

Rainforest, Airport, Park: Navigating extractive entanglements  
through the synthesis of infrastructure and ecological function in Iquitos, Peru

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**Abstract**

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Chair of Supervisory Committee: Julie Parrett

Urban landscapes have become characterized by static, impervious systems, disconnected from nature. In Iquitos, a city of half-a-million in the Peruvian Amazon, attempts to replace natural systems with engineered infrastructure have yielded unhealthy conditions for both the human residents and the surrounding ecology. As Peru unrolls a national initiative to build commemorative Bicentennial parks, we envision this as an opportunity to revive an economy that

has suffered from boom and bust cycles of extractive industries. This thesis explores the relationship between conventional city infrastructure and natural systems in the Amazon region across spatial and time scales to answer the question; how can urban parks serve as critical infrastructure to support the local economy, address human and ecological health, and celebrate cultural identities?

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*The University of Washington's College of Built Environments* has been my home for the past three years. I thank the faculty for teaching, supporting, and inspiring me daily.

Our advisor *Julie Parrett's* insights as a designer inspired us to push our thinking and our drawings to do more. She has been our support system through this process, and I felt

continuously lucky to have her on our team.

*Leann Andrews*, our advisor during this thesis and while studying in Iquitos, has been a constant inspiration. Her insights about design and about being a designer have been greatly influential to me.

Without *Coco Alarcón's* belief that our project was worthwhile and encouragement to pursue funding to return to Iquitos are why this project happened. I am continually grateful for his mentorship.

*Rebecca Bachman*, who shaped this project during our research in Iquitos in Summer 2019.

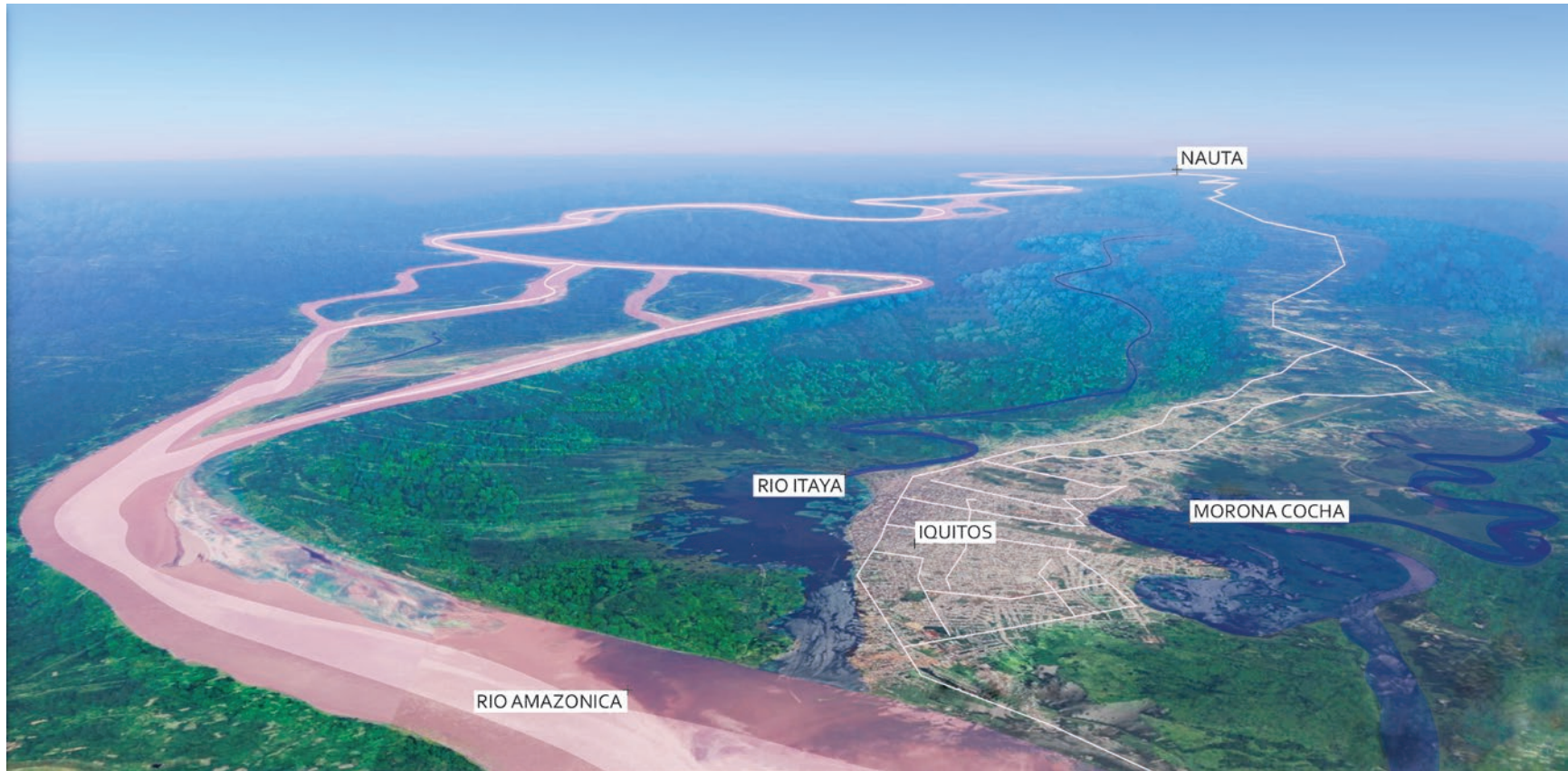
Our work is a direct result of the generosity of the following, who shared their work with us. Much of what we know about design, green space, and infrastructure in Iquitos, we know because of them. Thank you to: *Gabriela Vildolsola*, Dean of the Colegio de Arquitectos, *Jorge Tapullima*, the Dean of Architecture and Urbanism at the Universidad Científica del

Perú, botanist *Juan Ruiz* of the Herbarium Amazonense, Cesar Augusto Delgado Vasquez, researcher of biological diversity at the Instituto de Investigaciones de la Amazonia Peruana, *Eduardo Guinet*, architect at the Ministerio de Vivienda, Construcción y Saneamiento, and *Victor Ho*, architect for the Municipalidad de Maynas.

