

# The Hotspot Cities Project: the case study of Bogotá 2050

Richard Weller, David Gouverneur, Zuzanna Drozd, Boya Ye University of Pennsylvania, USA

## Abstract

This paper summarizes an urban and regional planning case study concerning urban growth in relation to biodiversity in the city of Bogotá, Colombia. The case study is the third phase of an ongoing research project—the Hotspot Cities Project—at the McHarg Center for Urbanism and Ecology at the University of Pennsylvania. The first phase involved an audit of land use in the world’s biodiversity hotspots in relation to the Convention on Biological Diversity.<sup>1</sup> The second involved mapping the projected 2030 urban growth of 463 cities in the hotspots, identifying the conflict between sprawl and endangered species. The set of 463 cities was then reduced to thirty-three by selecting the largest and fastest growing of these cities in each respective hotspot, the so-called ‘hotspot cities’.<sup>2</sup> Conservationists were then partnered with planners to represent these cities at a symposium at the University of Pennsylvania in June 2019 to share their experiences in regard to the conflict between urban growth and biodiversity occurring in their respective cities. In this third phase of the research we take one of these hotspot cities, Bogotá, as a case study and—through a research-by-design process—ask whether conservation values and urban development can be symbiotic and how this can be explicitly reflected in the spatial planning of the city.

*Biodiversity / hotspot / urbanism / ecology*

‘Biodiversity is to Colombia as oil is to the Arabs.’<sup>3</sup>

Juan Manuel Santos, President of Colombia, 2014

## Introduction

According to a recent report from The Nature Conservancy, *Nature in the Urban Century: A Global Assessment of Important Areas for Safeguarding Biodiversity and Human Wellbeing*, many high-value habitats around the world lie perilously within proximity to expanding urban areas.<sup>4</sup> In this age of urbanization, city authorities, researchers and NGOs committed to conservation are therefore necessarily starting to treat biodiversity and urbanization as coupled subjects. For example, the conclusion to the recent *Global Assessment of Urbanization, Biodiversity and Ecosystems Services Report* stresses that cities are central to the larger agenda of environmental stewardship:

As centers of human innovation, and perhaps the most active frontier of our impact on the planet in shaping its landscapes and seascapes, cities offer arenas for enormous opportunities to reimagine and invent a different kind of future with room for humans and other species to thrive. Cities may well be the ground where we secure a globally sustainable future—one that builds on nature-based solutions and ecosystem-based adaptation, and establishes responsible environmental stewardship at the heart of public interest.<sup>5</sup>

This should be the aim in all cities, but particularly so in those referred to in this research project as ‘hotspot cities’. For the purposes of this study hotspot cities are defined as cities in the world’s thirty-six recognized

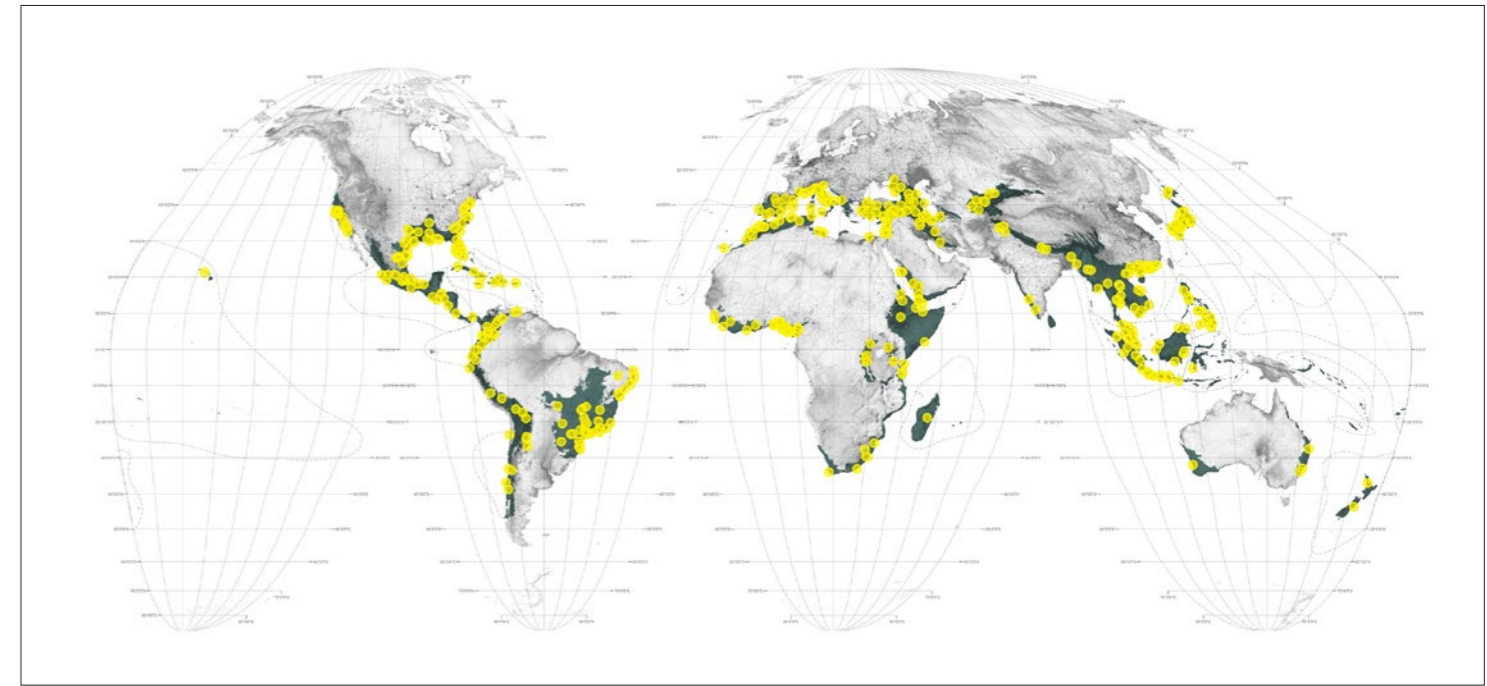


Figure 1 463 cities (yellow dots) in biodiversity hotspots where urban growth and endangered species are in direct conflict with one another.

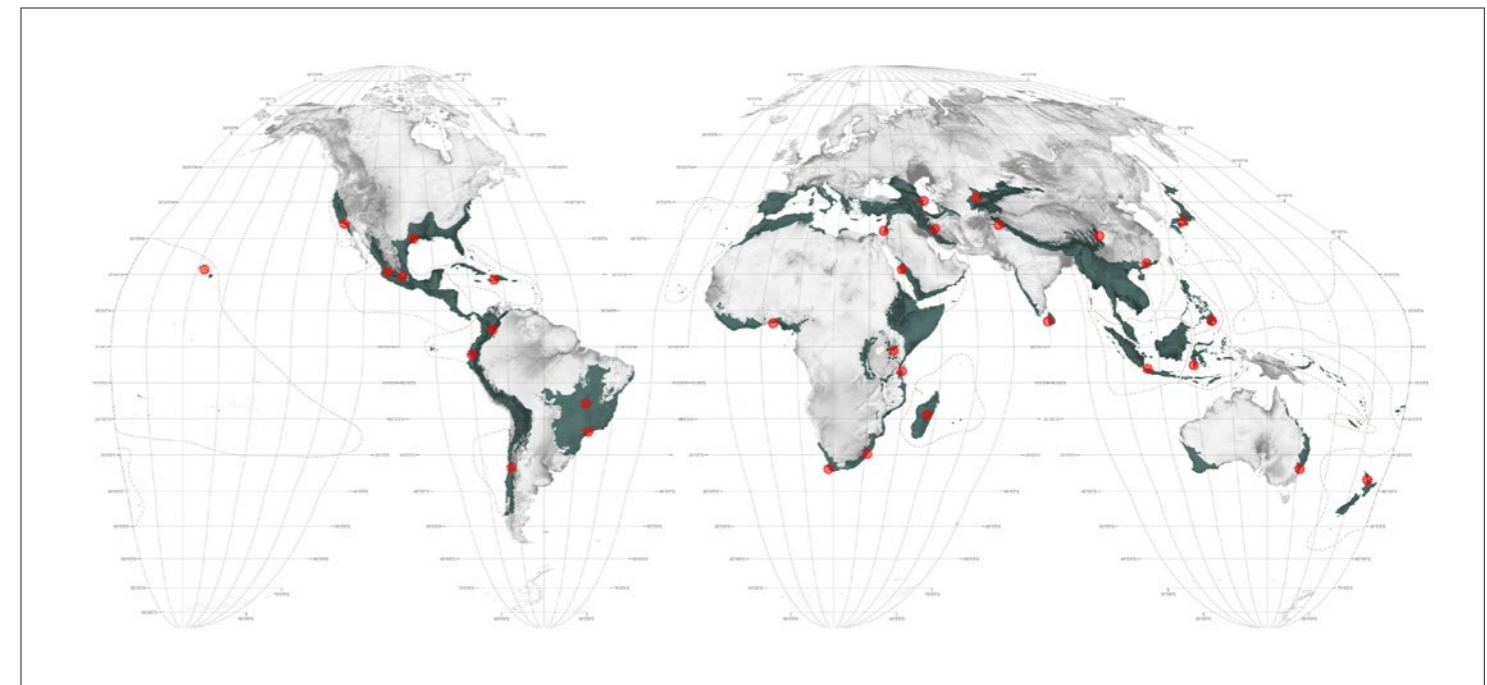


Figure 2 The Hotspot Cities (red dots). Each of these cities is the largest and fastest-growing city in each of the hotspots (See endnote 8).

biodiversity hotspots of 300,000 people or more and that are sprawling in direct conflict with endangered species. The identification of these cities is a result of a previous phase of research concerning the world’s biodiversity hotspots. For a region to be classified as a hotspot means that it not only contains unique biodiversity, but also that this biodiversity is threatened with extinction.<sup>6</sup> There have been three phases to this research. The first involved an audit of land use in the world’s biodiversity hotspots in relation to the Convention on Biological Diversity (CBD) Aichi Target #11 of reaching 17 per cent global protected area by 2020.<sup>7</sup> The second involved

mapping the projected 2030 urban growth of 463 cities in the hotspots identifying peri-urban territory where sprawl and endangered species are in direct conflict with one another (Fig. 1). This study of 463 cities was then reduced to a set of thirty-three of the biggest and fastest-growing cities in each hotspot—designated by the authors as ‘hotspot cities’ (Fig. 2).<sup>8</sup> The third phase, of which this essay is a part, concerns selecting a range of cities from the sample set of thirty-three as sites for design and planning case studies focused on mitigating the conflict between biodiversity and urban growth. Bogotá was selected as the first of these case studies.<sup>9</sup>



Figure 3 The city of Bogotá, the capital of Colombia, located in the Tropical Andes Hotspot.

