashes over the resource intensified notably during the last decades of the seventeenth and throughout the eighteenth centuries. This significant increase in conflicts can be attributed to two main causes. First, the increase in the Indigenous population in the region played a crucial role in this dynamic. Secondly, land appropriation by Spanish *hacendados* became a determining factor that generated intense competition for water resources, given that the available water sources were not sufficient to meet the growing irrigation needs of their crops (Camacho Pichardo 2010).

In the first decade of the seventeenth century, controversies arose between the Indians and the Spaniards regarding the use of water resources. The conflicts originated from poorly defined policies and practices regarding the allocation of water rights during the first decades of the colonial period. Due to the lack of a precise specification of the amount of water that both the Spaniards and the Indigenous communities were allowed to receive, misappropriations occurred, generating tensions among the beneficiaries. This situation culminated in clashes, such as that which occurred in 1605 between the Spaniards and the community of Huiluco over the use of the waters for an irrigation ditch. The natives argued that they had been using these waters since before the arrival of the Spaniards and even had the viceroyalty's authorization for its use. In response to these conflicts, the authorities dictated that the inhabitants of the towns share access to water with the Spaniards (Camacho Pichardo 1998).

During this period, there was a significant change in the perception of water, which came to be seen as a marketable resource. In *repartimientos*, a rule was established that each Spanish beneficiary had to make a payment to the Spanish Crown in exchange for water access rights. This process was conceived as an effective mech-

anism to grant property titles, since it could be interpreted as a purchase and sale agreement. Consequently, the Crown handed over the right to and ownership of the water in exchange for the corresponding payment, which led the Spaniards to begin to perceive themselves as owners of the resource, often ignoring property titles held by Indigenous peoples. On numerous occasions, legal disputes arose between landowners and Indigenous communities over water access rights. In most cases, the resolution of these disputes was characterized by prevalent violence.

The Indigenous people often complained about the inadequate distribution of water to irrigate their fields. They argued that numerous haciendas dedicated to wheat and sugarcane cultivation had been established in many valleys, as well as *ingenios* and mills. Therefore, they argued that they could not adequately cultivate their plots of corn, cotton, garbanzos, peas, and other seeds, causing them a variety of difficulties and losses. In the seventeenth century, in the midst of water-related conflicts, priority was given to the needs of the *hacendados*, dismissing the claims of the Indigenous communities and their legitimate right to use water resources. There was a clear interest in emphasizing the supposed inability of the Indigenous people to manage their own resources, which resulted in most of the water allocations being oriented mainly for the benefit of the *hacendados*.

In addition, it is essential to consider how other factors, such as the presence of livestock, deforestation, and extensive plowing, contributed significantly to soil erosion and reduced water availability. These elements further aggravated the competition for water resources, as they reduced the soil's capacity to retain water and, at the same time, increased the demand for irrigation. This complex interplay of factors made water management and access to water key issues in this historic region.

Disputes and tensions between the Spanish and Indigenous communities over access to water reflected the growing interaction between diverse human groups and their natural environment – a characteristic aspect of the Anthropocene. In the eighteenth century, infrastructure projects such as dams, canals, and reservoirs and the diversion of key rivers for agricultural irrigation and urban supply were already visible in the landscape. However, in drought-prone regions, water scarcity and conflicts related to access became common. Although some communities collaborated in the creation of water distribution systems to cope with shortages during times of drought or late rains, competition for the resource and legal disagreements over rights and access were frequent, often exacerbated by human intervention in water management and inequalities in its distribution (Endfield, Fernandez and O'Hara 2004).

In this context, it is evident that humans have had a significant impact on nature and local water systems. The prioritization of the *hacendados*' needs over those of the Indigenous communities can also be interpreted as an example of how colonial society was adapting to and managing changes in its environment during the Anthropocene.

Final Discussion

The study of water management in Mesoamerica, contextualized within the framework of the Anthropocene, reveals how human intervention has left an indelible mark on the environment and social structures of the region. Water resource management practices by Mesoamerican civilizations, although sophisticated and adapted to their environments, were radically altered by the arrival of European colonizers. This chapter revealed that intervention had a greater impact in New Spain, while in Central America, the impact was limited to the use of Indigenous hydraulic systems without altering nature to a large extent.

But in central and northern Mexico, the introduction of new agricultural practices, the intensive exploitation of natural resources and the reconfiguration of land and water ownership systems marked the beginning of an ecological and social crisis. Deforestation, mining, and the implementation of European hydraulic infrastructure not only changed the landscape but also profoundly affected hydrological cycles and water availability in the region.

Thus, it can be affirmed that the Anthropocene, triggered by European colonization, represents an era of profound ecological and social alterations. This period not only transformed natural systems and the availability of water resources but also redefined human interactions with the environment, leaving a lasting legacy that continues to influence water management and distribution in the region today.

Finally, recognizing the role of the Anthropocene as an era of significant human intervention in nature forces us to reflect on our current actions and responsibilities. The legacy of colonization in Mesoamerica reminds us that our decisions and policies must be informed by a deep understanding of history and a long-term vision prioritizing sustainability and social justice. Therefore, it is crucial to consider this historical background if we are to develop water resource management strategies that are sustainable and equitable in the contemporary context.

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