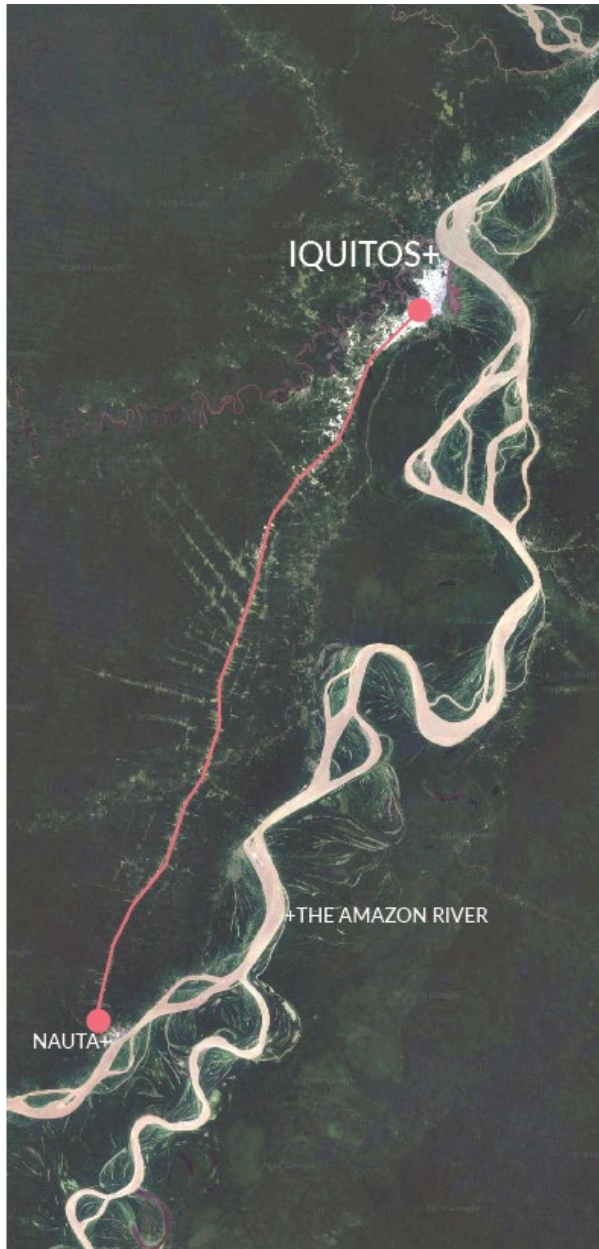
*Kasia Keely*, who offered her time and valuable feedback to us during multiple reviews, including virtual reviews during the pandemic.

My cohort, a group of wonderful people who I have been lucky to learn from and alongside of.

And to my family, whose support means everything to me.



*Graphic by Hope Freije. A bird's eye view of Iquitos, the largest city in the world that cannot be accessed by road.*



# CHAPTER 01:

## INTRODUCTION

In writing and speaking about Iquitos, Peru, many choose to first reveal the city's "fun fact:" Iquitos is the largest city in the world that cannot be accessed by car—only by boat or plane. After hearing this characterization dozens of times, the repetitiveness starts to sound cliché or essentializing. Yet after spending the past two years researching this Amazonian city, I have come to appreciate how much this description encapsulates the urban condition of Iquitos, a city that was built in relative isolation from the rest of the country, yet tethered to its neighbors along the natural highway that is the Amazon River. After both summers I spent in Iquitos, I would grapple with how to describe it—with over half a million people, it is more populated than New Orleans but smaller than Portland; home to several universities and research centers, but lacks a working

sewage system; and despite the deep, local connection to and knowledge of the Amazon Basin and its biodiversity, the pattern of disconnecting from ecological systems in order to build cities has taken place here. In short, Iquitos does not fit easily into the descriptions we use to define how “developed” a city is.

The context of Iquitos is largely defined by its status as an island, surrounded by the Amazon River and its tributaries. On a map it appears as a stark contrast to its surroundings, a swath of gridded gray against dense green and winding brown. In reading about infrastructure, much of the literature notes the struggle to connect Iquitos to the coast where most of Peru’s population and commerce is concentrated. Routes from other Amazonian cities to the coast were eventually paved, forming economic pathways that Iquitos still lacks. The furthest you can travel by road from Iquitos is 60 miles south to Nauta, on a road completed in 2005 and built not to connect Iquitos outward but to provide Nauta with access to Iquitos’ international airport (see image on page 8). Inside the city, traffic is

dominated by motorcycles, a testament to the challenge of importing cars along river routes.

The isolated condition of Iquitos makes its history of extractive industries that much more compelling. Which plants were so alluring that they drew people into the Amazon, willing to traverse the Andes Mountains through a dense Amazonian thicket? Which resources were so lucrative that one would embark on an arduous river journey from the east in order to access them? The dense mass of green bursting with botanic diversity has beckoned to global demand while also forming a barrier to those wishing to capitalize on it. When I began reading about infrastructure in the Amazon, the connections between Iquitos’ geography emerged, thick like the jungle itself. The work of Anna Tsing in *The Mushroom at the End of the World* was influential to the way I began to put these pieces together and the way I have wanted to tell this story. Her concept of entanglements shows us how to follow “connections snaking in and out of nations, regions, and local landscapes” (Tsing, 2015) rather than searching for a

single, overarching framework through which to define them. These entanglements arise “from common histories—but also from unexpected convergences and moments of uncanny coordination” (Tsing, 2015). Using this lens, I have aimed to understand Iquitos at the confluence of space and time, in the context of the borders drawn around it, the watershed that feeds it, and the forces of power and ideas of progress that have intervened in it.

The first goal of this thesis, then, is to tell a story of Iquitos’ entanglements between infrastructure and extractive industries, a history rooted in geography, where its position near the equator and at the mouth of the world’s most voluminous river (Roach, 2008) has made it a target of both resource extraction and conservation by outside entities, and where its thick jungle surroundings have dissuaded colonizers and national presence alike. Through this lens, infrastructure is both a tool for accessing resources and the structure that emerges in the wake of prosperous booms; a symbol of state investment and economic opportunity, as well as

the antithesis to conservation. The understanding of infrastructure and extractive industries in Iquitos facilitates a deep analysis of site, highlighting the struggle to infuse the surrounding biodiversity into the city fabric while seeking connections to outside economic markets. Further, we develop an understanding of the City’s goal for moving forward with nonextractive industries, as both a means of sustainable city growth and of nourishing the human population.

### *How has botanical extraction from the Amazonian landscape shaped its urbanization?*

The second goal of this paper is to offer a vision for a park design that could serve as a piece of poly-functional infrastructure for Iquitos, as part of Peru’s bicentennial park initiative. First, we analyze the present conditions of infrastructure in Iquitos, focusing on the impacts to human health. Next we offer a layered park design, where sustainable commercial opportunities add diversity to an extraction-dominated economy, and vibrant social spaces

are woven into a culturally meaningful park that prioritizes human and ecological health. Referencing the City's published plans for growth as well as our study of entanglements between infrastructure and extraction, we ask:

*How can landscape act as infrastructure in the Amazonian context moving forward?*

## Project Background + Collaborations

This thesis documents and expands upon a group capstone project done in partnership with Rhiannon Neuville, a fellow graduate student in the University of Washington's landscape architecture program, with whom I have been conducting research in and about Iquitos for the past two years. As we explored how this project would expand upon our on-the-ground research in Iquitos, we first gave ourselves space to pursue our interests through literature review—Rhiannon focused on the development of sewage systems in cities along the Amazon River, the use of medicinal plants in Iquitos, and the meanings of parks over

time, while I focused on roads, extractive industries, and floodplain agriculture. We both did extensive research on the history of the rubber industry in Iquitos.