Bogotá was chosen as an exemplary case study because it is a very rapidly expanding city in the world's third-most biodiverse nation, Colombia, and also because its urban growth is both formal (planned) and informal (unplanned/self-constructed).<sup>10</sup> Adding to its relevance, not only is Bogotá sprawling into habitat that harbours endangered species, it is also sprawling into its own food bowl, the rich agricultural lands directly adjacent to the city known as the Sabana (savannah) de Bogotá (Fig 3). And finally, Bogotá does not have a regional plan that aspires to integrating these conflicting land uses. As such, creating a regional plan that integrates formal and informal urban growth with biodiversity and agricultural lands could, we believe, not only contribute to the city of Bogotá, but also serve as a model for other hotspot cities.

The core problem confronted by this research is that conservation and urbanization are usually studied and managed in academic, professional and legal silos. The conservation of biodiversity has typically been subject to what is pejoratively known as 'fortress conservation', where land is locked up in protected areas, whereas urban growth is typically cast in purely economic and sociological terms. These antithetical conceptualizations of conservation on the one hand and urban development on the other reinforce an illusory world where nature and culture are cast as two different and separate things. In some cases, at certain scales, a clear spatial

separation of biodiversity and urbanization may be warranted, but as the intensity of human land uses increases and urbanization continues apace, a carefully designed hybridization is increasingly necessary. It is our contention that the conservation of biodiversity therefore cuts across and links the large scale of regional planning with the smaller scale of urban design and that landscape architects—particularly in the wake of the discourse on landscape urbanism—can play a significant role as negotiators and interlocutors between conservation and urban development.

#### The international and national context

All 196 nations that are signatory to the Convention on Biological Diversity (CBD), of which Colombia is one, must report to the Secretariat of the Convention on Biological Diversity (CBD) with National Biodiversity Strategy Action Plans (NBSAPs). Colombia submitted its first NBSAP in 1996 and an updated plan called the Política Nacional para la Gestión Integral de la Biodiversidad y sus Servicios Ecosistémicos (PNGIBSE; National Policy for the Integral Management of Biodiversity and its Ecosystemic Services) followed in 2012.<sup>11</sup> The PNGIBSE policy is implemented through the Plan de Acción de Biodiversidad (PAB; Biodiversity Action Plan), which is aligned with the following six overarching principles paraphrased below.

1. Conservation in both wild and transformed areas must take place across representative landscapes that ensure viable populations of plants and animals such that the resilience of socioecological systems as well as the supply of ecosystem services are maintained.
2. The government must work with citizens to help teach society that biodiversity is an irreplaceable asset that protects and improves the quality of life for people throughout the country.
3. Biodiversity must be incorporated into sectorial planning and co-responsibility must be shared between the government and the private and public sectors to incentivize sustainable methods of production, extraction and settlement.
4. The generation, dissemination and integration of knowledge and technological developments concerning biodiversity are needed to better guide decision making regarding biodiversity and ecosystem management.
5. The threats associated with environmental change due to the loss and transformation of biodiversity and its associated ecosystem services need to be addressed and socioecosystemic resilience in relation to climate change needs to be protected.
6. Colombia's position in the international community as a megadiverse country whose ecosystem services are vital at a global scale needs to be strengthened while also undertaking actions to contribute to the global fight against biodiversity loss and climate change.

These are powerful declarations, but they remain platitudes unless translated into spatially explicit plans for land use and urban growth. It is not unusual for nations to have wordy NBSAPs unaccompanied by spatial plans. Of the 142 sovereign nations who have jurisdiction over the world's thirty-six biodiversity hotspots, we have found that only sixteen of them had spatially explicit, (publicly available) plans accompanying the text of their NBSAPs.<sup>12</sup> In addition to this lack of national land use planning to reflect conservation principles, there is also a lack of planning for individual cities in the hotspots.<sup>13</sup> Although the Convention on Biological Diversity (CBD) encourages 'biodiversity friendly city design' and 'holistic landscape management practices' at the subnational scale, we found that in over 90 per cent of the 463 hotspot cities we examined, urban growth is taking place in direct conflict with endangered species and very few of these have any semblance of spatial planning that addresses the problem. This case study focuses not only on accommodating 2050 urban growth projections for Bogotá but attempts to show that this growth can be leveraged to protect and enhance biodiversity at the urban, peri-urban and regional scale.

Colombia's exceptional biodiversity is a consequence of its tropical location and of its diverse climatic conditions with elevations ranging from sea level to 5,575 m. Colombia is comprised of three parallel branches of the Andes, the Sierra Nevada de Santa Marta (considered the highest coastal

range in the world), the Llanos of the Orinoco basin (shared with Venezuela), and a portion of the Amazonian basin. In addition to this diversity Colombia is the only South American nation with Pacific and Caribbean coastlines. With a population of close to 50 million, Colombia is also the third most populous nation in Latin America. In 2019 Colombia had an annual demographic growth rate of close to 1.4 million,<sup>15</sup> and this has increased in recent years due to the ongoing exodus from Venezuela, its closest neighbour.<sup>16</sup> Due in part to years of civil war in rural areas, Colombia is one of the most urbanized nations in the world, with close to 87 per cent of its population living in urban centres. All of these urban areas are rapidly growing. At least half of the people in Colombia live in self-constructed 'informal' settlements, with different degrees of consolidation, infrastructure and communal services. These settlements eventually acquire legal cadastral records and are then formally subject to taxation.

Several Colombian cities, such as Medellín, and to a lesser degree Bogotá, have gained worldwide recognition for the quality and impact of projects aimed at upgrading living conditions in once violent, informally constructed neighbourhoods.<sup>17</sup> However, for the most part, Colombian cities are still socially and spatially segregated. The Colombian Urbanism and Construction Law, enacted in 1997, provided municipalities with the autonomy (and directive) to produce their own urban plans and codes but did not emphasize intermunicipal planning policies, which are required to cope with the challenges of large metropolitan systems. As will be explained below, this law has presented a major impediment to comprehensive regional planning in the case of Bogotá.

It is also important to appreciate that, like many of the world's most biodiverse regions, Colombia has suffered from social and political unrest from the late 1940s to the early 1990s. At the core of this was a civil war between the government and the left-wing (FARC) guerrilla movement in the region. The FARC emerged out of land and labour disputes between wealthy cattle ranchers and peasant farmers, a situation then significantly complicated and fuelled by the global cocaine trade. The ensuing guerrilla warfare triggered the rise of a reactionary right-wing paramilitary movement, resulting in a generalized state of violence, loss of governance, over 500,000 deaths, and the inability to commute by land between the main urban centres and productive areas. During this period some 5 million Colombians emigrated. Since the early 1990s, the country has gradually recovered political and economic stability, culminating in a peace treaty with the FARC in 2016. While the rural exodus Colombia has experienced may in fact have had certain benefits for biodiversity, accelerated and fragmented urban growth, in addition to unregulated mining and deforestation practices, has had a severe impact on habitats in Colombia. The main threats to habitats across the nation include population growth, urbanization, coffee production and other agricultural practices, such as flowers and coca-leaf plantations, the expansion of transportation infrastructure especially through delicate ecosystems such as cloud forests, dam construction, mining, firewood collection in remote areas, and the illegal wildlife trade.<sup>18</sup> The loss of biodiversity in Colombia, as elsewhere, is a complicated and multipronged problem, and our research does not claim to broach the totality of this issue other than through the spatial aspects of urban and regional planning.

