

Planting Design in the Ecuadorian Andes: Memory, Resilience, and Re-Connection

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ABSTRACT

Modern cities are constantly growing and evolving. This expansion of urban development bleeds into the surrounding landscapes, causing the displacement and disturbance of native plant and animal species to remote areas where topography limits human access. As a result, metropolitan areas often become gray places with low biodiversity, elevated temperatures, poor air quality, flood issues, and lack of a local identity. Quito, Ecuador is one of the cities facing this important challenge. Perched high in the Andes, Quito is a place of great biodiversity, nevertheless the constructed landscapes are dominated by introduced species due to colonization and to the lack of availability of native species in the nursery trade. This article walks through the creation of a native nursery in Quito and the implementation of initial trial plots, a green roof, and a garden. It explains the discoveries made during the process and provides directions for future goals to reintroduce native plant species into urban environments and contemporary landscapes in order to create more sustainable cities. The goal is to help people reconnect with their natural heritage and to learn about native plants to ensure the continuity of ancestral knowledge of the natural world for future generations.

KEYWORDS

Native Plant Species;
Trial Garden;
Plant Observation;
Andes Mountains;
Ecuador

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HIGHLIGHTS

- Creation of specialized native plant nurseries in developing nations like Ecuador
- Development of trial plots for green roofs and gardens
- Phenology and spatial study on native species implemented in temperate climates
- Creation of sustainable places that are connected to their heritage and that benefit future generations

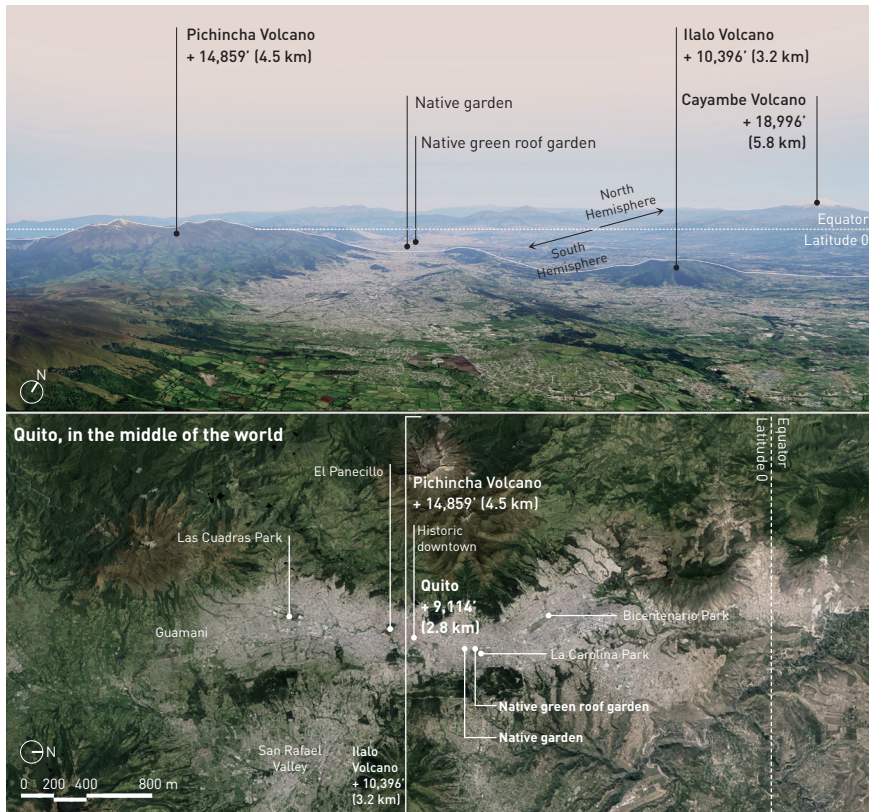
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1 Quito: A Place in the Mountains

San Francisco de Quito, the capital city of Ecuador, sits high in the Andes Mountains at an altitude of 2,800 meters, making it the second most elevated capital city in South America. Its distinctive position in a valley on the eastern slopes of the Pichincha Volcano (Fig. 1) has made Quito an advantageous settlement location for many groups throughout history, beginning with local Indigenous people including the Quitus-Caras. It later became an important

city for the Inca Empire before being conquered by Spanish conquistadors. Quito became what it is today, the capital city of a free nation, after winning independence from the Spanish crown. The valuable landscapes have made expansion inevitable and unstoppable in Quito ever since its founding in 1534—“The historical development and current spatial configuration of Quito has clearly been considerably influenced by the dominant natural features of the region”^[1]. The organic sprawl of the city resulted in a decreased natural coverage in the area. Quito’s ongoing



1. Map of Quito, located in the Andes Mountain range.

rapid expansion has led to the disturbance of natural ecosystems, displacing many native plant and animal species to bordering ravines and steep mountainsides where the complex topography has restricted human access.

