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Water Factories of the High Colombian Mountains: Páramo as 'Infrastructural Nature'

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ABSTRACT: *Páramo* is a term imported from Spain to the northern Andes to refer to uninhabited, barren, mountainous areas. This notion has, in more recent times, acquired new meanings. Today, the páramo is known as a high mountain tropical ecosystem of strategic importance to carbon storage, water provision, and biodiversity. In Colombia, the páramos located around Bogotá have been central in the emergence and consolidation of conceptualisations of the páramo as a strategic ecosystem. In close relation to their importance for the country's first large-scale water infrastructures to supply urbanizing populations, they are today imagined as *fábricas de agua*, or 'water factories'. In this article, we propose the notion of 'double support' to capture the coordinated work between water intake from the páramo and environmental conservation of the páramo as a situated articulation of the concept of 'infrastructural nature'. We trace the emergence of the páramo as infrastructural nature through two partly overlapping trajectories of what we define as 'infrastructuralisation', the first driven by the work of water engineers, the second materialising in the work of natural scientists. While these trajectories do not exhaust the complex historical process that gives rise to the 'páramo as we know it today', they do allow us to grasp contemporary understandings of the páramo as a 'marriage of convenience', whose stability should not be taken for granted.

KEYWORDS: páramo, infrastructure, water, nature conservation, Colombia

INTRODUCTION

Páramo is a term that originated in Spain and that was used first in the Andean region by European colonisers to refer to uninhabited, barren, mountainous areas, "deserted, flat, and open to all winds"

(Covarrubias, 1611, cited in Quiroga, 2015; Ospina and Tocancipá, 2000).[1] In the Northern Andes, the term páramo has continued to be used in allusion to areas lying above the continuous forest line and below the permanent snowline, yet for centuries the word retained its colonial connotations of vastness, unproductivity, and dangerousness. In Colombia, the term has been historically perceived as 'uncivilised', disregarding the ritual importance these areas have for the Muisca people. 'Páramo' was situated *al revés de* (spatially 'on the other side of' and temporally 'in the rearview of') the nation's modern unfolding (Serje, 2005).

The highest parts of the mountains surrounding Bogotá have for centuries featured centrally in ritual practices of indigenous Muisca communities because of the presence of water. However, permanent human occupation is recorded only since the late 19th century, when impoverished *campesino*[2] families settled here, escaping violent conflict, labour exploitation, and mounting pressures on the land. Since roughly the mid-20th century, amid rapid urbanisation and new scientific developments, the term páramo has acquired new meanings. Today, the páramo is known as a high mountain tropical ecosystem typical of the northern Andes and most abundant in Colombia (Cuatrecasas, 1958; Guhl, 1982; van der Hammen, 1998; Rangel, 2000). Its significance as an ecosystem, rich in biodiversity and water and with unique carbon storage capacities, has been consolidated over the last decades in tandem with intensifying conservation initiatives. In Colombia, the páramo's role in supplying urban centres with drinking water in particular has heightened its strategic importance (Duarte-Abadía and Roa, 2014; Duarte-Abadía and Boelens, 2016; Osejo and Ungar, 2017; Murillo-Marín, 2022). Based on its capacities to store water and regulate its flow, Colombia's páramos provide close to 70% of the water that is used for human consumption and a range of economic activities in the country (Minambiente, 2019). Seizing on (albeit simplified) scientific insights into the páramo's extensive water provision capacities, the image of the páramo as a 'water factory' (*fábrica de agua*) has gained prominence since the late 20th century.

In recent decades, the notion of the páramo as a strategic ecosystem has been fundamental in generating a regulatory framework for human-centred activities in the páramo, seeking to shield this ecosystem from mining and agricultural intervention (Osejo and Ungar, 2017; Duarte-Abadía et al., 2021). Partially overlooked in this process is the fact that the páramos have been inhabited by generations of campesinos whose practices often conflict with the páramos' qualification as non-human nature to be 'strategically' preserved. From this perspective, we view páramos as part of a broader discursive, political, and physical production of certain territories – often constructed as frontier spaces – as 'vacant', 'ungoverned', 'natural', or 'uninhabited' spaces, in turn enabling expulsion, relocation, and resettlement of unwanted populations, their lifeways treated as collateral damage (Baka, 2014; Rasmussen and Lund, 2018; Estes, 2019). In the case of the páramos, this assemblage of legal, scientific, social, and technical practices produces what we call in this article the 'páramo as we know it today'.

Accordingly, we interrogate this notion of the páramo as a strategic ecosystem, tracing its emergence through historical processes that have conceptually and materially reorganised these high Andean territories within expanding urban, capitalist-driven spaces. In particular, Sumapaz and Chingaza – two páramos located around Colombia's capital, Bogotá, as displayed in Figure 1 – have been central in the emergence and consolidation of the concept of the páramo as an ecosystem.[3] They were the first to be connected with large-scale water infrastructures in the country and constitute some of the most studied páramo sites within the natural sciences. The municipality of Bogotá exercises significant control over both through urban water provision and through public and private institutions operating from the city with ownership over páramo land or right to regulate páramo land use. Two institutions which are key to articulating this relationship are the *Empresa de Acueducto y Alcantarillado de Bogotá* (Water and

[1] All Spanish citations have been translated by the authors.

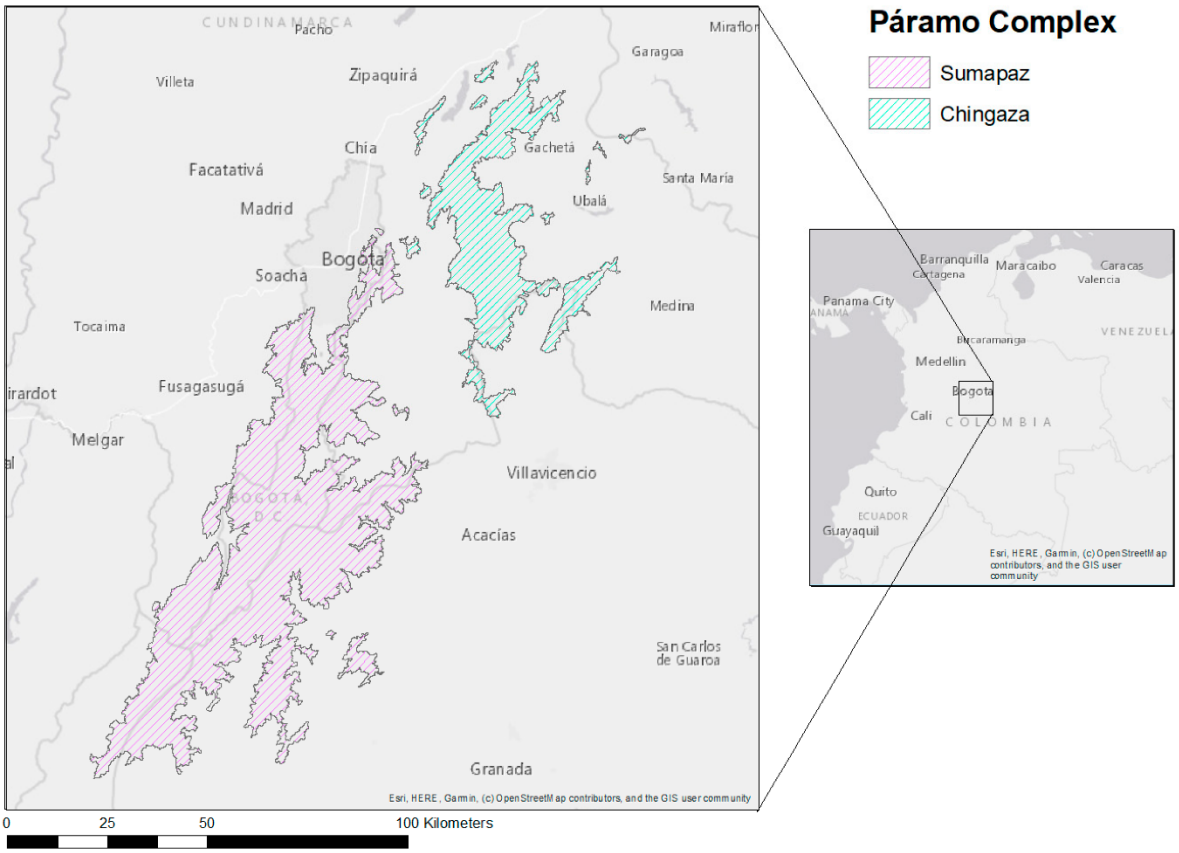
[2] Although 'peasant' is often used as a translation of campesino, in this article we prefer to use the Spanish word to emphasize that this category is not limited to class or occupation. See also Koopman (2007) and Edelman (2022).