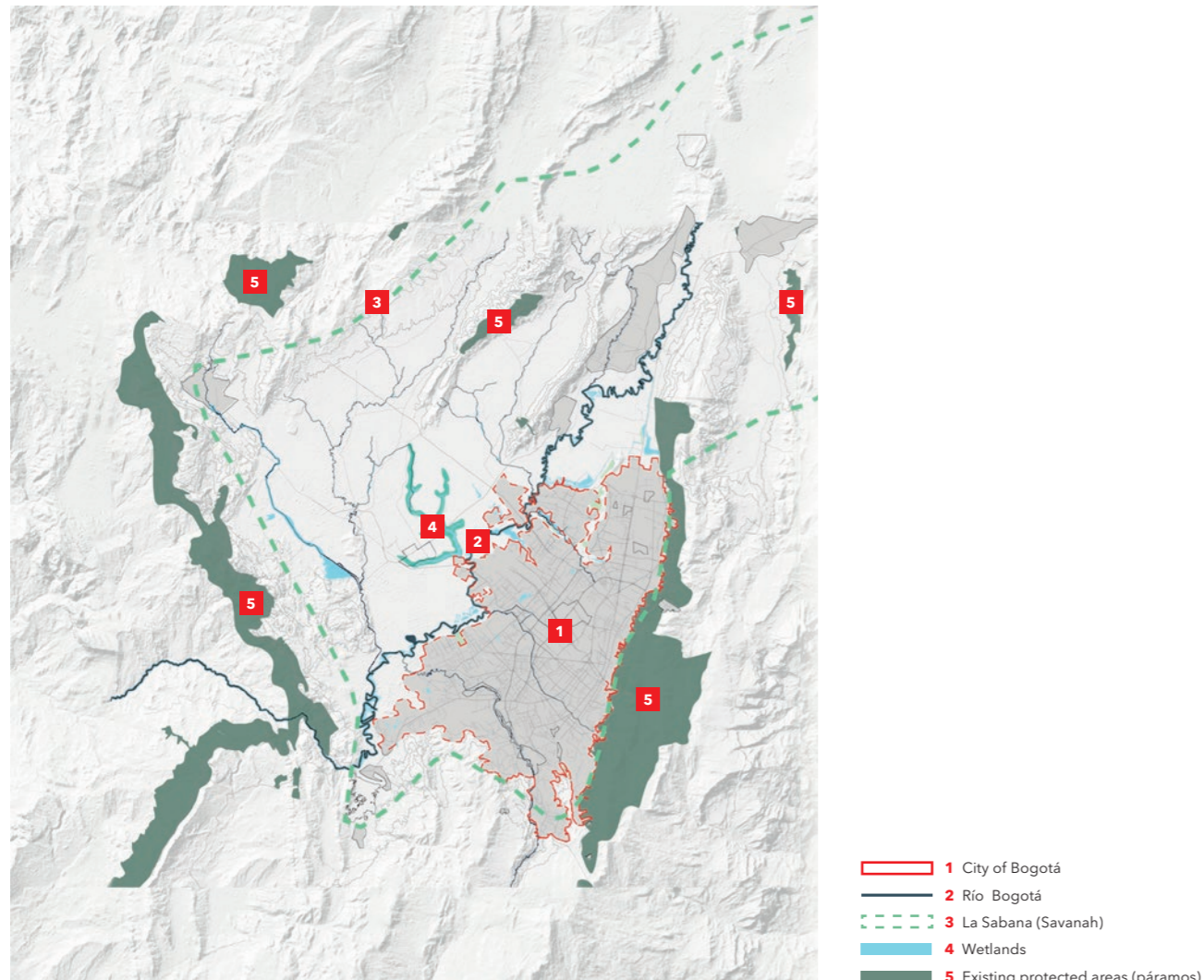


Figure 4 The existing footprint of Bogotá and La Sabana de Bogotá divided by the Río Bogotá with existing surrounding protected areas (paramos).

### The Bogotá-La Sabana region: capital of the Tropical Andean Hotspot

Designating a city a ‘hotspot city’ is a rhetorical ploy to expand a city’s sense of place and sense of identity from its national boundary to its biological boundaries. Bogotá, for example, sits in the heart of the Tropical Andes hotspot, which is the most biodiverse of all the world’s thirty-six biodiversity hotspots (Fig. 4). It contains one-sixth of all plant species on the planet and at least half of these are endemic.<sup>19</sup> This hotspot also has exceptional cultural diversity. More than forty indigenous groups live here with over 52 per cent of the hotspot’s land area owned by or reserved for indigenous peoples.<sup>20</sup> The Tropical Andes Hotspot has a high percentage (24 per cent) of protected areas in comparison with other hotspots. However, the heavily cultivated inter-Andean valleys are not well represented in these protected areas and have been severely ecologically degraded, especially around major cities such as Bogotá. Today, only 10 per cent of their original vegetation remains.<sup>21</sup> If Bogotá were to conceive of itself as the capital not only of Colombia, but ostensibly also the capital of the Tropical Andean hotspot, it opens the possibility of the city foregrounding its

regional ecology with a sense of pride, and by extension a sense of responsibility. The ethos of this case study is that an expanded, ecological sense of place can then be expressed in the urban form of the city and its related infrastructure.

The city of Bogotá and myriad neighbouring smaller cities and towns lie in La Sabana, a plateau nestled in the high Andes at an elevation of 2,500 m. La Sabana is essentially a wetland that has been drained and desiccated since early colonial times to accommodate agricultural practices and urban occupation. The occupation of La Sabana by indigenous (Muisca) people, over 2,000 years ago, relied on a close relation with the wetlands of La Sabana, introducing canals for irrigation and transportation, wet-agricultural practices and fishing. A Muisca creation myth tells how Bochica, the deity, broke a mountain to create ‘el Salto del Tequendama’, a sacred waterfall, draining La Sabana. To this day, managing the waters of La Sabana is crucial to the region’s agricultural productivity and cannot be ignored by immanent urban development.



Figure 5 Image of remnant wetlands in La Sabana de Bogotá

Elevated significantly higher than the plateau of La Sabana is the unique páramo ecosystem (or high Andean moorland), which not only has exceptional levels of endemism, but is also valuable for its immense capacity for water capture and retention. These perched wetlands serve as massive elevated sponges that feed rivers and streams throughout the year, making them the most important water source in Colombia.<sup>22</sup> The city of Bogotá, like much of Colombia, is dependent on páramos for water—one páramo in Chingaza National Park to the northeast of the city provides 70 per cent of Bogotá’s water, and the rest comes from the Sumapaz and Guerrero páramos (located respectively to the south and the north of the city). Like páramos throughout the country, these are threatened by farming, coal mining and climate change.<sup>23</sup> Water filtering down from the páramos is captured in reservoirs or moves through today’s city of Bogotá in heavily polluted rivers, including the main Río Bogotá, and infiltrates aquifers through the porous limestone of the foothills.<sup>24</sup>

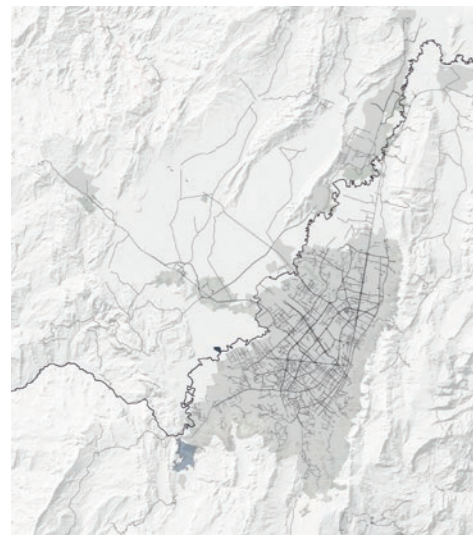
The riparian zone of the Río Bogotá is a completely transformed and heavily polluted landscape. Set within channels the river is several metres higher than the adjacent La Sabana agricultural lands and flanked by large swathes of flood-prone land with a few remnant wetlands (Fig. 5). A recent six-year river improvement project along 52.2 km of the Río Bogotá that widened the river channel in places from 30 to 60 m and constructed raised banks, has failed to improve water quality.<sup>25</sup> Today, the once more than 50,000 hectares of wetlands in and around Bogotá have been reduced to 800. There is, however, increasing popular and political awareness of the value of wetlands. For instance, on the eve of his departure from office in August 2018, President Juan Manuel Santos declared that 704 hectares of fifteen wetlands in and around Bogotá would be designated as protected Ramsar sites.<sup>26</sup> Bogotá’s explosive urban growth has now pushed up against and is leap-frogging its natural and legal boundary formed by the Río Bogotá. This sprawl threatens the remnant wetlands with further degradation if not complete obliteration.



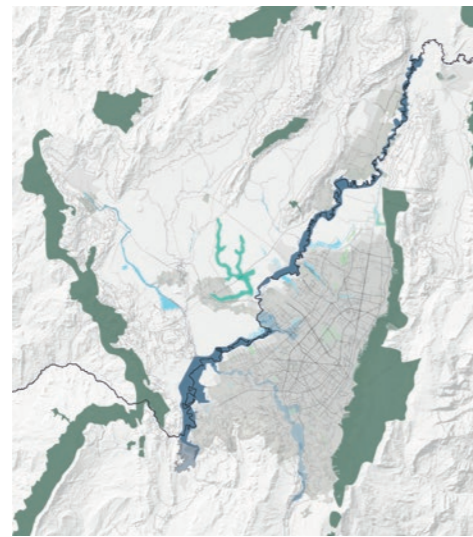
Figure 6 Image of the flower industry and sprawl into La Sabana de Bogotá

### The problem: uncoordinated urban sprawl

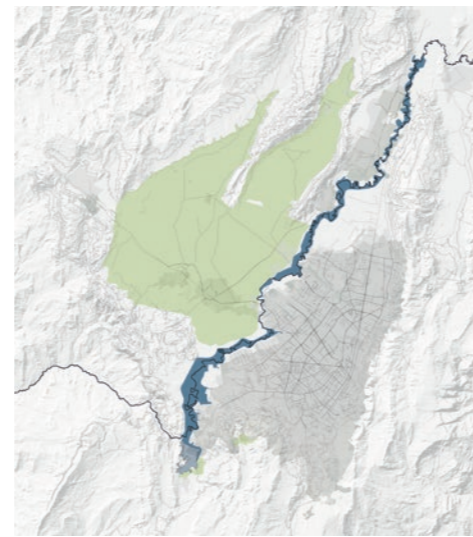
In the mid-twentieth century, Bogotá began to experience exponential growth. Colombia’s industrialization and modernization attracted waves of migrants from rural areas, escaping from poverty, guerrilla warfare and drug-related violence. Consequently, the population of Bogotá has almost doubled over the last 30 years.<sup>27</sup> Bogotá is a compact, gridded, street-wall city with the built fabric averaging out at five to six storeys. Faced with nowhere for its urban growth to extend to within the legal limits of the municipality of Bogotá, the city is crossing the boundary of the Río Bogotá and sprawling out across the adjacent agricultural lands and small townships of La Sabana.<sup>28</sup> La Sabana is, however, still a rich local food bowl for the city, and a much-loved cultural and recreational landscape, as well as a centre for the flower export industry (Fig. 6). Almost half of the municipalities closer to Bogotá have been impacted by sprawl, often replacing