The methods, design, and narrative arch of our project were developed in close collaboration. Throughout the first half of the project (the pre-design phase), we would often come together and share our findings, weaving a dynamic narrative as our readings took us on twists and turns through the Amazon. During the design phase, we divided tasks but came together weekly to provide feedback and critique. Thus, while some graphics were done independently, they all reflect close collaboration. My decision to submit a written thesis (which is not a requirement for group capstone projects in our department) reflects my interest in delving into the literature on infrastructure and extraction, as well as an interest in future academic endeavors. Like our graphics, the additional research I did in order to write this thesis was influenced and supported by conversation and collaboration with Rhiannon.

## Iquitos Travel + Research

Rhiannon and I first visited Iquitos as part of a study abroad program that focused on the connections between the built environment with human and ecological health in the urban, peri-urban, and rural areas of the Peruvian Amazon. Led by Coco Alarcón, a landscape architect and researcher from Lima, we spent a month exploring locations along this urban spectrum while absorbing information from local biologists, urban planners, architects, and medical professionals. We left with questions, and along with fellow Master's candidate Rebecca Bachman, returned to Iquitos the next summer, through funding from the University of Washington's Global Health Department and Traction, the design nonprofit founded by Leann Andrews and Coco Alarcón. Through the lens of our studies from the previous summer, we designed a research project to explore strategies for addressing human and ecological health concerns in Iquitos through interventions in the built environment. Our team conducted a series of interviews, which helped us to define our scope and build upon work that was already

underway in Iquitos.

Through these interviews and by reading local theses and reports (*Plan de desarrollo urbano sostenible de Iquitos 2011- 2021*.2010; Darbin Villacorta Rocha, 2015; Aldo Silva López, 2016) we gathered information about of the City's goals, challenges, concerns, and achievements in the urban landscape. This data informed the field work portion of our study, which included a fourteen-day walking survey of streetscape infrastructure within the District of Iquitos, during which we became familiar with the uses of plazas, streets, and other public spaces of the city. Many people we spoke to—in the context of interviews as well as in casual conversations during our walking survey—have visions for a greener Iquitos. Whether it was a desire for a revived urban canopy, the use of native plants, or a reduction in misplaced trash, they exhibited both a deep connection to the Amazonian landscape and a critique of how their city was hosting it. The perspectives and resources shared by these collaborators were invaluable to our understanding of Iquitos and its plans for urban growth.

*Interviewees:*

- **Gabriela Vildolsola** - Dean of the Colegio de Arquitectos
- **Jorge Tapullima** - Dean of Architecture and Urbanism at the Universidad Científica del Perú (UCP)
- **Juan Ruiz** - botanist of the Herbarium Amazonense
- **Cesar Augusto Delgado Vasquez** - researcher of biological diversity at the Instituto de Investigaciones de la Amazonia Peruana (IIAP)
- **Eduardo Guinet** - Architect at the Ministerio de Vivienda, Construcción y Saneamiento
- **Victor Ho** - Architect for the Municipalidad de Maynas

## The Bicentennial Park

As Rhiannon and I began to outline our thesis project, we learned of an opportunity to become involved in an international design competition that was planned for Iquitos' forthcoming Bicentennial Park, as part of a national initiative to celebrate Peru's 200th year of independence from Spain. Coco Alarcón was involved with the team that

was coordinating the design competition, which includes architect Gabriela Vildolsola. He expressed a potential for our research to inform the competition brief, lending a landscape architecture framework to help guide the design proposals. A few months into our thesis work, Vildolsola informed us that they had postponed the design competition, which shifted our project to a primarily academic endeavor. While Rhiannon and I had hoped to directly collaborate with those we had interviewed in Iquitos, this shift gave us space to explore ideas more freely, knowing that our work would not directly influence the design of Iquitos' Bicentennial Park. Rather than developing guidelines for a design competition, we would offer our own bold yet relevant vision for the park. As we shifted into the design phase of the project, there were several guiding theories to our approach.

# THEORY + FRAMEWORK

## Design for human and ecological health

The approach to the design portion of this thesis is rooted in the theory that human health is inextricably linked to the health of plant, animal, microscopic and other species, especially those cohabitating the same ecosystem. Those in the field of Global Health recognize this concept as One Health theory, which asserts that the key to addressing today's most threatening "zoonotic and veterinary diseases" is understanding the relationship between humans, non-human species, and the environment, where maintaining vital ecosystem services such as climate regulation, the cleaning of water, and nutrient cycling affects all organisms. (Andrews, 2018). Cities have become the stage on which we witness what happens when these ecosystem services break down. High amounts of pavement, low amounts of greenery and biodiversity, the elimination of most animals from the urban fabric, and many other characteristics of urbanization have yielded unhealthy ecological conditions,

which affect the health of human inhabitants. The built environment is thus a social determinant of health, which presents opportunities to address health through better design (Alarcón, Alarcón, & Andrews, 2018).

## Urban ecological design

Whereas the field of conservation has focused on the protection of land from urbanization and development, landscape architects work within the urban fabric to improve conditions for human and nonhuman constituents. Urban ecological design unites ecological theory with sustainable urban design approaches to enhance co-benefits to humans, species and ecosystems (Rottle & Yocom, 2011). This is the basis for the University of Washington Landscape Architecture program.

The deleterious effects of urbanization are exacerbated by social inequalities, where those with fewer resources are at greater risk from the pollution, poor water quality, and other factors associated with environmental degradation. To prioritize and value human health in our design, we

must consider these other intertwined systems, such as the sociopolitical structures that dictate the way wealth is created and shared among its constituents. If we are thinking about a waterbody that is polluted, we cannot simply measure the pollutants and the effects they have on human health without considering the structures that dictate who profits off of the polluting industry and who is left living among its wastestreams. Our framework thus aims to improve conditions for humans, recognizing that economic, environmental, and social conditions all factor into human health and wellness.

Landscape architecture is not practiced in Peru. Public spaces in Iquitos are designed by architects, practitioners who uses similar tools but distinct frameworks. Given that many of the challenges that Iquitos is facing are tied to their built environment and the ecological systems they are connected to, there is an opportunity to apply urban ecological design thinking to the built environment and to harness this potential to leverage public space to create benefits for humans and nonhumans alike.

## Infrastructure and Entanglements

Infrastructure is meaningful. I did not set out to write a thesis rooted in anthropological research, but found that the work of modern anthropologists has played a key role in dissecting the meaning of the complex topic of infrastructure. One of the most influential texts I read was written by anthropologists Penny Harvey and Hannah Knox, whose ethnographic research on roads in Peru offers a lens through which to investigate “how a mundane material structure [could register] histories and expectations of state presence and state neglect” (Knox & Harvey, 2015). They write specifically about the construction of the road that links Iquitos to Nauta, a process that took over 30 years, and was fraught with corruption and complications and describe how “scholars increasingly view infrastructures as sociotechnical assemblages through which it is possible to tease out the arrangements of people and things and ideas and materials that make up larger technological systems” (Knox & Harvey, 2015).