[3] Interview with Mauricio Diazgranados, 6 November 2020.

Sewerage Company of Bogotá; Bogotá Water Company hereafter), and *Parques Naturales Nacionales de Colombia* (the Colombian National Natural Parks, the agency in charge of public conservation areas).

Resonating with what Carse observes with regard to the Panama Canal, these institutions have come to study, engineer, and manage the páramo in terms that make the páramo an instance of "nature as infrastructure" (Carse, 2012; Nelson and Bigger, 2022). Emerging from our long-term ethnographical fieldwork that sought to delve deeper into the relations through which the páramo emerges both as 'nature' and as 'infrastructure', we propose the notion of 'double support' in order to capture the coordinated, mutually reinforcing work performed by engineering and natural sciences institutions such as the Bogotá Water Company and the Colombian National Natural Parks. In this article, we combine this notion with anthropological, historical, and science and technology studies (STS) literature to understand how nature and human projects become 'internal' to each other, within the context of the páramos surrounding Bogotá, through the coordinated work between water intake and environmental conservation, both stemming from the páramo. Borrowing Nelson and Bigger's term, we argue that the interlinked and recursive relationship between infrastructure and nature has produced the páramo as 'infrastructural nature' (2022; see also Carse, 2012; Harvey et al., 2016; Morita, 2016; Cardoso Da Silva and Wheeler, 2017; Hetherington, 2019; Enns and Sneyd, 2020). While campesino households and their histories have been at the heart of our research, this article places the institutional coordination around water engineering at the centre of analysis while also highlighting the ways that campesinos have been repeatedly excluded from these processes, even while they respond to that coordination.

Figure 1. Map highlighting the areas of the páramo, Chingaza (light blue hashed area) and Sumapaz (purple hashed area).



Map created by Christopher Wheatley.

In what follows, we develop a historical-ethnographic case study that traces in detail the specific confluence of different historical processes that inhere in the incorporation of the páramos around Bogotá as a 'double support' system'. We do not aim to contest the scientific insights accumulated over recent decades regarding páramos, but rather to develop an approach to the páramo that allows us to unsettle its contemporary construction as a natural water source, even a water factory. We specifically attempt to destabilise the recent – and currently almost univocal – conceptualisation of the páramo as an ecosystem, related to a conception of nature as contrary to and separate from the presence of inhabitants in the páramo.

We collected and analysed documentation from the archives of the Bogotá Water Company covering the period of the 1920s to the 1960s, during which the first large-scale projects for extending Bogotá's water infrastructure into páramo lands were planned and constructed by municipal planners. Sources for later periods, including the design and implementation of the Chingaza System, were not accessible at the time of our research. We studied this particular moment through published reports from the Bogotá Water Company and the World Bank, as well as through interviews (see details below). We also consulted sources at the Institute of Natural Sciences of Colombia (*Instituto de Ciencias Naturales*) and conducted a literature review of biological and geographical papers and books on páramos published since the early 20th century. We undertook multi-sited ethnographic fieldwork between June 2019 and April 2021, including 10 pre-pandemic field visits. We conducted 25 (mostly virtual) semi-structured interviews and nondirective conversations with campesinos, community leaders, and scholars from Chingaza and Sumapaz. We carried out 11 interviews with officials, scientists of diverse disciplines, and engineers operating in these páramos. Attendance at workshops and public meetings on policies implemented in the case regions supplemented the interviews.

In the following section, we introduce the notion of 'double support' in order to explain how we understand the expansion of water infrastructure to have forged a close relationship between water intake from the páramo and environmental conservation. Sections Three and Four trace the emergence of the páramo as we know it today through two partly overlapping trajectories of what can be defined as 'infrastructuralisation', the first driven by the work of water engineers and the second materialising in the work of scientists. Section Five then turns to the convergence of these trajectories and considers the agency of the many actors – human and non-human – that have been excluded from these processes. In so doing, we consider how their responses constitute obstacles to the páramo's complete and total infrastructuralisation.

THE BOGOTÁ WATER COMPANY AND CHINGAZA NATIONAL PARK: THE 'DOUBLE SUPPORT' CONDITION IN CHINGAZA

Situated to the east of Bogotá, Chingaza National Natural Park has been a key protagonist in the consolidation of the notion of páramo as a strategic ecosystem. Established in 1977, the park is home to rich biodiversity and wildlife, including the Andean bear, several species of *frailejones* (perennial shrubs of the genus *Espeletia*), endemic birds such as the *barbadito paramuno*, páramo deer, and tapirs. The protected area is considered particularly relevant for housing a substantial proportion of páramo, to the point that, for many Colombian observers, Chingaza Park has become synonymous with páramo in one of its most 'preserved' states (Parques Nacionales Naturales de Colombia, 2016). Chingaza Park houses the Chuza dam and a system of tunnels and intakes, operated by the Bogotá Water Company. The water captured from the páramo of Chingaza provides drinking water to more than 80% of the inhabitants of Bogotá (or more than 7 million people) (Canal Capital, 2017).

When Chingaza Park celebrated its 40th birthday in 2018, news reports underscored the importance of the anniversary by invoking Chingaza as a *fábrica de agua*, a 'factory' that produces water. A documentary on Bogotá's public television channel, *Canal Capital,* introduced Chingaza to *bogotanos* as "the water factory of Bogotá", a message supported by video footage that established an analogy

between viewers' kitchen tap at home and the water streams that run through the park (Canal Capital, 2017). The extent to which the páramo of Chingaza has been integrated into urban water infrastructures has helped to forge the commonly held alignment by Bogotá's residents of páramo protection with water production. Through its material and semiotic reorganisation as a 'water factory', Chingaza emerged as the archetype of a specific kind of nature: a water-providing ecosystem.