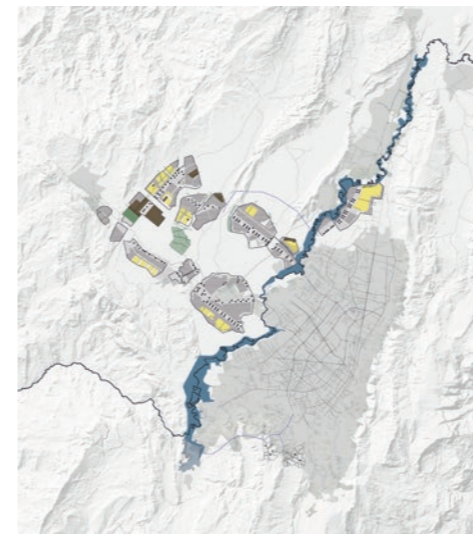
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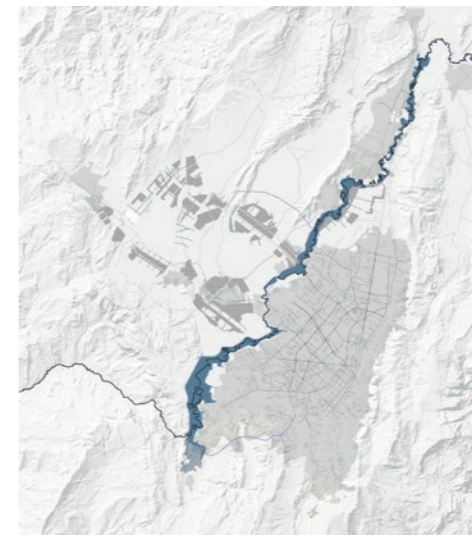
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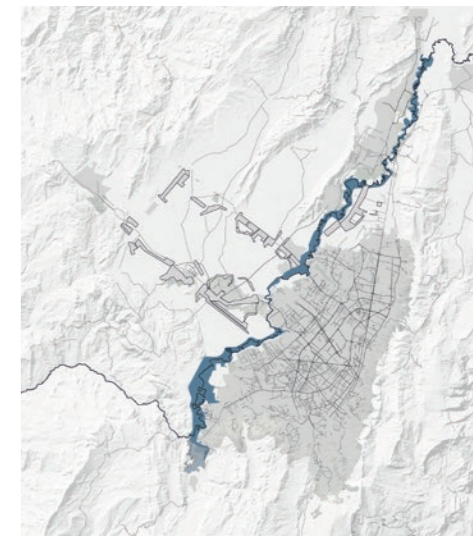
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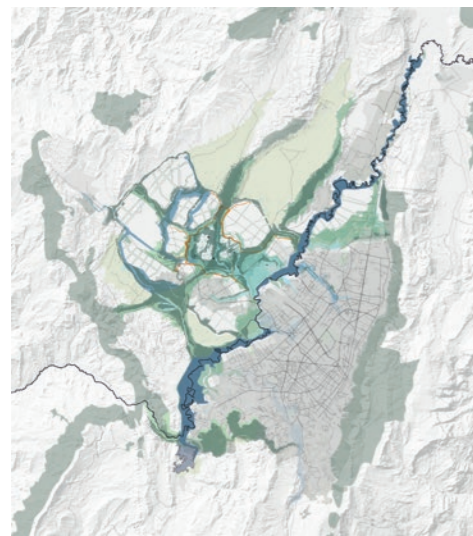
10 URBAN NETWORK



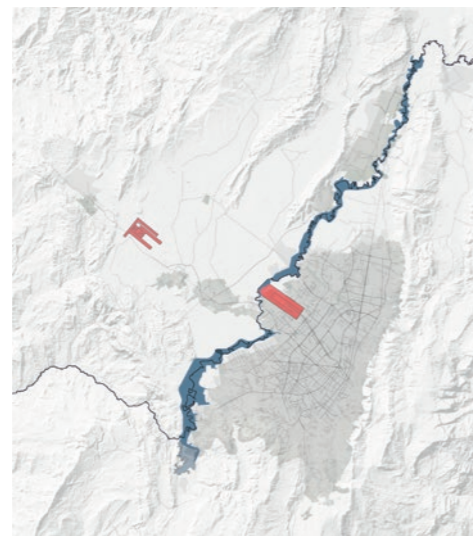
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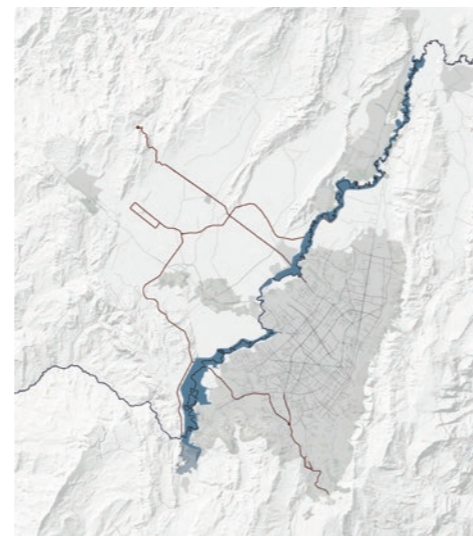
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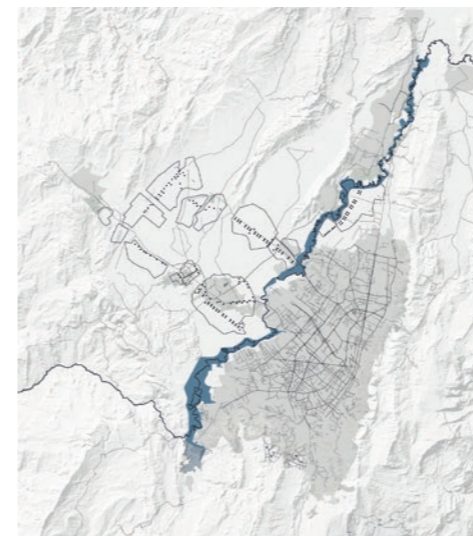
4 ECOLOGICAL NETWORK / GREEN HEART



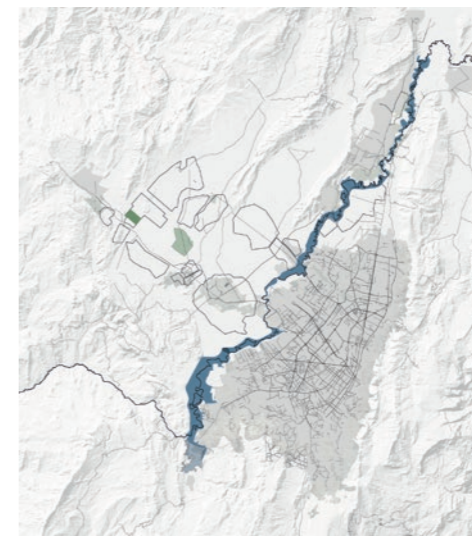
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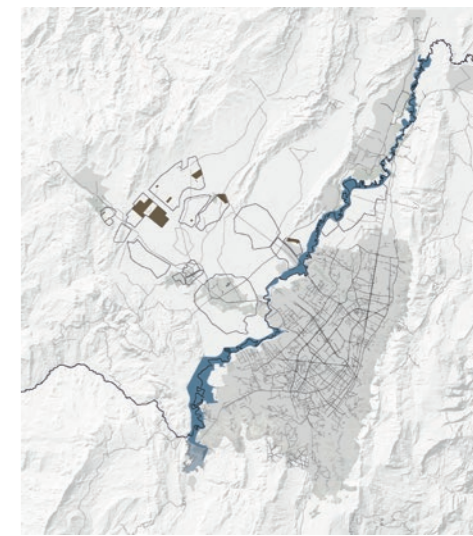
6 REGIONAL HIGHWAY



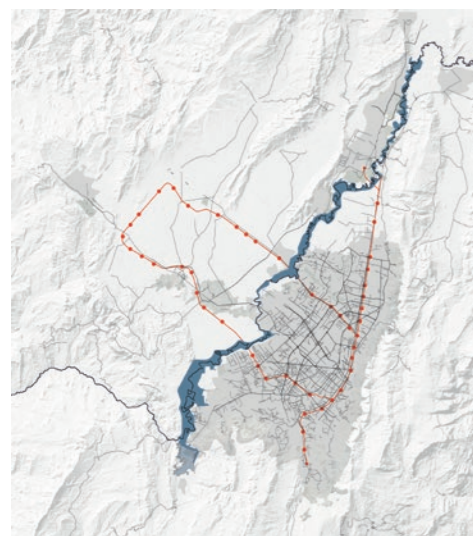
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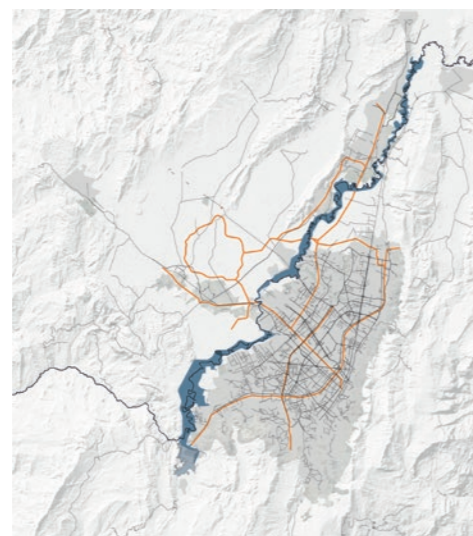
14 FLOWER PRODUCTION