This concept of assemblages is key in *The Mushroom at the End of the World*, in which anthropologist Anna Tsing examines trade, social networks, and capitalism through the story of the matsutake mushroom, which spans borders, political systems and ecologies. She explains assemblages as collisions between human and nonhuman entities that “allow us to ask about communal effects without assuming them,” and uses the concept to emphasize the unique context that led to each piece of her story. The text shows that comparing across contexts requires a commitment to acknowledging the complexity of the involved systems. This framework is useful for unraveling the Amazon, whose shared geologic feature weaves together cities that each possess unique colonization histories, political contexts, tribal networks, and microclimates. Rather than searching for a distinct linkage between them—comparing road networks and city development or plotting a city’s journey along some axis of progress—her work encourages a more thoughtful examination of “encounter-based collaborations.” In this project, that meant that infrastructure and extraction

become events in time where human and nonhuman entities converged. Each road, project, or commodity carries its own unique entanglements,

Harvey’s chapter in *The Promise of Infrastructure* envisions infrastructure similarly as “an event in time.” The compilation’s title encapsulates the ways in which infrastructure impacts economies, ecologies, and social spheres—a phenomenon that Harvey elaborates on:

*The promise of the road and the promise of some recognition and concern from the state are entangled in this story, raising the question of what exactly infrastructural connectivity is expected to deliver[...] There is an important difference between the delivery of the project—a specified, material connection between nodes[...]and a general and underspecified notion of enhanced connectivity to a more productive and secure life world, the “modern” world of the future positive.”*  
(Anand et al., 2018, p 90)

In *Nature, Infrastructure, and the State: Rethinking Development in Latin America*, anthropologists Gregg Hetherington and Jeremy M. Campbell also communicate the promise of infrastructure, refuting descriptions of infrastructure as “background,” noting that this invisibility of

infrastructure is true only in contexts where functioning infrastructure is a given.

*“Public building projects have offered spectacular proof of the presence of state, colonial powers, or multinational lenders. Infrastructure projects such as giant dams, highways, and canals, all of which were key to mid-20th century strategies of economic development, were hardly recognized as ‘invisible’ by those who were touched by them. Part of what was at stake here was all about visibility, about establishing the hand of human intervention in areas that were considered too ‘natural’ and therefore development failures”*  
(Hetherington & Campbell, 2014, p192).

These descriptions were crucial in framing an understanding of Iquitos, a city defined by its lack of roads and challenged by a nonfunctioning sewage system, ever moving landfill, and fringe communities that are disconnected from the things that pipes and wires bring. While an urban ecological design framework points us towards opportunities to act in the built environment, the theory of assemblages and entanglements encourages us to examine the meanings that infrastructure has held at different moments in time and space. We begin to see infrastructure as the material result of multiple entities

colliding in a given moment—a foreign country’s need for a rubber producing tree results in a new airport, a state’s desire to connect across mountains to transport oil yields pipes, two governments agree to build a roadway that connects across borders—and the disconnect between the powers that dictate the creation of public works, the meanings they hold to people at a local level, and the multiple futures that can result from a “project to transform the material conditions of people’s lives” (Anand et al., 2018). This informs our design response to the challenges Iquitos faces, for we understand that the response must navigate the entanglements of the present while being resilient to their uncertain futures.

The cycles of boom and bust in Iquitos are the rhythms of expansion or abandonment of infrastructure projects, lending context to the stop and start projects like the construction of the Iquitos-Nauta road. Where an influx in income from extractive industry is sporadic and the effects of an infrastructure project unpredictable, the need for resiliency is clear. Iquitos will likely become connected by road, potentially bringing in more people, cars, and

commerce, but this future will depend on the context created by the human and nonhuman actors at the moment the pavement is laid. Ideally, the City will complete projects such as the abandoned sewage treatment plant, but the question remains as to who will have access to its services. The design of the Bicentennial Park thus needs to engage with a dynamic future and provide a resiliency that has been lacking in the infrastructural systems thus far.

## Feminist Design

The field of landscape architecture has been and continues to be an arbiter of whiteness, molding cities according to the values of its practitioners, mainly white people (Data USA, 2020). While we are increasingly seeing the role of the designer as one who carries out the goals and values of the community, rather than their own, we must also acknowledge that shaping space is a position of power. Part of the work of preparing for this thesis was studying feminist methodologies, asking who would benefit from my research, and how to challenge the power structure

between researcher and subject (Hesse-Biber 2012). This is important even for design and research projects in one's own community, but those who mold or envision space across borders, in places with histories of colonization, have a higher responsibility to understand their positionality. Scholars who call for decolonizing methods urge researchers to examine their assumptions that their research will benefit mankind or serve an "emancipatory goal for an oppressed community" (Smith 1999).

At the same time, design as a methodology has the potential to lend itself to feminist inquiry. With an inherently non-positivistic framework, it quietly interrogates empirical methods through its collection and expression both of knowledges considered objective as well as those historically written off as biased or emotional (Hesse-Biber 2012). According to Hesse-Biber's *Feminist Approaches to Research as a Process: Reconceptualizing Epistemology, Methodology, and Method*, "Positivism is a traditional research paradigm based on the 'scientific method,' a form of knowledge building in which 'there is

only one logic of science, to which any intellectual activity aspiring to the title of 'science' should follow." Unlike methodologies that maintain the illusion of unbiased research, design has permission to be overtly subjective. Through design research, we can draw on both qualitative and quantitative means to understand site; we can use drawings to offer design visions and solicit feedback in a way that is more accessible than academic writing tends to be. Through built work we can iterate and measure success and work towards designs that achieve the desired ends, rather than claiming to know the answer forthright.

## METHODS + METHODOLOGY

### Geography + Mapping

Landscape architects draw maps to understand the neighborhoods and regions they work in, as well as to communicate the opportunities and challenges they identify within their site. Increasingly, as James Corner notes in "Agency of Mapping: Speculation, Critique and Invention" (Cosgrove, 1999), young landscape architects are

now also valuing the process of mapping as a method through which to reveal relationships and inspire insights. It stops being a simple inventory and instead becomes a tool for analyzing data and making arguments. We are embracing the subjectivity of the map.

Mapping was an important part of the process of analyzing roads in Peru and the Amazon. While there are maps showing all roads and of major highways, I endeavored to do a temporal mapping of highways in the Peruvian and Brazilian Amazon as well as roads that were written about as important connections. This yielded an understanding of the pace at which certain connections were made between Amazonian cities in Brazil and Peru. Though these maps did not all make it into our final presentation graphics, they were an exercise in understanding the patterns of development across spatial and time scales, as well as a method for visualizing the geography of Iquitos.

In addition to creating maps as a way to understand information, much of the literature on the Peruvian

Amazon has been carried by geographers or published in geographic journals. These were fitting sources for an exploration of trade and urbanization along the Amazon River. As Bélanger (2009) notes, landscape architecture has grown to encapsulate aspects of geography, and these sources and methods were indeed key in this analysis.