The close relationship between the páramo and water does not simply exist as a marketing strategy but has also been internalised in páramo conservation practices. During a virtual meeting with officials from the National Parks agency at the onset of the global coronavirus pandemic, we learned about the agency's plans to ensure Chingaza's conservation in the face of climate change. An official from the Park stated that one of the Park's priorities is to consolidate its position as 'green infrastructure' for the Bogotá Water Company.[4] For this official, the Park's future is joined to that of the Company. This has been the case for the last several decades, and according to him and his colleagues, it is crucial to strengthen this bond in the face of the immediate and long-term futures brought about by environmental crisis.

The making and management of 'green infrastructure' has become an important signifier for the composite (and heterogeneous) activities performed by the park's officials. The officials explained green infrastructure as "any ecosystem-supporting infrastructure that enables the provision of an ecosystem service".[5] In the case of the páramo, that 'green infrastructure' is reflected by the image of a 'water factory'. Having emerged in the 1980s amid the rise of neoliberal policy in Colombia and elsewhere in Latin America, which promoted market-oriented approaches, the term 'green infrastructure' has started to circulate across sectors as a loosely defined strategy and concept to identify, optimise, and manage an interconnected network of conservation and other spaces that support sustainable land-use management (Benedict et al., 2012; Cardoso Da Silva and Wheeler, 2017; Wang and Banzhaf, 2018). 'Green infrastructure' suggests a relation of complementarity with so-called 'grey' infrastructures, conventionally understood in the narrow sense of human-engineered structures of cement, tunnels, treatment plants, storage tanks, and pipes (Palmer et al., 2015). "There are many people", one of the officials explained, "who see the páramo of Chingaza as the green infrastructure that *supports* the [Bogotá Water] Company's work".[6] Accentuating *support* in his comment, the official underscored the double-sided nature of the relationship between páramo and Bogotá, as well as the mediation of this relationship by the Company. The official reminded us that without the 'natural páramo' maintained by Chingaza Park as an institution, the Company would not be able to provide water, and millions of Bogotá's citizens would go thirsty. He underscored, in other words, the multiple *inter*dependencies between the 'preserved' páramo and urban water consumption.

The case for 'green infrastructure' reinforces a deep bond between the Park and the Company, underpinned by concrete logistical and economic commitments. These include the Company's payments to the park as compensation for the water intake. These compensations include a voluntary annual payment as well as a water use fee composed of a fixed minimum charge and a variable amount that equals the estimated investments required to cover conservation costs, stakeholders' socio-economic needs, and projected water scarcity (OECD/ECLAC, 2014: 205). Recent numbers on the total value of this payment for ecosystem services (PES) could not be obtained, but in 2009, these revenues were estimated at an average of 7000 million Colombian pesos (then worth close to US$3.5 million) for certificates over a time span of 10 years and over 881 million Colombian pesos per month from the water bill (Figueroa, 2009: 42). Thanks to this interinstitutional arrangement, Chingaza Park has become the only Colombian national park to garner significant financial support.

[4] Meeting with Parques Nacionales Naturales, 21 April 2020.

[5] Ibid.

[6] Ibid.

In a later interview with a Water Company official, we inquired about the history of this interdependent relationship between Chingaza as protected area and Chingaza as core component of the Water Company's infrastructure.[7] The official asserted that the Company had been vital in supporting the Park and the páramo through the years, playing a leading role in the restoration and conservation of the páramo. As the official continued to explain, the vast areas that tourists visit today in pursuit of the natural, untouched páramo were once pastures and potato fields, "recovered" by the Company. "If it weren't for the Company, Chingaza would be a degraded páramo today, like many others in the eastern mountain range of Colombia".[8]

In addition to underscoring the Company's recuperation of a once-degraded páramo (and with this the continuation of those foundational associations of the páramo with the wild, the unkempt, and the disorderly), the official discursively established the Company's ownership of land within the Park, the funds that the Company contributes and pays for the conservation of páramo, and the very history of the relationship between water intake and conservation as central to the current 'natural' state of the páramo of Chingaza. Before being declared a national park in the late 1970s, the Company had acquired extensive areas of land from campesinos through purchase and expropriation (Garrido et al., 2021). During the late 19th and early 20th centuries, through cycles of violent conflict and land expropriations, the páramo lands surrounding Bogotá had become a site of spontaneous settlement and refuge for campesino families displaced by expanding haciendas (LeGrand, 1980: 326-327 and 343; Rincón and Sarmiento, 2002: 151; Londoño, 2012: 20). Their productive practices, including potato crops, cattle raising, and small-scale mining such as the exploitation of limestone, characterised Chingaza when the infrastructure project began to be built in the 1970s. The valuation of once marginal páramo lands in support of Bogotá's drinking water supply implied the devaluation of these campesinos' activities, their labour, and their relationship to the land, now framed as 'degradation'. With the argument of protecting its water sources, (some) humans and non-humans were effectively excluded from the páramo (see also Garrido et al., 2021).

In other words, the supporting condition for producing value (in the form of drinking water) only materialised through a human-engineered reorganisation of the páramo as a selective assemblage that excluded certain humans and non-humans, including campesino workers and cattle, along with their labour. Moreover, conservation was not always a clear priority. According to historian Claudia Leal (2015), there was an initial contradiction between the water infrastructure constructed between 1972 and 1983 and the aim of what we would today consider natural conservation. Hundreds of workers lived in the páramo for years, building roads, tunnels, intakes, and dams.[9] The system diverted the waters of streams and rivers, which had previously descended the mountain range in search of the Orinoco River to the east, so as now to introduce their waters into the pipes of an increasingly populated and thirsty Bogotá to the west. For this reason, in 1971, INDERENA, the institute then in charge of the administration of the newly created national natural parks, considered the infrastructure to have irreparably damaged the ecosystem, for which reason it changed its status from a national natural park to a protected forest zone. Some years later, the páramos had become a key motivation in the creation of parks, which in 1977 led to Chingaza being included again as national natural park (Leal, personal communication). Today, this possible contradiction between water intake and natural páramo – and the implicit devaluation of campesino life – is all but invisible, giving the 'support' task provided by the Company an 'infra' (assumed, given, and partially unnoticed) character.

We suggest this condition of 'double support' captures how the human project of urban drinking water supply is not made upon the páramo, but *through* the páramo, just as the páramo is made *through* this

[7] Interview with Bogotá Water Company, 5 February 2021.

[8] Ibid.

[9] Bogotá Archive, Fondo EAAB, Caja 1, Volumes 606-133 to 606-138.

human project. Water intake for human consumption and páramo as a non-human part of nature are therefore mutually related, both being infra to the other.[10] The work of anthropologist Andrea Ballestero helps us to understand the operation of this double support relation in the context of the páramo's emergence as a water-providing ecosystem (2019). In her study of aquifers in Costa Rica, she introduces the notion of 'infrastructuralisation' to refer to the legal and technical reduction of environmental phenomena to their infrastructural function, allowing water to become a "natural resource" (Ballestero, 2019: 22). Vital for this process to take place, infrastructuralisation entails the separation of the resource from its background. Water's specific qualities – its volume, mobility, and mass – and encoded meanings actively contribute to shaping the power-laden transformation of water into a resource (Strang, 2004; Bichsel, 2016: 359). In our case, water is separated from the páramo as liquid flow to be made potable. This separation occurs thanks to the grey infrastructure of the Bogotá Water Company.