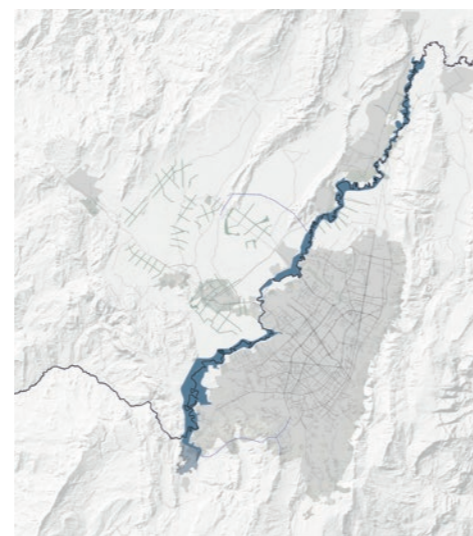
15 INDUSTRIAL



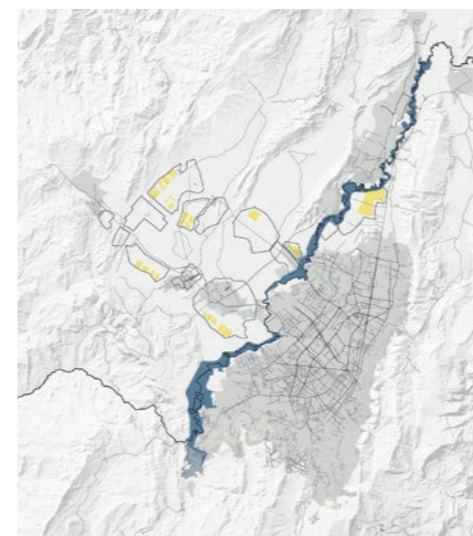
7 METRO



8 LIGHT RAIL



9 ALAMEDAS



16 SELF CONSTRUCTED

Figure 7.1 – 7.16 The various layers of the ecological and urban networks

agricultural and grazing practices with gated, middleclass communities, hobby farms, informal settlements, industrial parks, shopping malls, private schools, universities and cemeteries. Part of the fragmented sprawl occurring in Bogotá is also due to the proliferation of greenhouses for the flower industry, within relative proximity to the existing airport. Plans for the location of a second airport some 15 km west of Bogotá's current city limits—its site predetermined by flight paths and land ownership—will inevitably catalyse further sprawl. The tragedy is that uncoordinated development is erasing La Sabana's past and destroying its future. In this research we have accepted the trajectory of Bogotá's urban growth into La Sabana as a necessity. The question is whether this growth can be directed in such a way so as to minimize loss of agricultural land and whether it can be integrated with an ecological network that conserves the region's hydrology and conjoins existing fragments of protected areas into a robust system.

The projections are that, despite the efforts to increase density and to urbanize the few remaining vacant areas in Bogotá, La Sabana will need to accommodate over 3.5 million additional inhabitants over the next two decades.<sup>29</sup> Thus, any future planning for the metropolitan systems of Bogotá, not least of all ecological planning, must address a complex mosaic of smaller, separately governed municipalities in La Sabana whose uncoordinated and self-interested growth is gradually eroding the region's ecological and agricultural assets. Bogotá has a qualified planning team and strong political leadership, but they cannot plan beyond its city limits, and regional and intermunicipal planning has been a consistent weakness of Colombian planning. Consequently, on the other side of the Río Bogotá from the built-up city, La Sabana has developed in a politically fragmented and piecemeal manner. A balanced metropolitan system between Bogotá and La Sabana can only be achieved by forming a common planning framework for the greater Bogotá–La Sabana region. In this regard the recently approved 'La Region Metropolitana de la Sabana' which now brings all the separate municipalities under one planning mechanism, is a breakthrough and presents an opportune moment for holistic visioning of the future of the city.<sup>30</sup> This megaregional mechanism may now enable more coordinated development of La Sabana, and it is with this in mind that we have crafted our 'Bogotá–La Sabana 2050' master plan. Before discussing the plan, it is important first to describe the way in which much of Bogotá's urban growth takes place informally, for unless urban planning can include this form of growth in its spatial arrangements, it is missing the reality of urbanization in this part of the world.

### Informal urbanism

The lack of formal jobs and thus stable income and savings, paired with the low supply and prohibitive cost of social housing options for the poorest sectors of Colombian society, has driven many residents of the Bogotá metro area into self-constructing their neighbourhoods. It is estimated that close to 45 per cent of the urban areas of Bogotá are initiated as informal settlements.<sup>31</sup> While precarious in their early stages, these settlements evolve and consolidate over time and eventually gain legal status and are gradually retrofitted with infrastructure and communal services.

These informal areas are better structured and served than those in many other Latin American cities, since most of them are located on relatively flat topography and configured by urban grids pre-established by 'pirate' or informal developers.<sup>32</sup> More recent informal occupations are, however,

occurring in precarious areas including steep, peripheral terrain and floodplains. As a result, these informal settlements are less structured and poorly served, and encroach on ecologically sensitive areas. It is important to note that while Colombia has gained international recognition for developing projects for the improvement of existing informal settlements, the urban plans of Bogotá and the municipalities of La Sabana currently only refer to formal urbanization.<sup>33</sup> While this planning includes social housing, it ignores the fact that social housing is not an option for the less affluent. Where it is an option, many people actually choose informality over social housing because building informally allows for gradual improvement of the homes, whereas in social housing, extra income is used to pay loans.

No municipality in the Bogotá–La Sabana megaregion explicitly recognizes the reality of emergent self-constructed neighbourhoods. Consequently, projections for future urban growth and its requisite land requirements are often inaccurate. Furthermore, ambitious urban design plans within Bogotá aim at positioning the city on a global stage and tend to similarly ignore the reality of informal urbanization. As land values continue to rise in Bogotá, any sustainable urban planning in La Sabana must take the reality of this process into account. In our case study we have actively included the reality of informality and placed it against the backdrop of the core principles of Colombia's National Biodiversity Strategy Action Plan (NBSAP) as summarized above. To the six principles previously listed, we have therefore added a seventh: *Bogotá's future formal and informal development should be leveraged to restore and reconnect the city's urban and peri-urban landscape ecology in a way that foregrounds the cultural and ecological value of biodiversity.* Demonstrating how this can take shape at a whole-of-city scale is now the focus of this paper.

### Method

The method for developing a plan for Bogotá–La Sabana 2050 that manifests a symbiotic relationship between urban growth and biodiversity, was studio based and involved a team of two academic instructors, Richard Weller and David Gouverneur; one research assistant, Zuzanna Drozd, and eleven graduate landscape architecture, planning and architecture students over a four-month period in 2018.<sup>34</sup> Prior to the studio the research assistant was tasked with providing a summation of all available data pertaining to Bogotá's urban and regional socioecological conditions. Further collection of data occurred through site visits to Bogotá and La Sabana, lectures by government officials and local experts, as well as design charrettes carried out with faculty and students of the School of Architecture of La Universidad de Los Andes (Uniandes).<sup>35</sup>

The analytical phase of the project was conducted by three teams: 1) biodiversity conservation, 2) agricultural productivity and 3) urban development. Each team was asked to produce a vision of an ideal future from the perspective of their subject with little regard for the other two subjects. For example, the conservation team expanded protected areas, forged landscape connectivity across all scales, buffered and enlarged wetlands and riparian zones, and proposed major recreational and institutional initiatives to inculcate both an academic and popular culture of biodiversity in the region. Likewise, the agricultural team prioritized agricultural productivity by quarantining La Sabana de Bogotá from any further development, proposed agroforestry to define buffers between land uses, proposed raising yields through technology and land parcelling, and rationalized and concentrated the flower export

industry around the new airport. Finally, the urban development team created a plan manifesting orthodox (New Urbanist) principles of a 'liveable' city. This meant accepting Bogotá's urban expansion into La Sabana as a *fait accompli*, while proposing that this expansion be compact, transit-oriented, mixed-use, walkable, green, affordable and at least in theory, socially integrated. This team did not, however, incorporate informal urban development in its vision as this falls outside of a typical new urbanist lexicon. The urban development team did, however, underpin its proposal with a (McHargian) suitability analysis so as to avoid further habitat loss and preclude development in areas of potential environmental hazard such as floodplains and steep slopes. In this scenario, significant amounts of agricultural land in La Sabana were sacrificed to development and the continuous tracts of restored habitat envisioned by the conservation group were largely forsaken as to ensure a seamless continuity of urban form.