## Informed Site Analysis

Rhiannon and I performed a collaborative, blended ethnographic and informed design thinking approach to our site analysis methodology. We lived in Iquitos for a total of 3 months, experiencing the city through food, events, and daily tasks, as well as the following:

- Took a one-month course where we experienced the deep jungle, peri-urban areas, and the city.
- Performed a walking survey over two weeks of full days, measuring and inspecting public space infrastructure.
- Engaged in informal conversations with residents during two-week walking survey, where questions about our project often sparked conversations about green space

in Iquitos.

- Participated in a run for charity and regularly attended a local gym, which acquainted us with the desire and need for recreational opportunities in Iquitos.
- Conducted eight formal interviews with professional architects, biologists, planners, and botanists.
- Engaged in informal conversations with biologists, tour guides, academic instructors and indigenous locals during month-long study abroad course.
- Attended an architecture conference—Congreso Nacional de Arquitectos XVI—which brought together designers from Peru, Colombia, Brazil, and Spain, among other areas.
- Set up a one-day questionnaire in the street, asking residents pointed questions about their vision of the city.

## Design Process

The design process responded to both the on-the-ground research and our literature reviews. Rhiannon and I performed the following in order to reach our final design:

- **Evidence-based design:** referencing the work of Andrews (2018) and Alarcón (2016), we used evidence-based studies to inform our goals for improving human health, such as the reduction of standing water as a means of curbing mosquito populations.
- **Material + Meaning:** our exploration of infrastructure and extraction informed our perception of the site's meanings as a relic of the rubber industry and as a floodplain that represents a core lifeway of the Amazonian peoples. Our on-the-ground observation in Iquitos and our study of extraction both informed our proposed materials for the Bicentennial Park.
- **Iteration + Form:** Our iterative process was guided by our advisor Julie Parrett, whose work on large park design guided our thinking on form, program, and meaning, as well as Leann Andrew and Coco Alarcón, whose experience designing in Iquitos lent critical realism to our ideas. Our informed site analysis led us to the need for a park form that carries the colonial forms that have become part of the modern design language in Iquitos, while also reflecting indigenous values.

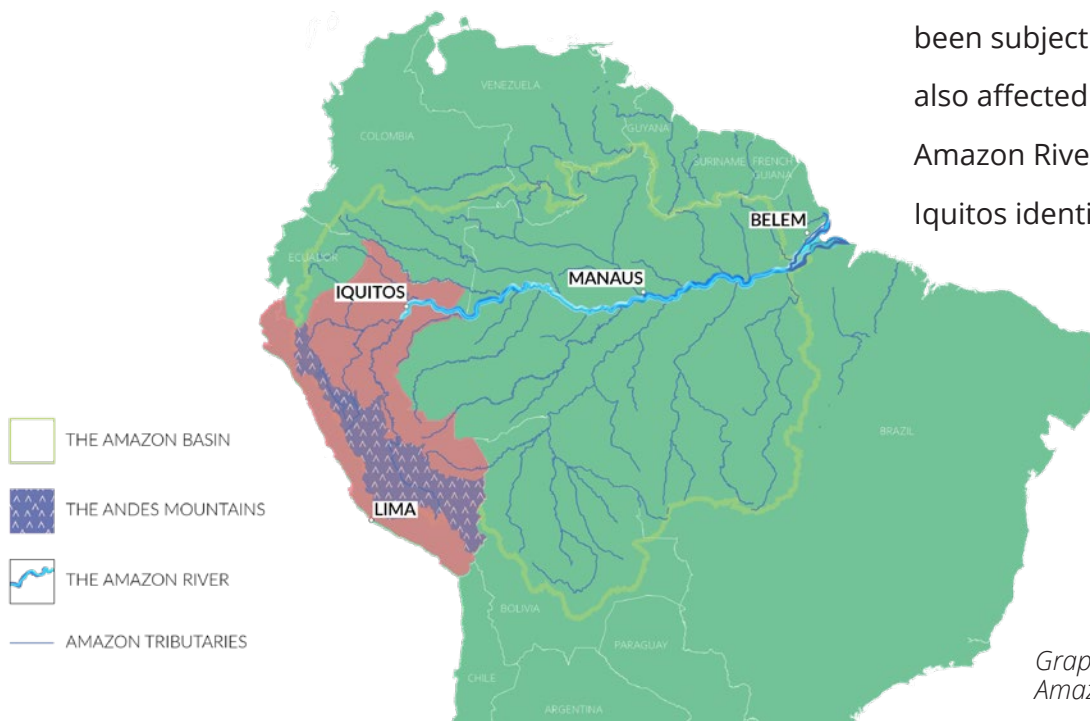
- **Layered Approach:** envisioning the park as a piece of infrastructure, we approached each space within the park, including those we did not render, as opportunities to promote health, industry, and culture within an ecological framework.



*Photo by Rhiannon Neville. Asking the residents of Iquitos, "How do you envision your streetscape?"*

# CHAPTER 01

## THE ENTANGLED GEOGRAPHY OF IQUITOS, PERU



Iquitos exists within two spheres. According to national borders it is part of Peru, occupying the 'selva' or jungle, one of the country's three distinct geographic regions, along with the desert coast and the Andes mountains. Geographically it is also part of the Amazon Basin, which encompasses areas of Brazil, Colombia, Bolivia, Ecuador, Venezuela, Suriname, and Guyana. The Amazon River acts as a highway, spurring trade and other exchanges between the cities along its course. As part of Peru, Iquitos has been subject to its national policies and initiatives, yet it is also affected by Brazil's governance over its portion of the Amazon River. From an outsider's perspective, people in Iquitos identify with both regions, cheering loudly for the nation's football team while also identifying as Amazonians and holding a strong connection to the river and river lifeways.

Iquitos is a remote place within both of these regions—the Andes Mountains

*Graphic by Hope Freije. Iquitos as part of the Amazon Basin as well as part of Peru.*

separate it from Lima and other cities on the coast (see map on page 22), and it sits at the end of a vast network of jungle rivers spanning some 4300 km from the Atlantic Ocean (Denevan & Coomes, 1992). Beyond being geographically remote, the Amazon's harsh climate and dense vegetation make venturing in a difficult undertaking, which did its part to discourage migration and colonization into the region initially. Yet the lush jungle, bursting with globally renowned biodiversity, was also what eventually drove outside interest into the Amazon, with people eager to profit and benefit from the medicines, poisons, flavors, and raw materials it hosts.

The separation of the Peruvian jungle from the Andes and desert zones of Peru can be seen clearly in their differing histories of Spanish colonization. After the Spanish carried out their brutal conquest of the Incan Empire, they founded their first city near modern day Cuzco in 1532. A year later they moved towards the coast to found the capital city of Lima; it was not until ten years later that the Spanish would venture into the Amazon in search of cinnamon trees and

gold. Colonization of the present day Peruvian Amazon was slow, and initial attempts during the 16th and 17th century were unsuccessful. So as the rule of the Spanish began to transform the coast and the Andes regions, the Amazon remained outside of this influence, shielded by the thick jungle and a belief that there was nothing valuable enough there to warrant the high cost of transporting it out (Chibnik, 1994).