2 Quito: A Hotspot for Biodiversity

Ecuador is considered one of the most biodiverse countries in the world. According to the Environmental Department of Ecuador, Quito hosts a wide range of forest, shrub, and herbaceous plant ecosystems distributed across both Andean and tropical landscapes at altitudes between 490 and 4,950 meters. This wide range of ecosystems is due in part to the highly complex topography surrounding Quito, which creates five distinct climatic floors with a high level of endemism and biodiversity. There are as many as 17 different ecosystems in the area spreading out across the high mountains, inter-Andean valleys, as well as high and middle foothills of the Andes mountain range^[2].

For centuries, Quito's unique biodiversity has given the Indigenous communities a wide range of native plants to use for food, medicine, and rituals. It has also inspired many notable

scientists to study the natural realm, including Alexander von Humboldt and other prominent botanists and illustrators from around the globe. Humboldt and Aimé Bonpland arrived in Quito in 1802 as part of their expedition to the Americas where they documented and studied more than 60,000 specimens and discovered thousands of new species^[3]. Their discoveries are explained in the book *Essay on the Geography of Plants*^[4] and their illustrations (Fig. 2)^[5]. During his time in the Andes and on numerous other expeditions, Humboldt linked the relationship between plants, climate, altitude, and geography. His insights and legacy have helped many scholars understand native ecosystems and how they change over time.

3 Environmental Challenges: Disconnections in a “Connected” World

In modern times, even when the internet has connected the world, we are quickly growing apart from nature. Quito, like many other cities, has evolved into a dull concrete jungle. The plants that once covered the city and fascinated Humboldt and other scientists two hundred years ago are now only found in remote areas, many having not been seen in over thirty years. My home is located in downtown Quito, surrounded by houses, shopping malls, and an increasing number of skyscrapers. When my grandfather purchased the land to build his dream home, the area was on the outskirts of the historic downtown area. My mother and grandmother remember a time when the house was surrounded by large areas of grasslands and beautiful forests where they could collect plants to brew tea, cook meals, or make medicinal remedies. I grew up in the same house thirty years later, but my experience was completely different—I did not have the same opportunity to



2. Illustration by Humboldt and Bonpland versus a picture of the same species found during collection trips.



© Alexander von Humboldt and Aimé Bonpland

3. Illustration by Humboldt and Bonpland [Source: Ref. [5]]

create a relationship with the plants around me. I had access to a few trees in the neighborhood, but the grasslands were barely visible, perched far up in the mountains. Knowledge of native plants seemed to escape my generation and be confined to the Indigenous communities far away in the countryside.

After finishing my undergraduate degree in Architecture, I migrated to the United States to pursue a master's degree in Landscape Architecture. It was here that my eyes opened to a new world of possibilities where plants are a fundamental part of the city. I was especially interested in learning more about native plant species and their benefits, and how to create a sustainable relationship between cities and the native ecosystems. The National Audubon Society noted that “the modern obsession with highly manicured ‘perfect’ lawns alone has created a green, monoculture carpet... the human-dominated landscape no longer supports functioning ecosystems, and the remaining isolated natural areas are not large enough to support wildlife”^[6]. It was the same issue that I experienced growing up in Quito. Despite an abundance of natural biodiversity, the constructed landscapes are dominated by foreign species of plants. I also noticed that those exotic species did not support the local biodiversity and furthermore, many of them became invasive, taking over large areas of native habitats. Sadly, we have forgotten the basic scientific theories, exposed by Humboldt and Bonpland in *Essay on the Geography of Plants*^[4], which outlined how plants and animals are linked to geography and climate (Fig. 3). The solution to this problem was clear to me and seemed so simple—go to the local nurseries and buy the native plants. Unfortunately, the reality proved more difficult as most local nurseries only offered foreign plants. This meant that even if people

understood the importance of supporting native biodiversity, they were forced to use exotic plants that require large amounts of water and heavy maintenance, and that did not support local key species of pollinators and native animals. I became determined to respond to this important issue.

4 The Landscape Revolution

Once I realized this big issue, I was determined to change it. In 2017 after working at OLIN, a landscape architecture firm in Philadelphia, I returned to Ecuador where I met Liliana Jaramillo, a young biologist who, like me, just returned home after finishing her studies in Australia which focused on the use of native species for green roofs. We both recognized the lack of native plant availability as a great problem for the city and wanted to do something about it.