The bulk of the studio was then devoted to the iterative, highly interactive and non-linear process of integrating these three different scenarios into a single plan. This entailed first critiquing each of the three scenarios unto themselves, then identifying the conflicts arising between the superimposition of all three. The respective pros and cons of each conflict were debated and reconciliatory trade-offs and alternatives formulated. It is important to note here that while everyone in the studio worked together at the whole-of-city scale, individuals were also simultaneously assigned to, and charged with, designing specific smaller-scale areas. This ensured a constant reciprocity between the scale of regional planning (land use) and the scale of urban design (streets, blocks and public space), the two constantly informing one another. It also enabled a certain creative tension between individual design intentions and the collective will of the group. Ultimately, all fourteen participants in this process reached a consensus on a single, unambiguous spatial plan that assiduously combines conservation, agriculture and urban development. Rejecting recent claims by new urbanists such as Andres Duany and Emily Talen that landscape form and urban form are fundamentally incompatible, the plan aspires to be a demonstration that an *urbanism of landscape* and a *landscape of urbanism* is not only possible, but desirable.<sup>36</sup>

In their 2013 book *Landscape Urbanism and Its Discontents*, Duany and Talen argue that 'nature' is best kept in national parks whereas 'culture' works best in uninterrupted urban grids. Duany and Talen dedicate their book to urbanist Jane Jacobs on the one hand and proto-environmentalist Rachel Carson on the other. The reason for this dual dedication, they write, is because neither of them ever 'confused the urban with the natural'—the insinuation being that so called 'landscape urbanists' do confuse the two, and it is this confusion that leads to poor urban design outcomes. Indeed, in some cases where landscape architects forget the forest for the trees, they have a point. But it is profoundly problematic that for new urbanists, the evolution of urbanism is essentially arrested in the nineteenth century and the possibility of cities becoming more sophisticated ecological systems is foreclosed. The essence then for the Bogotá–La Sabana 2050 plan is that the future city is a tightly woven synthesis of an ecological network and an urban fabric. The various layers of this synthesis are documented in Figure 7.

### Bogotá–La Sabana 2050

#### The Ecological Network

The Bogotá–La Sabana 2050 plan is fundamentally organized around an ecological network (Fig. 9) determined by forging connectivity between patches of protected areas and buffering the hydrological system of La Sabana and the Río Bogotá. To achieve this, existing large-scale protected areas in the regional context are connected to peri-urban areas of remnant habitat, which in turn are connected to riparian zones and wetlands. The ecological network is not a monoculture; while primarily devoted to enabling flows of biodiversity through the city region it is also responsive to its variable urban and agrarian adjacencies. For example, wherever the network abuts or dissects residential districts, in addition to serving as an ecological conduit, the landscape takes the form of multifunctional parkland. Wherever it abuts or dissects agricultural lands a bandwidth of agroforestry serves to mediate between farms and urbanity. Where areas of development abut the ecological network there is always a risk of an overflow of informal development. For this reason, particular types of land use such as recreation and horticulture, and particular institutions such as universities, schools, hospitals and libraries, are situated at the edge between the open space of the ecological network to passively resist informal urban encroachment.

The ecological network is conceived as a broad-brush framework: cheap, robust and low maintenance in the first instance, but one into which a mosaic of specific restoration projects can be undertaken by Bogotá's increasingly active environmentalist citizenry. Threaded through the entire ecological network are also cycling tracks (a popular form of transportation and recreation in Bogotá), which in turn connect to a finer-grained network of *alamedas*—traditional local pedestrian and bike-friendly walks or promenades. The *alamedas* stitch the urban development districts into the ecological network. Keyed into a finer grain of public spaces in the new residential areas, the *alamedas* serve as social and recreational space, but also provide stormwater infiltration, support biodiversity and offer opportunities for small-scale, community-based food production.

The main armature of the ecological network is the riparian corridor of the Río Bogotá. The river is currently significantly reduced in flow, severely contaminated, and mostly contained by berms and gates. The hydrology of La Sabana is controlled through a system of gates, four major pumping stations and more than 130 manual sluices. To the south of the city, its polluted waters are pumped into the Muña reservoir, which in turn feeds the main hydroelectric power production facility of Bogotá. Today, the Río Bogotá is ignored at the edge of the existing city and divides the city from La Sabana, but as La Sabana is inevitably developed this will change. In our plan the Río Bogotá necessarily becomes a green and blue spine for the new megacity to develop around and orient on.

In our Bogotá–La Sabana 2050 plan, the riparian zone of the Río Bogotá is set back from development and revegetated. Making 'room for the river' as such will also contribute to flood control, an important factor to be considered as urbanization advances. The river will additionally need to be gradually decontaminated by a combination of wastewater treatment plants and berms where overflow can be contained in (reconstructed) wetlands. Ultimately, however, in addition to investing in the riparian corridor of the river, Bogotá will need to implement green infrastructure in relation to storm- and wastewater throughout the entire urban and agrarian catchment if the river is ever to become the central recreational, ecological and aesthetic spine as depicted in the plan.



Figure 8 The urban network.

The riparian corridor of the Río Bogotá connects with a second major open space in the new plan; El 'Corazón Verde' (Green Heart). Because of restrictions related to the airspace between the existing and proposed airports and also to ensure robust ecological functionality in what is ostensibly a vast flood-prone wetland, El Corazón Verde is an open space around ten times as large as New York's Central Park. But whereas Central Park is an object isolated inside the Manhattan grid, El Corazón Verde is connected to the broader body of the landscape via the linear corridors of the proposed ecological network. In addition to restoring and expanding its remnant wetlands to help with cleaning the Río Bogotá and facilitating international bird migrations, El Corazón Verde as proposed would also contain an arboretum and a zoological research campus devoted to the region's biodiversity. The vast parkland of El Corazón Verde also affords space for nurseries responsible for producing the plants needed by the region for the creation, and eventual expansion, of the ecological network. These nurseries can function in synchrony with a new industrial zone for the flower industry adjacent to the new airport. The urban edge of El Corazón Verde is a 20 km-long 'promenade' of heavily programmed commercial and recreational activity serviced by a tram. This edge also presents itself as a prime real estate opportunity for high-density, high-amenity living.

### The Urban Fabric

As landscape urbanism's critics have argued, a good city cannot be made by exclusively following hydrological guidelines and simply filling in the gaps between with development. Of course urbanization has its own logistical and spatial needs: it requires a regular plat for development and takes shape in connection to linear infrastructure and transport systems. But

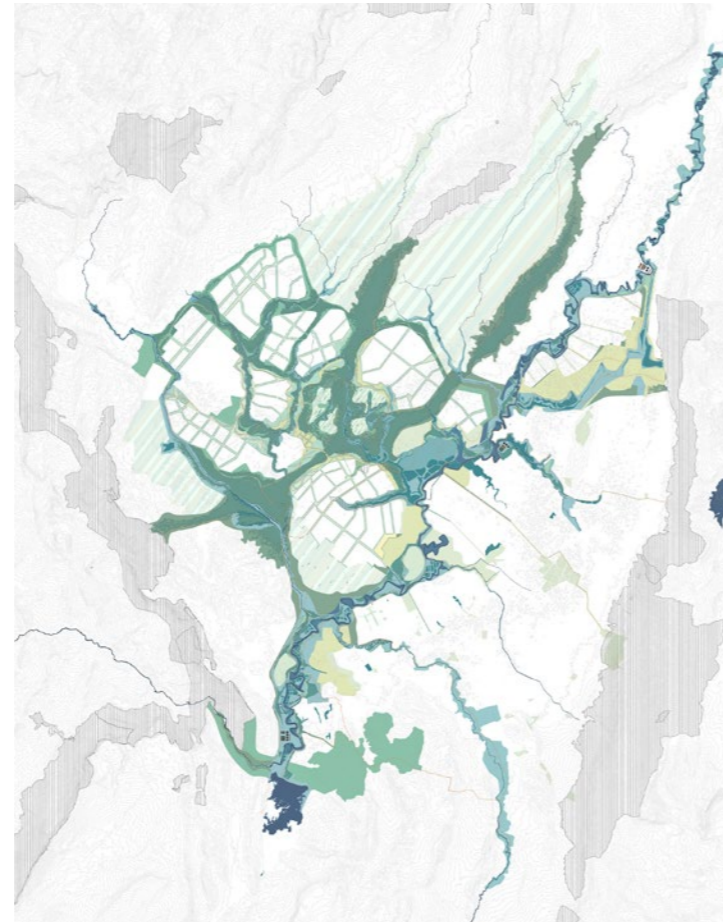


Figure 9 The ecological network.

so, too, an ecological urbanism of the twenty-first century requires urban form to adapt to topography, hydrology and open-space connectivity and habitat protection as best it can.

The creative challenge for urban planners and designers is to now strike a balance between the many good ideas of the new urbanism and an urbanism that also takes ecology as if it really mattered. The new urban districts proposed in the Bogotá-La Sabana 2050 plan (Fig. 10) are set out as 'traditional' mixed-use, walkable, green and transit-oriented developments, but their urban morphology is also adjusted at its edges to meet the organic form of the ecological network. By the same token, the ecological network has been adjusted—tightened, and in parts realigned—so as to help achieve functional and legible urban form.

The catalyst and primary planning tool in the formation of a viable urban growth plan is a coherent public transport system, something currently lacking in Bogotá. Establishing an efficient public transport system can induce urban occupation towards favourable locations, integrate the existing city with new urban expansion zones, provide democratic access to the metropolitan system, and reduce energy consumption and pollution. In the Bogotá-La Sabana 2050 plan, a new metro line forms a loop that links the existing city with the proposed new airport and existing townships as well as catalysing new urban centres. The metro loop is supplemented by light rail, BRT routes, a tram around El Corazón Verde and a network of bike paths and pedestrian ways along the *alamedas*. Additionally, as have been used successfully in Medellín, aerial gondolas can service peripheral low-income neighbourhoods located on steep terrain. Regional freeways facilitating nation-wide distribution bypass the new urban areas but are connected to food distribution centres and the new airport precinct.