Spain and Portugal did eventually turn their attention to the Amazon and began competing for control over its territories during the 1600s. The early Spaniards to reach the area reported a continuous band of settlement along the Amazon River, many of whom practiced floodplain agriculture on its shores—one source reports 56 tribes contacted by the Spanish in one area of the Peruvian Amazon (Chibnik, 1994).

As part of their campaign for control, Spain encouraged the Catholic church to establish missions along the river. Jesuits and Franciscans set up missions around 1635, and by 1760,

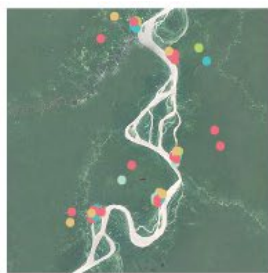
Jesuit missionaries controlled more than 12,000 indigenous people in 34 communities (Chibnik, 1994). Between 1540 and 1700, floodplain population dropped dramatically. Instead of continuous settlement along the river, mission communities were separated by many kilometers and hosted dense populations of peoples of different tribes. This created the perfect conditions for the spread of European diseases, and many died or left the floodplain areas to escape this disease, the presence of missionaries, and the threat of enslavement (Chibnik, 1994). The diagram below shows the changes to settlement patterns that occurred along the river as the Spanish arrived and left. The church monopolized trade in the Peruvian Amazon

during its occupation, (Langer et al., 2010), and thus their expulsion in the late 18th century reunited traders with access to exporting products such as sarsaparilla, “panama” hats, salt fish, wax, balsam, copal, turtle fat and eggs, hammocks, tobacco, and quinine (Chibnik, 1994; Langer et al., 2010) to their Brazilian neighbors down the river. One can imagine that with the Amazon River acting as the region’s highway system, trade across the Andes mountains would have been rare or practically nonexistent.

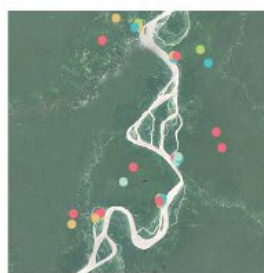
Peru’s declaration of Independence from Spain in 1824 drew borders around the jungle, mountains, and coast, but did not inspire equal state presence throughout the three



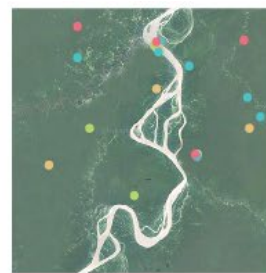
Pre 1540: Before the arrival of the Spanish, floodplain societies lined the river, forming a nearly continuous band of settlement.



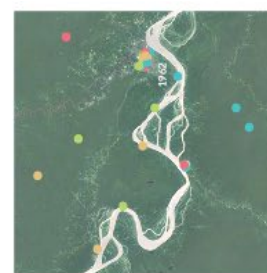
1540-1700: Mission communities are many km apart and include people from the Omaguas, Yurimaguas, Mayorunas, Cocamas, and Cocamillas. Old world disease proliferates, and many move from floodplain to forest to escape disease and enslavement.



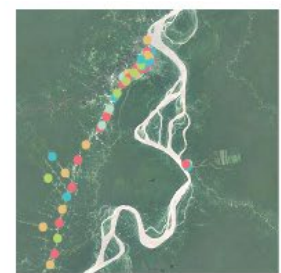
1667-1799: The Jesuits are expelled from all Spanish territories. Population at the 36 missions halves.



1824: Peru gains independence from Spain and missionary activity is suppressed. The new Peruvian government passes laws to protect indigenous groups and their land, but laws are rarely enforced.



1860-1910: Iquitos' population starts to climb with the boom in rubber trade. Rubber barons set up estates along the river.



1970s: The population of Iquitos climbs dramatically at the beginning of the petroleum boom. Informal settlements on the fringes begin to grow at faster rates.

*Graphic by Hope Freije and Rhiannon Neuville. Settlement patterns along the Amazon River near present day Iquitos over time.*

regions. The early years of Peru were spent solidifying its new borders (Knox & Harvey, 2015), leaving few surplus resources to put towards building infrastructure in the Amazon, though it was being treated as Peru's new frontier. In 1853, the young nation passed a law offering free passage, tools, and land for nationals and foreigners to settle along the Amazon River (Chibnik, 1994), but as migrants slowly trickled in, the presence of the State did not. The War of the Pacific (1879-1883) pitted Peru against Chile, further drawing on the country's resources.

The roadways in Peru today demonstrate the continued separation between of the Amazon region from the rest of the country. Most roads run through the Andes and west along the coast, where the country's capitol, along with most of its population and commerce, reside. Part of the barrier to modern road building is geographic, a reflection of the dense rainforest, persistent heat, and intermittent, deluges of rain. But it also reflects a lack of political representation east of the Andes—for example, not one Peruvian president has come from the jungle region.