Our research demonstrates how this process also requires another type of separation. Through the infrastructuralisation of the páramo, a particular version of the páramo – that of an ecosystem capable of providing water – is separated from other possible versions of the páramo. In Chingaza, these other possibilities include the projects of rural households that configure the páramo as a refuge for displaced campesinos, or the state- and market-driven projects that depict the páramo as a productive agrarian frontier. To the extent that the páramo is incorporated as a strategic ecosystem through infrastructure, these other versions of the páramo remain as obstacles. Infrastructuralisation is thus a material and semiotic process that identifies, simplifies, and amplifies certain historical, societal, ecological, material, and hydrological relationships. In summary, Bogotá's water infrastructures do more than capture, store, and conduct the water from Chingaza to the city. They *support* the very existence of a páramo as 'nature that produces water'. We understand infrastructuralisation as the process that enables and sustains the operation of the double support condition between this material, developmentalist project and the generation of the páramo as we know it today.

The notion of infrastructuralisation also implies the partial concealment of the 'support' task, which is why each group of officials underlines the support role from their institution. Only by listening to both did we notice the double condition of this support: without the páramo, there would be no water for the Company; without the Company, there would be no 'natural páramo' for the Park. This complex pattern could be traced through the trajectories that made this double support possible. As we show, the páramo has not always been referred to as an ecosystem and has not always been synonymous with water: both ecosystem and water are fundamental in producing the relationship between conservation and water intake exemplified through the *double support* condition of the Company and Chingaza Park. In what follows, we present the two main trajectories from which the páramo as we know it today emerged: water engineering and natural science. Although both trajectories arise from different practices and interests, they converge in the present, supporting each other, yet not without friction and gaps.

INFRASTRUCTURALISATION 1: ENGINEERS SEARCHING FOR WATER IN A WASTELAND

The first trajectory starts some 100 years ago, when water became a prime concern of the city of Bogotá (Gallini et al., 2014), yet its surrounding páramo areas, considered wasteland, were largely left out of the picture. Research and policy discussions in the context of the city's infrastructural expansion nonetheless hint at a shifting perception, which would intertwine with new scientific developments (as we will see in the next section).

[10] Assuming that the water intake project happens upon the páramo reifies the separation between the páramo as nature and the human projects. We follow Moore (2015) in his attempt to understand the historical processes in terms of a "double internality". We agree with him that "everything that humans do is already joined with extra-human nature and the web of life: nature as a whole that includes humans" (17).

In the early 20th century, Bogotá's nearly uninterrupted urban expansion drove ever larger water infrastructure projects that reached further into the city's hinterlands. Although Bogotá is surrounded by rivers, streams, and lagoons, its elected officials, policymakers, and ordinary residents have been haunted for a long time by the fear of peak water supply and depletion. After 1914, when the municipality of Bogotá had acquired the *Empresa de Acueducto*, ending a period of private water management, water policies and infrastructure plans received a boost. In 1915, the municipality obtained the legal authority to buy and expropriate lands that fed into the aqueduct, and the Company initiated a programme to purchase the hydrographic basins of the city's water sources and to reforest them (Jaramillo Giraldo, 2004: 31; Felacio Jiménez, 2011; Rodríguez Gómez, 2012).

In the 1920s, Bogotá's municipal government started to develop a more ambitious strategy to guarantee its future water supply through a combination of spatial and technological expansion. In 1927, this strategy was formalised through the establishment of the *Comisión del Agua* (Municipal Water Commission). Additionally, Decree 52, enacted by the municipal government, defined water as a "primordial necessity for the city" and authorised a feasibility study into the possible increase of the aqueduct's current water sources.[11] In response to this open tender, the city council reviewed a host of proposals to research and design a solution for Bogotá's water supply.[12] Many of these proposals are bundled in the 1928 report *Water Supply for Bogotá*, stating that until then, nobody had considered relying on the yields of the hydrographic basins of the rivers, which would require the construction of an aqueduct; hence, the project became known as *El Nuevo Acueducto de Bogotá*.[13] This widening focus from rivers to entire river basins implied that rivers no longer sufficed as the natural infrastructure distributing water to the city. Human engineering was required to optimise the flow of water.

The search for water extended for many kilometres around Bogotá. The Commission's engineers climbed the mountains where the rivers originated. The most promising site was the Sumapaz massif to the south of the city, in the direction of what is now Sumapaz National Natural Park, home to the most extensive páramo in the world as well as to campesino households, who had been settling there since the late 19th century. However, it was the rivers, not the páramo, that attracted the engineers, as at that time, the notion of páramo that is used today – as an ecosystem closely related to water – did not exist. A different understanding did exist, appropriated by campesinos living in the higher mountainous areas outside the city, of páramo as a localized notion of territory and home. As they expressed in complaints directed at the Company, however, the campesinos' rich knowledge of these areas was systematically dismissed by the Company.

> Bogotá has a very different idea of those of us who live in the Páramo. We are well aware of the river basins, inch by inch, and we offer with all our will our service for the sake of the purity of the waters and conservation of the woods and forests.[14]

The Water Commission relied on the technological knowledge submitted by landlords and engineers in the form of infrastructure projects. One of the 17 proposals, signed by Roberto Wills – administrator of the hacienda El Hato, one of the largest in Sumapaz (Londoño, 2012: 42) – and designed by the Swiss engineer C. R. Marthaler, concerned a project to collect water from the Chisacá River, which originates

[11] Bogotá Archive, Fondo EAAB, Caja 7, Tomo 2, 102-106.

[12] The council received two early proposals in 1927, but most of them were in 1928. While most proposals concerned Sumapaz, some intended to capture water in the North, where we currently find the Neusa water reservoir, and some even pointed to the Siecha lagoons towards the east of the city in the páramo de Chingaza, although that option would remain unfeasible for many years. Bogotá Archive, Fondo EAAB, Caja 40, Tomo 1, 39-42.

[13] Abastecimiento de aguas para Bogotá, 1928. Bogotá Archive, Fondo EAAB, Caja 40, Tomo 1, 49-72.

[14] Letter, 1925. Bogotá Archive, Fondo EAAB, Caja 10, Tomo 2, 176.

in the Chisacá Lake and 10 surrounding smaller lakes.[15] The proposal outlined several options for exploiting the Chisacá River catchment area, including damming and interconnecting the lakes, in order to link the Chisacá area with the San Cristobal River and to construct a dam to power a large hydroelectric plant.

Wills' offer was supported by a detailed technical report by Marthaler, who concluded that the area was promising and deserved a definitive study.[16] Despite the description of a "marshy", "very rainy", and "mountainous, bare" region with "low temperatures and dominant winds" and of "extraordinary altitude" – the Chisacá Lake being situated at 3769 meters above sea level – the report does not explicitly mention 'páramos'.[17] The pictures accompanying the report, including Figure 2, depict a landscape that we would nowadays easily identify as a 'páramo'. However, the few times the word 'páramo' appears in the archive, it was used as an adjective, as a descriptor of the conditions of a place: cold, uninhabited, poor, and deserted. Wasteland, not waterland. Wills and Marthaler never ascended to the 'páramo as we know it today', even if they were photographed among frailejones next to the Chisacá Lagoon, where today there is a cabin owned by Sumapaz National Natural Park and a viewpoint for tourists to appreciate the natural beauty of the páramo.