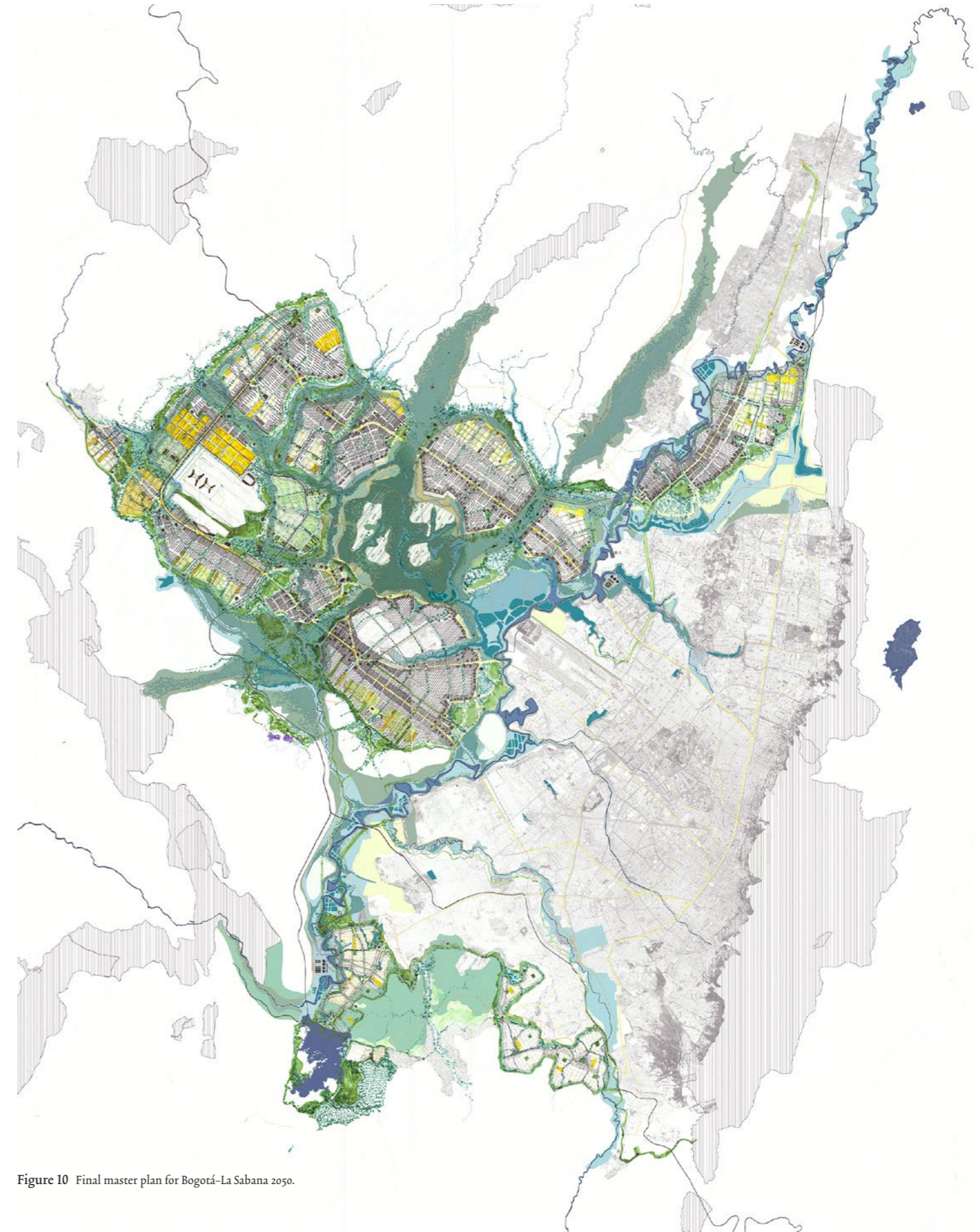


Figure 10 Final master plan for Bogotá-La Sabana 2050.

The new urban development districts are concentrated around the proposed metro-loop stations. The design of the new urban districts seeks a balance between the legibility of simple urban grids while also incorporating new mixed-use typologies along the mobility corridors: work-live residential solutions with the possibility of increased density over time and larger block typologies defining friendly public spaces oriented towards the street. Importantly, each district accepts and proactively includes provisions for informal development, enshrining it as a legitimate—indeed, in many ways a desirable—part of the urban and social mosaic. This means specifically allocating land in each development district to reflect all of Bogotá’s different social strata and their different housing typologies.

Finally, a system of incentives that translate into profitable urban operations for landowners and developers is necessary to achieve both ecological and urban design goals. For example, developable areas can be doubled when the developers invest in public transport corridors, or tripled around public transport nodes and at the edge of El Corazón Verde. A similar triple development bonus, or direct compensation, is offered when landowners offer their land as part of the ecological network, or for social housing and self-constructed neighbourhoods.

## Conclusion

In the Latin American context, long-term spatial planning for growth at a whole-of-city scale is unusual. Development still tends to be ad hoc, opportunistic and largely disrespectful of ecological issues. Not only is it difficult to finance ecological restoration, even where habitat exists, its legal protection does not have the same significance as it would in the global North. In Latin America, the boundaries between different land uses tend to be porous. For example, millions today live illegally in national parks and in other so-called protected areas. Furthermore, environmental impact assessments for the approval of large-scale urban or infrastructure products are not common, and when developers or communities violate environmental regulations, they are not generally held accountable. Urban planning and zoning codes tend to focus on quantitative rather than qualitative aspects of development.

The international community needs to be mindful that it may be demanding that hotspot cities now engage in conservation practices that the industrialized nations of the global North did not themselves undertake until they had the wealth to do so. Pretending these realities do not exist and simply placing faith in the apparent rationality of planning is naive. That said, none of this is an excuse for not planning rapidly growing cities and importing best practice and adapting it to local culture. This best practice should be tuned to local ecological, political and social characteristics and have embedded within it the expectation of unintended consequences. Plans are nonetheless crucial rhetorical devices and having a clear spatial plan at a whole-of-city scale as is being put forward here is a useful step towards galvanizing competing interest groups.

The dichotomy between conservation and urbanization can be overcome by envisioning urban design as a process of compromise in which both urban logistics and the ecological imperatives perform as a single system, each adding value to the other. This requires a deep and culturally specific understanding of how both the ecosystem and the urban development system function as well as incentives to mobilize change away from the status quo of socially and ecologically irresponsible growth.

## Acknowledgments

The authors wish to thank Diego Bermudez, our colleague and friend in Bogotá, for his review of this paper and the students Yifan Cai, Yu-Te Chiang, Mariela Hernandez, Terence Hogan, Ruobing Huang, Yichao Jia, Meichun Jia, Hong Li, Xuanang Li and Zhiyu Weio. Thank you also to the JoLA editors for their attention to detail.

## NOTES

1 Richard J. Weller, Claire Hoch and Chieh Huang, *Atlas for the End of the World: Atlas for the Beginning of the Anthropocene* (2017), atlas-for-the-end-of-the-world.com.

2 Richard J. Weller, Zuzanna Drozd and Sara Kjaersgaard, ‘Hotspot Cities: Identifying Peri-Urban Conflict Zones in the World’s Biodiversity Hotspots’, *Journal of Landscape Architecture* 1 (2019), 36–47.

3 ‘Colombia declares Bahia Portete to be national nature park’, *San Diego Union Tribune*, 21 December 2014, sandiegouniontribune.com/hoy-san-diego/sdhoy-colombia-declares-bahia-portete-to-be-national-2014dec21-story.html, accessed 12 January 2021.

4 Rob McDonald et al., ‘Nature in the Urban Century: A Global Assessment of Important Areas for Safeguarding Biodiversity and Human Wellbeing’, *The Nature Conservancy* (2019).

5 Thomas Elmqvist et al., ‘Stewardship of the Biosphere in the Urban Era’, in: Thomas Elmqvist, et al. (eds), *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities* (Dordrecht, the Netherlands: Springer, 2013), 750.

6 In 1988, Norman Myers first identified ten global hotspots featuring exceptional concentration and endemism of plant species under unusual threat of destruction. According to Myers, E. O. Wilson has said the identification of hotspots was ‘the most important contribution to conservation biology of the last century’; Norman Myers and Russell A. Mittermeier, ‘Impact and Acceptance of the Hotspots Strategy: Response to Ovidia and to Brummitt and Lughadha’, *Conservation Biology* 17/5 (2003), 1449–1450. There are now thirty-six recognized hotspots. Together, these areas contain at least 50 per cent of the world’s total plant species and 42 per cent of the world’s terrestrial vertebrates as endemic. The original and unique habitat in these hotspots is at least 70 per cent depleted and is under imminent threat of total destruction due to habitat fragmentation related to urbanization, agriculture and related economic activities. Russell A. Mittermeier et al., *Hotspots Revisited: Earth’s Biologically Richest and Most Endangered Terrestrial Ecoregions* (Washington, DC: Conservation International and Cemex: 2004).