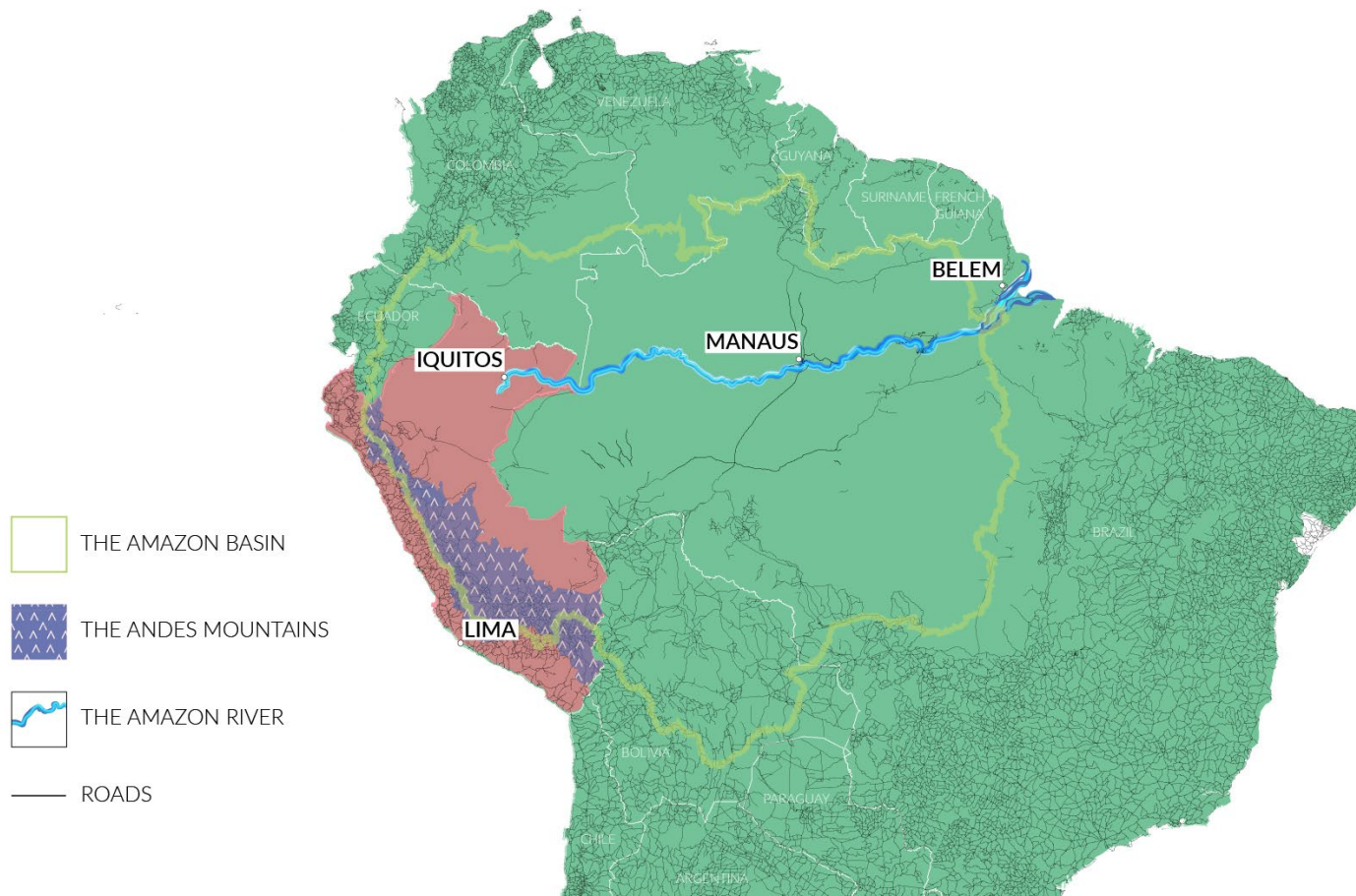


*Graphic by Hope Freije. The three geographic zones of Peru and the roadways between them.*

Brazil's Amazon region, like Peru's, has been politically separated from the rest of the country—for example, it was not until 1940 that a Brazilian president visited the Amazon (Langer, Langer, McNeill, Tutino, & Wilkinson, 2010). Similarly, there is a lack of roads in the Brazilian Amazon compared to the rest of the country. The fact

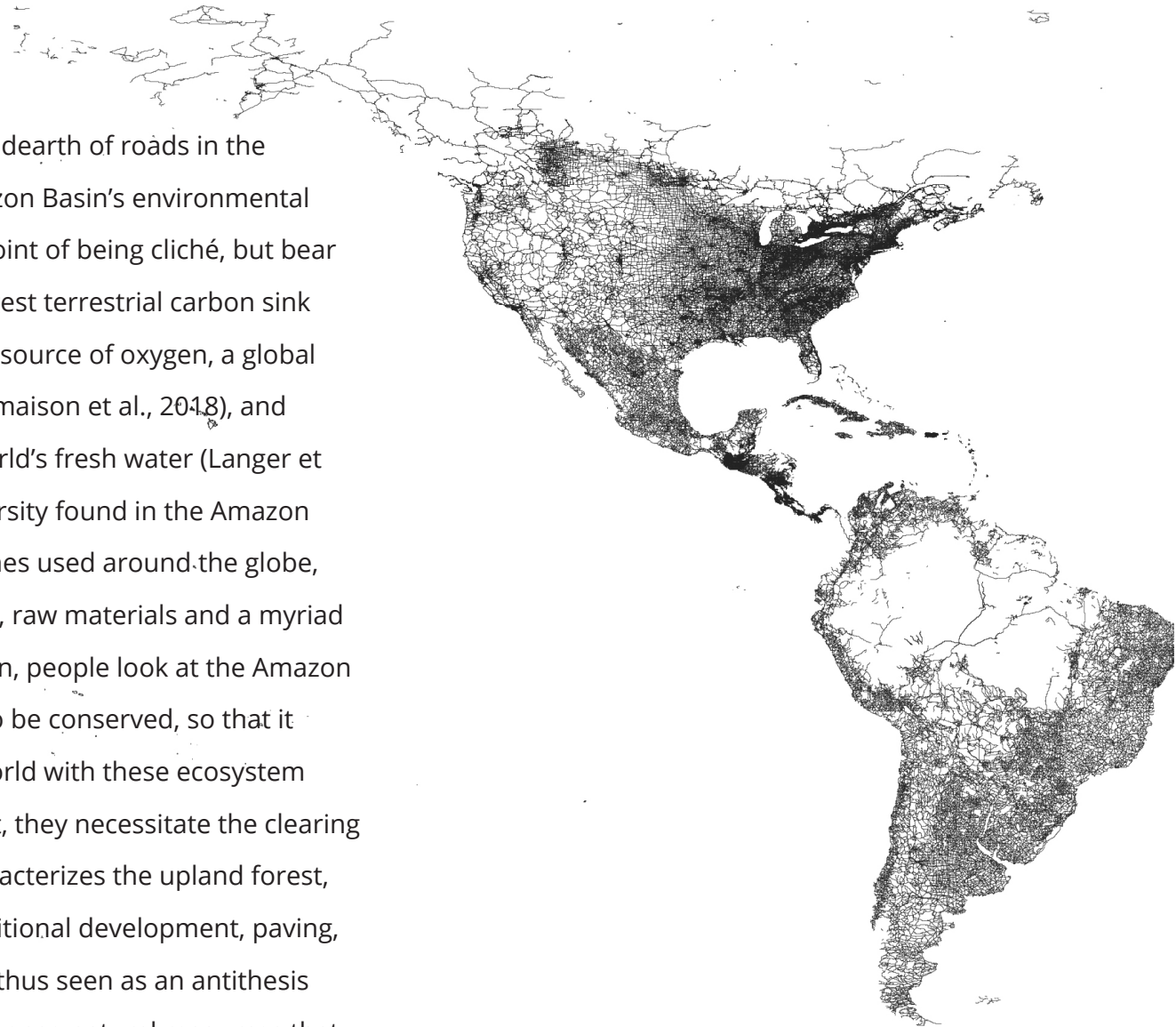
that there *are* road connections to major cities in the Brazilian Amazon, however, reflects the country's overall higher investment in roadways (Godfrey, 1990; Knox & Harvey, 2015), but perhaps was advantaged by the lack of a mountainous barrier separating the jungle from the more populous regions. The political and geographic

separation between these Amazon regions and their respective countries cannot be disentangled—their geographic separations have created political realities that have endured.