Figure 2. Picture of the Chisacá Lake surrounded by frailejones and depicting a person on horseback.

Picture probably by C. R. Marthaler or Wills, 1928 (EAAB, *Caja 42, Tomo 2*, f. 61). Permission obtained from the Bogotá Archive.

[15] Informe sobre la conducción del agua del río Chisacá para la ciudad de Bogotá, según el proyecto general (Variante A). La unión con la planta del río San Cristóbal, 1928. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, fs. 21-31.

[16] Marthaler consulted, among other documents, the cadastral map of 1904 of the entire hacienda El Hato, the geographic map of Cundinamarca, the local inspection, the *Anales del Observatorio Nacional de San Bartolomé* and other meteorological observations, and indications given by the local population. Informe sobre los proyectos generales de abasto de agua (Variante A) en combinación con una gran planta hidro-eléctrica (Variante B). Región del Chisacá, Municipio de Usme, 1928. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, 57-71. See also: Letter by Roberto Wills, s.d. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, f. 119.

[17] Informe sobre los proyectos generales de abasto de agua (Variante A) en combinación con una gran planta hidro-eléctrica (Variante B). Región del Chisacá, Municipio de Usme, 1928. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, 57-71. See also: Letter by Roberto Wills, s.d. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, f. 119.

The proposal for urban water provision was never carried out. The Commission sent a US-Colombian team to inspect the site,[18] but decided in 1929 to exploit the potential of the Tunjuelo River instead.[19] The decision was based on calculations of the water flow, evaporation, and rainfall regimes, over which Wills and the Commission continued to disagree.[20] Reservoirs would be built several kilometres downstream of the Chisacá lakes, where the Chisacá River joins the Curubital River. In reaction, Roberto Wills insisted on the exceptional hydrographic advantages of Chisacá[21] and reminded the Council that the Tunjuelo proposal, called La Regadera, required costly and controversial expropriations of the local population's lands, which was not an issue with the acquisition of the privately owned Chisacá Basin.[22] Wills even proposed to undertake the works himself and offer the water for sale to the municipality.[23] Yet the Company considered the lands in the páramo to be of no value, and would continue to reject the Chisacá plans.[24]

To understand the reasons why the Water Company did not agree with the hydraulic calculations of the Wills-Marthaler project, it is necessary to refer to another document. The surfacing of the word 'páramos' on the pathways and in the calculations of water engineers becomes more apparent in the proceedings of the Río Blanco Commission, 1932-1933. Under the guidance of Francisco Wiesner, this Commission explored the possibility of collecting water from the Blanco River – a major tributary to the Meta River – also in the Sumapaz region. The project consisted of water collection from the Blanco River and its tributaries into a canal, to be channelled to the city via a tunnel passing at the Bocagrande lagoons, without the need to construct a dam.[25]

In the geological study, ordered by the Commission and executed by geologist Enrique Hubach and engineer Francisco Wiesner, the Blanco River Basin was described as "mountainous and *paramuno*", situated between 3000 and 4000 metres above sea level with a cold, foggy climate and a vegetation of grasses and bushes.[26] The hydrographic description of the river basin is interspersed with references to the terrain's, the lagoons', and the climate's 'páramo' qualities, illustrated with several photographs. The peaty vegetation layer that characterises the páramo soil is defined as an "excellent regulator of waters in times of rain"[27] that "holds water like a sponge": "In this way, the paramuno peatland becomes a main

[18] Letter by Roberto Wills to the Municipal Council of Bogotá, 1928; Copy of a telegram of the *Comisión de Aguas* to Alfredo Wills, 1929; Letter by Alfredo Wills to the Municipal Council, 1929. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, f. 74-75; f. 152.

[19] Letter by Alfredo Wills to the Mayor of Bogotá, 1929. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, f. 38.

[20] Report by the Comisión de Aguas, 1929. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, f. 42-46.

[21] See also the appendix of the 1928 report in which Marthaler elaborates on pluviometric and hydrographic data to stress Chisacá's extraordinary potential compared to other basins. "Informe sobre la conducción del agua del río Chisacá para la ciudad de Bogotá, según el proyecto general, variante A. La unión con la planta del río San Cristóbal," 1928. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, fs. 30-31.

[22] Letter by Alfredo Wills to the Mayor of the city, 1929. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, f. 39.

[23] At one point, he also proposed building a private hydroelectric plant to supply a number of urban neighbourhoods. Letter by Roberto Wills to the Municipal Council of Bogotá, 1928; Letter by Alberto Wills to the Municipal Council of Bogotá, 1929. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, fs. 80-81, fs. 91-92.

[24] Until the late 1930s, representatives of the Hacienda repeated their offer to sell the entire Chisacá River Basin to the city, but without success. Letter by Gregorio Obregon to the President of the Junta de las Empresas Municipales, 11 July 1938; Letter by the *Acueducto de Bogotá*, 18 July 1938. Bogotá Archive, Fondo EAAB, Caja 42, Tomo 2, f. 160-161.

[25] The contractor claimed to be in possession of the river basins, extending over 25,000 fanegadas (16,000 hectares). Letter by Horacio Hernandez to the Municipal Council of Bogotá, 12 August 1932. Bogotá Archive, Fondo EAAB, Caja 40, Tomo 2, fs. 137-140.

[26] Apreciación geológica de la acequia Río Blanco de Gutiérrez-Bogotá, destinada al abasto con agua de Bogotá, 1932. Bogotá Archive, Fondo EAAB, Caja 40, Tomo 2, f. 195.

[27] Apreciación geológica de la acequia Río Blanco de Gutiérrez-Bogotá, destinada al abasto con agua de Bogotá, 1932. Bogotá Archive, Fondo EAAB, Caja 40, Tomo 2, f. 201.

element to conserve the rainwater that falls in the páramos".[28] Aside from such biophysical descriptions, the reports overlooked the presence of Sumapaz's powerful agrarian movement at the time, only briefly commenting that while "the farmers of the páramo" were distrustful, their lands were "abandoned", cheap, or otherwise easily expropriated.[29]

There was no consensus on the advantages of sites with 'paramuno' qualities at that time. Although in the eyes of the contemporary reader the sponge quality of the soil of the páramo is conventional wisdom, it was not without debate in the 1930s. In its final report on the Rio Blanco project, the Commission announced that all the lands intersected by the proposed canal were *paramunos*, characterised by grassland, *Espeletia* (*frailejones*), and rosemary (*romero*). Its swampy peaty layer regulated the water well, yet, contrary to the proposal's statement, the report concluded that it dried up in summer (in places where the layer's thickness was insufficient) and that there was no way to improve its drainage capacity, given that afforestation of the páramo was impossible.[30] At that time, trees were a central concern in regard to the improvement and protection of riverine landscapes. The páramo, as a treeless landscape, was the opposite of the ideal place to collect water for the city.