7 Weller et al., *Atlas for the End of the World*, op. cit. (note 1).

8 Weller et al., ‘Hotspot Cities’, op. cit. (note 2), 36–47. Following the format of Hotspot, City, Nation, the Hotspot Cities are: 1) Atlantic Forest: São Paulo, Brazil; 2) California Floristic Province: Los Angeles, USA; 3) Cape Floristic Region: Cape Town, South Africa; 4) Caribbean: Port-au-Prince, Haiti; 5) Caucasus: Baku, Republic of Azerbaijan; 6) Cerrado: Brasília, Brazil; 7) Chilean Winter Rainfall and Valdivian Forests: Santiago, Chile; 8) Coastal Forests of Eastern Africa: Dar es Salaam, United Republic of Tanzania; 9) Eastern Afrotropical: Nairobi, Kenya;

10 Forests of East Australia: Sydney, Australia; 11) Guinean Forests of West Africa: Lagos, Nigeria; 12) Himalaya: Rawalpindi, Pakistan; 13) Horn of Africa: Mecca, Saudi Arabia; 14) Indo-Burma: Guangzhou, China; 15) Irano-Anatolian: Esfahan, Iran; 16) Japan: Osaka, Japan; 17) Madagascar and the Indian Ocean Islands: Antananarivo, Madagascar; 18) Madrean Pine-Oak Woodlands: Ciudad de México, Mexico; 19) Maputaland-Pondoland-Albany: Durban, South Africa; 20) Mediterranean Basin: Tel Aviv, Israel; 21) Mesoamerica: Guadalajara, Mexico; 22) Mountains of Central Asia: Tashkent, Uzbekistan; 23) Mountains of Southwest China: Chengdu, China; 24) New Zealand: Auckland, New Zealand; 25) Philippines: Davao, Philippines; 26) Polynesia-Micronesia: Honolulu, USA; 27) Southwest Australia: Perth, Australia; 28) Sundaland: Jakarta, Indonesia; 29) Tropical Andes: Bogotá, Colombia; 30) Tumbes-Choco-Magdalen: Guayaquil, Ecuador; 31) Wallacea: Makassar (Ujung Padang), Indonesia; 32) Western Ghats and Sri Lanka: Mumbai, India; 33) North American Coastal Plain: Houston, USA.

9 Weller et al., ‘Hotspot Cities’, op. cit. (note 2), 36–47.

10 CEPF, ‘Tropical Andes: Threats’, [cepf.net/our-work/biodiversity-hotspots/tropical-andes](http://cepf.net/our-work/biodiversity-hotspots/tropical-andes), accessed 20 December 2018.

11 Ministry of Environment and Sustainable Development of the Republic of Colombia, *National Policy for the Integral Management of Biodiversity and Its Ecosystemic Services NPIMBES (PNGIBSE)* (Bogotá, Colombia, 2012).

12 Weller et al., *Atlas for the End of the World*, op. cit. (note 1).

13 Convention on Biological Diversity, *National Biodiversity Strategies and Action Plans (NBSAPs)*, [cbd.int/nbsap/](http://cbd.int/nbsap/), accessed 1 June 2017.

14 The reason this paper begins by citing 2030 growth projections and shifts to 2050 projections is because between the second and third phase of our research the Seto Lab at Yale updated its global urban growth projections from 2030 to 2050. Therefore, the sample set of thirty-three cities and the case study of Bogotá are based on 2050 projections. See: [urbanization.yale.edu](http://urbanization.yale.edu).

15 The World Bank, ‘Population growth (annual %) – Colombia’, [data.worldbank.org/indicator/SP.POP.GROW?end=2019&locations=CO&start=1961](http://data.worldbank.org/indicator/SP.POP.GROW?end=2019&locations=CO&start=1961), accessed 12 January 2020.

16 Juan Thomas Ordóñez and Hugo Eduardo Ramierz Arcos, ‘At the Crossroads of Uncertainty: Venezuelan Migration to Colombia’, *Journal of Latin American Geography* 18/2 (2019), 158 ff.

17 See, for example, the Medellín neighborhoods of Santa Cruz and Populare.

18 CEPF, ‘Tropical Andes’, op. cit. (note 10).

19 Ibid.

20 Ibid.

21 Ibid.

22 Secretaría Distrital de Ambiente de Bogotá, ‘Política para la Gestión de la Conservación de la Biodiversidad en el Distrito Capital’ (2010), [ambientebogota.gov.co/documents/10157/0/politica\\_biodiversidad\\_baja.pdf](http://ambientebogota.gov.co/documents/10157/0/politica_biodiversidad_baja.pdf).

23 Lucy Sherriff, ‘Why Bogotá Should Worry About Its Water’, *CityLab*, 13 June 2018, [citylab.com/environment/2018/06/why-bogota-should-worry-about-its-water/562655/](http://citylab.com/environment/2018/06/why-bogota-should-worry-about-its-water/562655/).

24 Water cannot infiltrate into the aquifers in the lowlands because a clay layer acts as a barrier to infiltration—another reason the paramos are especially important to protect.

25 Charlotte Mackenzie, ‘Recent Studies Raise Concerns about Dangerous Mercury Levels in the City’s Waterways and Call for More Effective Waste Management’, *The Bogotá Post*, 11 March 2016, [thebogotapost.com/bogota-water-mercury-rising/9829/](http://thebogotapost.com/bogota-water-mercury-rising/9829/).

26 Fundación Humedales Bogotá, a group of young activists—most of whom work as volunteers—has extensively documented Bogotá’s wetlands, including those that are recognized by government entities and those that are not. They map the city’s wetlands, write articles, teach classes and lead tours of the wetlands to raise awareness of the importance of their preservation. The group was awarded the 2015 Ramsar Convention Award to Young Wetland Advocates; Fundación Humedales Bogotá, ‘Mapa de los Humedales de Bogotá’, [humedalesbogota.com/mapa-humedales-bogota/](http://humedalesbogota.com/mapa-humedales-bogota/), accessed 11 July 2018.

27 Luis A. Guzman, Daniel Oviedo and Juan Panlo Bocrejo, ‘City profile: The Bogotá Metropolitan Area that never was’, *Cities* 60 (2017), 202.

28 There are some development opportunities to the north in and around the Van der Hammen reserve, currently at the center of a heated debate, since Mayor Enrique Peñalosa announced plans to urbanize it in 2019—an initiative vehemently denounced by environmentalists. His successor Claudia López ran on an environmental campaign that promised to protect and reforest the Van der Hammen reserve. Richard Emblin, ‘Editorial: President Duque and Bogotá’s Claudia López Share Common Ground’, *The City Paper Bogotá*, 11 February 2020, [thecitypaperbogota.com/opinion/editorial-president-duque-and-bogotas-claudia-lopez-share-common-ground/23855](http://thecitypaperbogota.com/opinion/editorial-president-duque-and-bogotas-claudia-lopez-share-common-ground/23855), accessed 11 February 2020.

29 Secretaría de Planeación de Bogotá, ‘Revisión General Plan De Ordenamiento Territorial: Diagnóstico POT Bogotá’, [sdp.gov.co/sites/default/files/201708\\_resumendiagnosticopot\\_v3.o.pdf](http://sdp.gov.co/sites/default/files/201708_resumendiagnosticopot_v3.o.pdf). Figures such as this are notoriously inaccurate (that is, low) given the fact that much of Bogotá’s urban growth is informal.

30 Congreso de la República de Colombia, ‘Cámara de Representantes aprueba creación de la Región Metropolitana de la Sabana’, 15 May 2020, [camara.gov.co/camara-de-representantes-aprueba-creacion-de-la-region-metropolitana-de-la-sabana](http://camara.gov.co/camara-de-representantes-aprueba-creacion-de-la-region-metropolitana-de-la-sabana).

31 Alexander Niño Ruiz, ‘Formal and Informal Housing Practices in Bogotá, Colombia: The experience of Metrovivienda and Juan XXIII’, Faculty of Law, Universidad de los Andes (2006), 183–206.

32 David Gouverneur, *Planning and Design for Future Informal Settlements: Shaping the Self-Constructed City* (London: Routledge, 2014).

33 The national government mandates municipalities and cities to adopt a city planning document called the Plan de Ordenamiento Territorial (POT) every twelve years. Secretaría Distrital de Planeación, ‘Plan de Ordenamiento Territorial’, [sdp.gov.co/micrositios/pot/que-es](http://sdp.gov.co/micrositios/pot/que-es), accessed 12 January 2021.

34 The students in this studio were: Yifan Cai, Yu-Te Chiang, Mariela Hernandez, Terence Hogan, Ruobing Huang, Yichao Jia, Meichun Jia, Hong Li, Xuanang Li, Zhiyu Weio and Boya Ye. After the studio the plan was further refined by Boya Ye, Xuanang Li and Yifan Cai under the supervision of the authors.

35 These activities were coordinated by local landscape architects and faculty at the Universidad de los Andes, Diego Bermúdez along with Manuél Guzman, Rafael Méndez and

Pedro Aparicio, all faculty at the School of Architecture and Design at Universidad de los Andes.

36 Andres Duany and Emily Talen (eds.), *Landscape Urbanism and its Discontents: Dissimulating the Sustainable City* (Gabriola Island, BC: New Society Publishers, 2013).

## BIOGRAPHICAL NOTE

Richard Weller is former Winthrop professor at the University of Western Australia (1994–2010) head of the Australian Urban Design Research Center (2010–2013) and is currently the Martin and Margy Meyerson Chair of Urbanism and Chair of Landscape Architecture at the Weitzman School of Design at the University of Pennsylvania.

David Gouverneur is professor of Practice in Landscape Architecture and Planning at the Weitzman School of Design, University of Pennsylvania. He was the former national director of Urban Planning for the Ministry of Urban Development of Venezuela and a recognized authority in regard to informal urbanism in the global South.

Zuzanna Drozd is a research associate to the Hotspot Cities Project at the McHarg Center for Urbanism and Ecology at the Weitzman School of Design at the University of Pennsylvania.

Boya Li is a landscape designer working at Reed Hilderbrand in Boston, USA.

## CONTACT

Richard Weller  
Department of Landscape Architecture, Stuart Weitzman School of Design  
University of Pennsylvania  
119 Meyerson Hall  
210 South 34th Street  
Philadelphia, PA 19104-6311  
USA  
Phone: +1 215 8986591  
[rjweller@design.upenn.edu](mailto:rjweller@design.upenn.edu)