We co-founded the project Nativus in 2017 in response to the limited availability of native plants in Quito. The project was awarded the United Nation's Young Champions of the Earth Award for Latin America and the Caribbean and the IMPAQTO's Urban Entrepreneurship Challenge, giving the team funding and mentorship to develop the initial research, build the nursery, and start testing plots in green roof prototypes in Quito. The project also had the mentorship and help from Carlos Ruales, professor at Universidad San Francisco de Quito whose life work is to study historical data from herbarium collections prepared by Humboldt and Bonpland in 1802 with the goal of reintroducing them to the urban landscapes.

For the research, over 80 initial species from the Humboldt and Bonpland's collections were considered because of their patrimonial value to the city's inhabitants. The team was able to collect several species documented in their journals and propagate them for their use in landscape projects (Fig. 4).

The main goal of the research and Nativus was to reintroduce Quito's native plants by identifying species that could thrive in the urban environment and utilizing them in local landscape projects. A set of additional objectives were developed to help guide the study.

- 1) Identify native species that could be suitable for green roof and garden applications.
- 2) Collect and propagate suitable native species through cutting or seeding.
- 3) Implement the native species into two different landscape elements: gardens and green roofs.
- 4) Study the effects of the native species installations including biological phenomena, plant response, aesthetic qualities, and associated wildlife engagement.



Senna multiglandulosa



Brugmansia sanguinea



lochroma cyaneum



Cavendishia bracteata



Rubus glaucus



Lantana rugulosa



Fuchsia boliviana



Chusquea scandens



Dalea coerulea



Dodonaea viscosa



Salvia humboldtiana



Salvia macrophylla



Lycianthes lycioides



Furcraea andina



Salvia quitensis



Solanum nigrescens

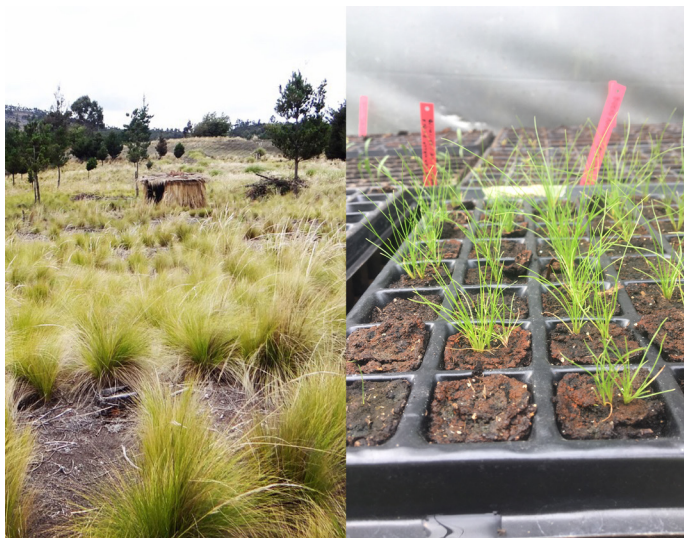
4 © Gabriela Arévalo Alvear

And 5) community engagement through education about the important value of native species.

4.1 The First Native Green Roof Garden

After the initial plant selection, the chosen species were then collected over many months during field trips to the isolated

natural areas surrounding several volcanoes on the outskirts of the city (Fig. 5). The collection of specimens was propagated until enough native plants were available to assemble the garden. The first native garden was installed in July 2018 on the intensive green roof of an 18-story building in downtown Quito (Fig. 6). The design intention was to allow people to walk through the small garden and



5 © Gabriela Arévalo Alvear



6 © Nativus

4. Examples of the initial selected species for the research
5. Collection site for grass and propagation seedlings after a few weeks of germination
6. The first green roof of native plants



7. Green roof garden documentation after installation
8. Biodiversity documented in the green roof garden

touch the native plants. From the corner of the roof terrace, there was a spectacular view of the Pichincha volcano where some of the plant species were collected, making it a focal point for storytelling. Signage with illustrations was added to give information about the selected plant species including their ancestral uses, origin, and geographical distribution.

The garden was studied after installation to understand how each of the native plant species performs (Fig. 7). Eight of the twelve species, mainly grasses, were extremely successful and thrived despite the summer heat, cold winter, and strong winds. Four species grew smaller, slower, or struggled to bloom. Visitors have documented the wildlife that came to interact with the native plant species on the green roof. The garden has attracted many diverse types of birds and pollinators (Fig. 8).

4.2 Reconnection to My Roots: My Personal Home Garden

The second native garden was installed in the backyard of my family's home in downtown Quito in 2018 (Fig. 9). The design for this garden aimed to break down the paved surfaces on the patio and replace them with a rich biodiverse ecosystem. By creating this garden, I hoped to gain a better understanding of how to maintain and care for the natural landscape on a daily basis. In addition, it allowed me to observe firsthand the birds and insects that the native plants attract.