Surprisingly, the páramo was not part of the calculations in later decades. In the report entitled *Second Aqueduct Expansion Programme*, dated 1966 and entrusted to the engineering consulting firm Ingetec, the extensive hydrological, financial, and engineering description of the project contrasts with the total absence of the term 'páramo'. The main subject of the report is the Chingaza project. Usable water calculations are made by detailed flow and rainfall measurements. Even in the section on "ecology of deviation basins", the report refers exclusively to the "minor" effects on animal and plant life that would result from diverting rivers and taking them to a completely different basin. Although the project involved major engineering challenges, Ingetec considered it worth the effort: "The quality of the water is good, as it comes from isolated basins without erosion, which can be easily conserved. The cost of treatment is minimal".[31]

In sum, in the 1920s and 1930s, the páramo's potential in terms of water supply was either overlooked or subject to debate in the context of water engineering projects. This perception gradually shifted, but contemporary biodiversity and water concerns were still deemed irrelevant in relation to areas with paramuno qualities. However, starting in the 1970s, the Chingaza system would be built and the Park would be born. This was a watershed moment in the reconfiguration of páramo-water-ecosystem entanglements. The conservation of the basins of this high-quality water – with little treatment needed to be drinkable – would come to imply the conservation of the páramo ecosystem. But for this to occur, a concept of páramo was required that allowed this articulation. The concept sits at the intersection of material and epistemic forms of work, its emergence within the wider purview of infrastructuralisation being as much the result of geo-engineering as of scientific research.

INFRASTRUCTURALISATION 2: BIOLOGISTS AND GEOGRAPHERS MAKE THE PÁRAMO AN ECOSYSTEM THAT PRODUCES WATER

The páramo as we know it today is a recent appearance. Geography and biology – particularly botany – played a crucial role in establishing the concept of the páramo as an ecosystem, in a process that is still unfolding (Ungar, 2018). In 1944, for example, the US botanist F. R. Fosberg described what was then understood by 'páramo' as follows:

[28] Ibid.

[29] Reports by the Rio Blanco Commission, led by F. Wiesner, 1933. Caja 40, Tomo 2, 257 and 286-292.

[30] Estudio del proyecto del Río Blanco. Informe de la Comisión de Aguas, 1933. Bogotá Archive, Fondo EAAB, Caja 40, Tomo 2, fs. 300-318.

[31] Segundo programa de ensanches de acueducto. Informe de factibilidad, 1966. Bogotá Archive, Fondo EAAB, Caja 615, Tomo 1, f. 40.

> The term 'páramo' means little to the average botanical reader. He has heard it used if he has talked with botanists who have visited Colombia or if he has read travel accounts of the country. To most Colombians it means a high, cold, inhospitable, wind-, rain-, and sleet-swept region. Botanists have attempted to use the term with various limitations. None of the definitions has become a part of the general terminology of vegetation students (Fosberg, 1944: 226).

Fosberg visited the Sumapaz páramo that year, most likely exploring an area close to where Wills and Marthaler had photographed themselves a few decades earlier. For Fosberg, calling these places 'páramo' was an example of "the idea of using popular terms in ecology to represent as nearly as possible what they mean to the people of whose languages they are parts" (1944: 226). In this sense, 'páramo' would constitute a vernacular term to label the part of the northern Andes situated between the forest limit and the line of perpetual snow. Vernacular and also imprecise: páramo "would correspond, roughly, with what the term means to the Colombians, although no two of them seem to have exactly the same idea of it" (Fosberg, 1944: 226).

More than 70 years later, not only do many Colombians now agree on what the páramo is, but these places have become the centre of a broad public debate around their use and conservation. The process that has led to the consolidation of a conception of the páramo as an ecosystem is complex and encompasses a large part of the history of natural sciences in Colombia. It also describes the way that the science of ecosystems is related to conservation, especially in the late 20th century, to later become part of a powerful state-business assemblage in the 21st century. As a result of this process, the Colombian páramos are being demarcated cartographically, and the productive activities within them partially prohibited (Osejo and Ungar, 2017; Ungar, 2018) to protect the water rendered as 'ecosystem service'.

According to the páramo scientists we interviewed, this process takes us back to the early 1930s, coinciding with the activities of the Río Blanco Commission, and began with a young Spanish botanist, Jose Cuatrecasas, climbing *the Páramo de Guasca* (a part of what is today referred to as the Chingaza Páramo Complex). Born in Spain, Cuatrecasas came to Colombia as part of the celebrations of the second centenary of José Celestino Mutis's birth in 1932. After finishing his official activities, Cuatrecasas extended his stay as far as his "resources allowed". During a total of two months of 'excursions', he managed to "gather a good collection of floristic and geobotanical materials" (1936: 5-6). In those two months, this scientist managed to collect "a thousand species", with more than "three thousand sheets" of samples sent to the Berlin-Dahlem Botanic Garden and Botanical Museum in Berlin, Germany (Ibid).

On April 24, 1932, Cuatrecasas ascended for the first time to the páramo de Guasca (as related in Cuatrecasas' 1932 diary, cited in Diazgranados, 2015: 170). He was not alone when he collected samples for his museum, but along with him came a way of relating to the landscape, particularly to the vegetation. Not just a taxonomist, Cuatrecasas was also interested in geobotany. Many years later, van der Hammen and Rangel (1997) recognised in the botanist's work the beginning of the formal studies of vegetation in Colombia. According to them, before Cuatrecasas, the terms used to refer to the types of vegetation "were not based on the floristic composition", but "on the visual impression of the landscape as a whole" (van der Hammen and Rangel, 1997: 17). Cuatrecasas established associations between the different components of the vegetation. This procedure, developed in the early 20th century, involves the elaboration of 'phytosociological' tables, in which 'characteristics' can be identified in associations with particular places. Accordingly, the páramo began to emerge as a particular pattern of vegetation associations, as well as the relationship between these and soil, climate, precipitation, and altitude.

Thanks to his methodology, Cuatrecasas traced an inventory of 'biotypological schemes': tables with the statistical analysis of the relative abundance of the different biotypes in the set and the critical morphological characteristics of each of the biotypes (Casado de Otaola, 1997: 345). Thanks to these procedures, the páramo was no longer an adjective for a place but a particular formation of plants and geo-ecological conditions. "Studying vegetation by differentiating communities or associations", continue van der Hammen and Rangel, "is also differentiating ecosystems, since plant species are good

ecological indicators" (1997, 25). Cuatrecasas´ work was the first conceptualisation of the páramo as an ecosystem, even if that term was not used by him in this early period.

Cuatrecasas climbed the *Páramo de Guasca* and began to descend 'a' páramo. In 1958 he published his influential article *Aspects of the Natural Vegetation of Colombia* (1958). Here, Cuatrecasas describes the Colombian plant formations, including the "páramo formations" ('sub-páramo', 'páramo proper', and 'super-páramo'). In the article, 'páramo' is both a descriptor of a place and a biogeographical concept. The geobotanical interest of Cuatrecasas is a very early elaboration of the páramo as a typology. From being a descriptor of certain conditions to being a set of Andean plant formations, the transformation is subtle but powerful. 'Páramo' started to become a particular kind of assemblage. It was a composition, not only of plants, shapes, climates, altitudes, rainfall, etc.; but also a collection of all those elements with a taxonomy at the service of characterising, locating, and mapping life forms related to places. In the subsequent decades, the páramo became an object of inquiry for biology, which described this ecosystem's colossal biodiversity and endemism. Botanists remained essential, as they developed the notion of the páramo as an Andean high-altitude ecosystem, making correlations between different páramos, tracing similitudes, and producing a conventional idea of the páramo as an abstraction created by comparison and conjunction. Nevertheless, even in 1986, van der Hammen and Cleef continued to doubt the notion of the páramo as an ecosystem, as they explained:

> One might question the use of the term "ecosystem" for the entire páramo, because the páramo includes many different types of vegetation and exhibits many local differences in climate, soil, and hydrology (...). Nevertheless, we apply the term here to the entire páramo because of the characteristic climate, flora, fauna, and soil types these ecosystems have in common, as well as the many interrelationships between the different páramo systems. Thus, we consider the different components of the páramo biome to be parts of a single major páramo ecosystem (1986: 153).

Although botanists have been vital in elaborating the contemporary concept of the páramo, according to botanist and specialist in páramo flora Diazgranados,[32] its elaboration also required input from the geographer Ernesto Ghul Nimtz' holistic analysis. Born in Germany, Guhl arrived in Colombia in 1937 and soon began his career as a geographer. Building on notions of landscape ecology, influential especially in the second half of the 20th century, Guhl developed a concept of the páramo that added ecological, biogeographical, ecomorphological, and climatic concepts. His integrative perspective of geography was grounded in a close collaboration with local campesinos, who would often join him on field trips, and allowed him to propose an understanding of the páramo from a historical, economic, and sociocultural dimension. Although Guhl extensively travelled the country's páramos, his work was based mainly on the páramos around Bogotá, particularly in Sumapaz. By 1982, Guhl had published in Spanish his most influential book about the páramos, *Los páramos circundantes de la sábana de Bogotá* (*The Surrounding Páramos of the Bogotá Savanna*). In this book, Guhl (1982) integrates these various tools to convey a complex perspective of the páramos, even including aesthetic views: the book asserts the beauty of the Colombian páramos against an extensive history of descriptions of the páramo as a wasteland.

To understand how the páramo's infrastructural functions were reconceptualised in close articulation with a shifting biographical framing of the páramo, it is necessary to link this trajectory to Guhl's groundbreaking work. The geographer played an essential role in the constitution of the páramo 'as we know it today' as an eco-systemic and a geographical concept. That is, the páramo is not only an ecosystem; rather, the páramo is an ecosystem-made-place and a place-made-ecosystem. In the 21st century, this close articulation explains why law and science, space and cartography, can delimit the Colombian páramos for conservation purposes.

Guhl also "makes a permanent allusion to the close relationship between páramos and water" (Guhl Nannetti, 2015: 149). This link, indicated by a wide variety of arguments, is part of the central purpose of

[32] Interview with Mauricio Diazgranados, 6 November 2020.

the work: to change "the vision of the páramo as a 'useless' space to consider it a provider of what today we call ecosystem services, especially those that are related to water" (Guhl Nannetti, 2015: 150). Guhl argues that the páramos are beautiful and valuable also because their services extend nationally, thanks to the water that flows from them. The hydrology of the country is anchored in the páramos. This argument stems from his integrative view, one that can see the páramo as stemming from geological forces affected by water and ice (the glacial origin of the páramos), as an arrangement of plants, soil, and climate, and as a long-term supplier of water to humans and non-humans.

> In addition to the fact that the immense swamps of the páramos constitute the source of rivers, they have another essential function of converting rainwater into drinking water. Through the marshy and living soil of the upper layer of the basin, the rainwater is converted into drinkable water. The water that filters from the rain to a certain depth in the ground undergoes some modifications during its vertical infiltration path until it becomes drinkable subsoil water. This process that the groundwater undergoes here produces the most valuable and constantly regenerated natural treasure available to man in the lower elevational floors and supplies the *Sabana de Bogotá* with excellent water (Guhl, 1982: 71).

The páramo becomes a water purification system in Guhl´s formulation, which continues "[s]o the páramo, apparently a region of 'little use' (…) fulfils, among many other essential functions for life in the Andes, also that of a 'phreatic water factory' with an enormous chemical activity, today not yet known in all its aspects" (1982: 71). Guhl also highlights the diversity of the páramos. Not all páramos are the same, and some often lack water. Nevertheless, water has emerged as a vital characteristic in relating to the páramo and its conservation, thanks to a conceptualisation produced mainly in the páramos surrounding Bogotá, which were already connected by pipes to the aqueduct system. The quantitative data supporting Guhl's climate argument, for example, derive from the rainfall and temperature figures for Sumapaz collected by the Bogotá Water Company since the 1940s. In this sense, the Company also *supported* the elaboration of the geographical concept of the páramo in a tangible way.

DISCUSSION: INFRASTRUCTURALISATION AS A 'MARRIAGE OF CONVENIENCE'

The notion of the páramo as an 'ecosystem', as we have shown in our engagement with wide-ranging historical sources, is also, notably, recent, the notion of 'ecosystem' itself only having been termed in 1935 (Golley, 1996). In *Caldasia*, one of Colombia's main scientific journals, which has run since the 1940s, the first scientific studies approaching Colombian páramos as an ecosystem appeared in the early 1980s. Under the rise of an 'ecosystem approach' within environmental management (De Lucia, 2015), the emergence of the páramo has been linked to the concern for its conservation (Márquez Calle, 1996), which has implicated scientists bringing the páramo into the framework of 'ecosystem services', 'benefits of nature', and 'nature-based solutions'. Monetisation and valuation are also crucial (Gómez-Baggethun et al., 2010): páramo conservation has been rendered as profitable and necessary for capital accumulation and wider development, particularly from urban settings in Colombia. According to a researcher at The Nature Conservancy (TNC), whom we interviewed about water-páramo relations, it is in this sense that we must understand the *double support* condition we presented earlier. "It is not gratuitous", she stated, "that the largest city in the country is related to the strictest conservation figure [Chingaza National Natural Park] in the entire country".[33]

This 'marriage of convenience', as she also put it, implies a certain simplification of how the páramo has been understood in contemporary Colombia: as a 'water factory'. The scientists we interviewed insisted that to say the páramo is a 'water factory' is reductive. However, the factory character is at the heart of the concept we have today. "The important issue", asserted another researcher from TNC, "is

[33] Interview with The Nature Conservancy (TNC), 9 March 2021.

that the notion of 'páramo' as a water factory has been functional to its conservation. Today, people all over Colombia are ready to take the streets to fight for páramo water against mining and extractivism".[34] For Diazgranados, this idea is partly the result of Guhl's work, conducted in the humid páramos of the eastern Colombian mountain range, those that surround Bogotá and that, as we already know, give it water. Immediately after pointing out the usefulness of the páramo, Guhl argues for the importance of its conservation. Certain practices threaten the páramo:

> But this function [as a water factory] is altered and seriously threatened by the action of man, who burns and destroys the páramos to such a degree that today, as we have said many times, they are the most devastated Colombian geographic regions in the country (Guhl, 1982: 71).