We installed ten different native species of plants using a new organic soil mixed with some existing sub-base soil. Most of the native species thrived from the very beginning and required medium to moderate watering during the first few months after installation. Most of the plants established themselves and grew steadily at their own rates during the first year. Three of the ten species did not succeed and were overpowered by the other species (Fig. 10). In the years to follow, the garden became a hotspot for all types of birds and insects including bumblebees, ladybugs, and hummingbirds. Over time, I witnessed the small garden become an entire living ecosystem. The garden continues to thrive today, and we use the space as a place to reconnect, observe, and meditate (Fig. 11).

5 Next Steps

As native planting becomes more readily available thanks to specialized nurseries like Nativus, there will be a need to perform more in-depth studies to ensure that native species thrive in contemporary landscapes. It will be important to characterize spatial qualities, maintenance schedules, watering regimens, soil



9. Home native garden



- 10. Home native garden documentation after installation
- 11. Home native garden flowering through the years
- 12. Selected species for future study plots

recommendations, and other critical aspects of native plants to help them survive in urban environments. By promoting this knowledge, we can help local designers, landscape architects, and community members better understand the benefits of native plants and to reconnect with their natural heritage. My next step in continuing this goal is to create a third trial garden on the outskirts of Quito in partnership with biologists, gardeners, and community members. Ten native species will be planted in different ground conditions and with different watering regimens in order to document their development (Fig. 12).

By promoting the use of native plants, my hope is to help Quito become more sustainable, further connected to its roots, and better prepared to benefit future generations. As Ruales once explained, “the new landscapes to be developed in Quito must consider, in



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addition to the intrinsic value of plant species and the urgency of their conservation, the historical, cultural, and appropriation value of what is ours; the species *quitensis*, *pichinchensis*, *lloensis*, *hallii* must take the place of Australian acacias, brushes, and eucalyptus, Chinese and Japanese medlars, Ash trees, and the large number of exotic species that have taken over the spaces and visual aesthetics in Quito's parks, sidewalks, and gardens"^[7]. It is essential that the landscape architecture profession expands in places like Ecuador, where much research is needed, to create sustainable landscapes with strong identities that are connected to the past and hopeful for the future.

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厄瓜多尔境内安第斯山脉上的种植设计： 回忆、韧性与再连接

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摘要

现代城市在不断增长和演变，其发展扩张逐渐侵入周围环境，致使本土动植物物种向免受人类干扰的偏远地区迁徙。这就导致大都会往往会成为生物多样性低、热岛效应显著、空气质量差、洪水频发及地域特色缺失的灰色地带。

厄瓜多尔基多市也面临同样的挑战。基多地处安第斯山脉的高海拔处，有着丰富的生物多样性。但长期以来外来物种的引进及苗木贸易中乡土植物的不足，使得城市景观多采用外来物种。

因此，为加深当地年轻一代对乡土植物及社区和文化的了解，笔者与一位生物学家合作，发起了Nativus项目，以期在基多建造乡土植物培育园。培育园的建造步骤包括：1) 确定适宜在绿色屋顶和花园中种植的乡土物种；2) 寻找合适的乡土植物，并利用扦插、播种等方式进行培育；3) 在绿色屋顶和花园中种植上述乡土植物幼苗；4) 研究乡土植物的种植对周围生物和环境的影响，包括是否产生了新的生物现象、对其他动植物的影响，以及整体环境的美学价值是否提高；5) 通过宣传教育，推动全社区居民积极参与种植和观察乡土植物，提升对乡土植物重要性的认识。

依据上述步骤，项目团队已在基多建造了两处乡土花园，居民们可以在花园中穿行，近距离观察乡土植物。同时，访客还可以记录花园中被乡土植物吸引而来的各种鸟类和传粉昆虫，获取珍贵的一手资料。一段时间之后，这些富有生命力的小花园将逐渐形成完整的生态系统，除了用于植物观察与学习，亦可作为人们与自然重新连接或冥想的场所。

这种乡土花园能够推动建设更加可持续的城市，有助于将乡土植物物种重新引入城市环境和当代景观，也可帮助人们重新认识周围的自然环境、乡土植物，并将不断积累的对自然世界认知持续传承下去。

文章亮点

- 在厄瓜多尔等发展中国家建立专门的乡土植物苗圃
- 开发绿色屋顶和花园作为乡土植物试验场地
- 探究温带气候条件下乡土物种的季节变化和空间生长情况
- 营建能够连接场地历史并造福子孙后代的可持续场所

关键词

乡土植物物种；
试验园；
植物观察；
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厄瓜多尔

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