This "call", in the words of Guhl Nannetti, "found an echo in the Environmental Law, which orders special protection for the páramos for their vital role as producers and regulators of water" (2015: 150). This is the basis of the many controversies that have featured in the recent history of the páramos. Because páramo protection as-synonymous-with-water-production is repeated throughout the country, this relationship became symbolic rather than merely functional, with implications in the legislation for protecting the páramos of the last decades and increasing influence on the public debate over their conservation (Duarte-Abadía and Boelens, 2016; Botero and Galeano, 2017; Osejo and Ungar, 2017; Duarte-Abadía et al., 2021; Murillo-Marín, 2022).

As we proposed before, the complex infrastructuralisation process that we have been describing requires separating a particular version of the páramo – that of an ecosystem capable of providing water – from other possible versions, including the páramo as campesino territory. This separation is far from just a conceptual affair. If we go back to Chingaza, we will find clues as to how it is also a material process. Méndez Polo describes in her thesis on Chingaza how the very process of building the water infrastructure was nourished by "an imagination in which the population, like some characteristics of the mountain, represents an obstacle to progress" (Méndez Polo, 2021: 82). In the end, people were considered "difficulties and delays for the work", for which "it was essential to marginalise them from the construction as much as possible" (Méndez Polo, 2021: 82). A combination of factors that include the previous purchase of land, peasant dynamics in the páramo (e.g. grazing practices that do not require the continuous presence of people or animals), the history of other previous extractive projects in Chingaza, and the contingencies of the water infrastructure's construction, contributed to consolidating the perception of large areas of Chingaza as 'virgin' territories.

There is, however, a difference between being a factor that 'opposes progress' and one that 'degrades the ecosystem'. Between one and the other is the articulation that we have been describing here as 'double support'. The concept of 'ecosystem' allows people to naturalise the páramo as a water-producing ecosystem. Through this categorisation, human activity, particularly the activities of campesinos, is separated from the páramo as 'nature'. For scientists, even if they have tried to convey the idea of the páramos as 'socioecological' territories, the notion of a natural ecosystem renders campesino activities 'transformation' (at best) or 'degradation' (mostly). Crucial for this process is to imagine a state of the páramo before any human activity, although historical records indicate a human presence even in pre-Columbian times. This pristine páramo of the past has important effects: it establishes a 'baseline' that makes all human intervention deleterious for the páramo, whose nature becomes the antonym of (some) human activities (Ureta et al., 2020). In this case, the campesinos become factors that can oppose progress and degrade the ecosystem *at the same time*. This situation does not often come up in discussions surrounding environmental conflicts related to development that involve local communities. In such cases, these populations may align themselves with regional, national, and even global networks of environmental activists to form alliances forged by convergent interests (de la Cadena, 2010). On the contrary, in the case of the páramos, conservation can sometimes align

[34] Ibid.

campesinos with large extractive companies, thereby limiting the possibility of forging viable alternatives for inhabiting the páramo beyond the 'marriage of convenience' that we have been describing.

While campesinos were largely expelled from Chingaza (Méndez Polo, 2021), in other páramos they have held their ground but face significant restrictions of their activities (Duarte-Abadía and Boelens, 2016; Duarte-Abadía et al., 2021). Today, these ecosystems are subjected to delimitation processes, as ordered in a recent law which prohibits certain agricultural practices within the officially established limits of the páramos. We suggest that the contemporary insistence on productive reconversion and eco-tourism projects with campesino participation attempts to include the populations of the páramos in the pattern that we have been outlining here. But this remains an incomplete process. Meanwhile, the bond between the páramo as nature and the water intake is strengthened in its symbolic and material collaboration against the campesinos' transformations of the páramo.

In this way, the double support condition has strengthened in recent decades. However, according to the TNC researcher we interviewed, this is still a marriage "of convenience", not a marriage "for love". Such marriages between development and capitalism are always risky: Since the construction of the Chingaza system, its expansion has been planned as the project called Chingaza II. According to calculations by independent geographers, the Chingaza II reservoir will affect almost 700 hectares of páramo, without counting the effects of the construction itself (Agencia de Noticias UN, 2015). The Company still has a "classic" engineering mentality, says the researcher we interviewed: there are no clear plans to increase water use efficiency in Bogotá, and the answer to Bogotá´s uncontrolled growth is to expand water intake, even at the cost of the páramo that supports and is supported by the water intake system.

CONCLUDING REMARKS

Through the notion of 'double support' this article elaborates a historical and situated understanding of infrastructuralisation in the production of nature and society. This meaning escapes traditional notions of 'green' and 'grey' infrastructure that portray the latter as built *upon* the former. In this article we argue, on the contrary, that the history of Chingaza and other páramos surrounding Bogotá invites us to recast the relationship between páramos and water infrastructure as a more complex interplay. Concretely, we propose that Ballestero's concept of 'infrastructuralisation' makes it possible to trace the process by which, in Jason Moore's terms, the nature/society binary can be rethought as a "double internality" (Moore, 2015: 13). This gives rise to what Nelson and Bigger call 'infrastructural nature' (2022) and is manifest in the incorporation of the páramos that surround Bogotá into the expanding radius of the city's vital infrastructure, as well as in the parallel incorporation of that infrastructure into part of an 'ecosystem' that needs protecting, conserving, and maintaining.

As we have shown, the contemporary páramo is a specific historical-geographical assemblage whose emergence is the result of a series of historical, geological, social, and ecological trajectories spurred by Bogotá's urban development project, with effects extending across Colombia. This assemblage can be articulated in science, engineering, development, and politics in contemporary Colombia, resulting in the coformation of a 'common nature' (de la Cadena, 2019) that can also be commodified and capitalized (Boelens et al., 2014; Moore, 2015). Our proposal does not exhaust other historical trajectories that converge on the páramos as we know them today – for instance, the one followed by environmental law or by legal and illegal armed actors who have participated in transforming páramo territories through securitisation strategies and violence against their inhabitants. Neither can we delve here into the numerous divergences in the processes of settlement, appropriation, and subsequent displacement of campesino communities in all páramo territories. The ways in which these multiple trajectories intertwine would explain the differences among the various páramos in the country. In this sense, our contribution is to highlight how the diversity of the páramos, including its current biodiversity, is also a historical – and human – result that must be studied case by case.

Finally, building on the ideas of our interviewees, we discuss the notion of 'double support' as a 'marriage of convenience'. This expression illustrates the powerful but unsteady alliance between water intake and conservation. However strong, these marriages only persist as long as they remain convenient to all parties. Upending such coordination can be disastrous for the páramo as an ecosystem. As our article demonstrates, ecosystems exist as inherently political assemblages through historically negotiated arrangements from which some actors, practices, and materialities are excluded. Rather than upending a water intake and conservation marriage, what we have explored here is the need for more binding vows, commitments, and responsibilities amongst all participants in páramo life in order to make those assemblages fairer, more democratic, and sustainable. This new arrangement cannot be merely an inclusion manoeuvre, as achieving the opening of the páramo 'as we know it today' first necessitates recognizing the profound asymmetries in which it originated.

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