*Graphic by Hope Freije. Brazilian trade hubs Manaus and Belém were eventually connected by road to the rest of the country, while Iquitos remains outside of Peru's road*

On one hand we can view the dearth of roads in the Amazon as positive. The Amazon Basin's environmental accolades are touted to the point of being cliché, but bear repeating: it is the world's largest terrestrial carbon sink (Kelly & Pryor, 2013), a critical source of oxygen, a global weather regulator (Belén Desmaison et al., 2018), and represents one fifth of the world's fresh water (Langer et al., 2010). The botanic biodiversity found in the Amazon rainforest has yielded medicines used around the globe, as well as foods, supplements, raw materials and a myriad other products. For this reason, people look at the Amazon as an ecosystem that needs to be conserved, so that it can continue providing the world with these ecosystem services. When roads are built, they necessitate the clearing of the dense canopy that characterizes the upland forest, and in their wake is often additional development, paving, and deforestation. Roads are thus seen as an antithesis to efforts to conserve the immense natural resources that exist within the Amazon Basin.



*Graphic by Hope Freije. Roads of the Americas. Data from NASA's Socioeconomic Data and Applications*

The Amazon Basin, however is also home to more than 30 million people (WWF 2020), who are disconnected from lucrative regional and global markets and suffer from the lack of infrastructure to support human health. “The common attitude of conservation-minded people that road construction should be banned has unfortunately not only been ineffective in preventing repetitions of the destructive history of Amazonian roads, but it has also failed to acknowledge the interest that local people have in finding solutions” writes Barcellos and team (2010), whose research maps road construction in the Brazilian Amazon and investigates impacts on human health. “Although road construction in the Amazonian lowlands has induced serious environmental, social, and economic problems, improving and intensifying the road network is an important development priority in many Amazonian countries.” (Barcellos, Feitosa, Damacena, & Andreazzi, 2010)

Because roads are the conduits through which we move materials to build cities and reflect state interest and

investment, we can view them as an indicator for what other infrastructure might be present in a region. This fact is not lost on those outside of road networks, who see them as critical steps to development as well as a sign that the government recognizes them. In *Roads: An Anthology of Infrastructure and Expertise*, Harvey and Knox recount their anthropological research on roads in Peru, specifically the road between Iquitos and Nauta, the town of 30,000 people 60 miles south. They write:

*“Time and time again we were told that roads were a basic requirement for producing an integrated, coherent, and democratic modern polity, and the lack of decent roads was a fundamental block to Peru’s future prosperity. Indeed, we found that in general people were quite passionate about roads both as a prosaic answer to the abandonment and abjection provoked by inadequate provision and as a redemptive promise to bring about social change”*  
(Knox & Harvey, 2015, p22).

Here they describe “the promise of infrastructure,” where a proposed infrastructure project carries the weight of expected economic prosperity and recognition by the state, a promise which “allows projects to get off the ground, giving body and energy to the notion of the collective

infrastructural possibilities...  
can thus only be apprehended  
in retrospect

a powerful site  
for interrogating  
the waxing and waning

both a crucial organizer of a given situation and  
has become routinized to the point of  
banality or invisibility.

**a road is like a person**  
**--it is not static, it is dynamic--it grows.**  
**Every day you learn more**  
**about its problems.**

### **Intrinsically relational**

Roads channel and constrain circulation, but as infrastructural systems they  
do so in ways that are open-ended and subject to continual modification.

infrastructure is always about  
the future, or different futures.

**an event in time** **spectacular proof of the presence of state,**  
**colonial powers, or multinational lenders.**

From around 1990, infrastructural  
investment would no longer be about  
**marking the landscape**

**with monuments to human intervention**  
that might spur sluggish national  
economies; infrastructure instead would  
become a subtler affair leading states  
to emphasize their role as  
scaffolders of human and natural capacities.

what exactly is infrastructural  
connectivity expected to deliver?

**the project to transform**  
**the material conditions**  
**of people's lives**

the singularity of any  
infrastructural project is always  
undone by its unruly and  
expansive promise.

Infrastructure in these frontier  
spaces continues to be entangled  
with promise, hope, possibility,  
and fear

*Graphic by Hope Freije. The many  
meanings of infrastructure.*

singular, as the means of addressing uncertain futures” (Anand et al., 2018).

Yet the futures brought by the roads are uncertain themselves. They may not deliver the economic opportunity that is hoped for, or this opportunity comes but the profit is filtered through inequitable structures and thus enjoyed by only a wealthy few. Disputes over land between locals and incoming “land grabbers” can result in violence and displacement, and the people and other vectors who traverse these new pathways can bring new diseases. In some instances, a road is built to access an already established industry, such as mining operations in remote areas of the forest (Barcellos, Feitosa, Damacena, & Andreazzi, 2010). In this way, roads begin to leave trails of economic interest, indicating where the state has sent out fingers to tap into resources.

Our understanding of roads and infrastructure in a region can thus facilitate an understanding of state presence, economic development, and city building. This lens yields

an insightful exploration into Iquitos, a city of half a million people that is not connected to the rest of the country by road. The city has goals for sustainable development, such as increasing tourism and green space, but they currently lack the infrastructure needed to ensure the health of their urban population (*Plan de desarrollo urbano sostenible de Iquitos 2011- 2021*.2010). As we attempted to untangle the story of infrastructure in Iquitos, we looked to other cities along the Amazon River, such as Manaus and Belém, whose urbanization was also closely tied to the Rubber Boom of the mid 1800s. We also considered other cities in the Peruvian Amazon, which may have encountered similar challenges in the face of industrialization. These inquiries did lend some insight, and these cities will be mentioned in this thesis. However, it became apparent that a more in-depth look at the factors that coalesced to form the urbanization of Iquitos was more important than an analysis across multiple cities according to a select few factors.

Because the biodiversity of the Amazon has attracted

outside interest, and because infrastructure has been erected in the wake of and in order to access existing markets, the cycle of boom and bust industry emerged as a piece of Iquitos' history that was essential to understanding its urban context.

It is fitting to start with the Rubber Boom, the industry that spurred much of Iquitos' urbanization.

## RUBBER TIMES

Seldom is the history of Iquitos talked about without mention of the rubber industry, which spurred much of its urbanization, as well as that of Brazilian cities Manaus and Belém. The concept of entanglements is apt here, where a flurry of national policy and world events coalesced to create this sliver of time, spanning, depending on who you ask, from 1860-1910. It starts with the rubber tree, *Hevea brasiliensis*, which produces a latex that peoples in the Amazon extracted to make rubber for shoes, pouches, bags, and other goods (Godfrey, 1990). Wild rubber trees were slit open, with cups placed under the incisions to collect liquid rubber (latex), which was then processed slowly on poles over the fire until it coagulated into the useful end product. Products made from rubber were

exported prior to the boom, especially from Belém, which exported 450,000 pairs of rubber shoes in 1839 (Chibnik, 1994).

European scientists became interested in rubber's unique properties in the early 1700s, but it was not until the 19th century that the rubber met the road (Penn, 2008). In 1839, Charles Goodyear discovered the process of vulcanization, which makes rubber resistant to heat and cold. This opened up a sea of industrial uses for the material, and played no small part in the onset of the industrial revolution, "beginning with the bicycle and growing with the development of automobiles, railroads and electricity" (Langer, Langer, McNeill, Tutino, & Wilkinson, 2010). Rubber imports to Britain skyrocketed from 211kg in 1830 to 58,710kg in 1874 (Chibnik, 1994).

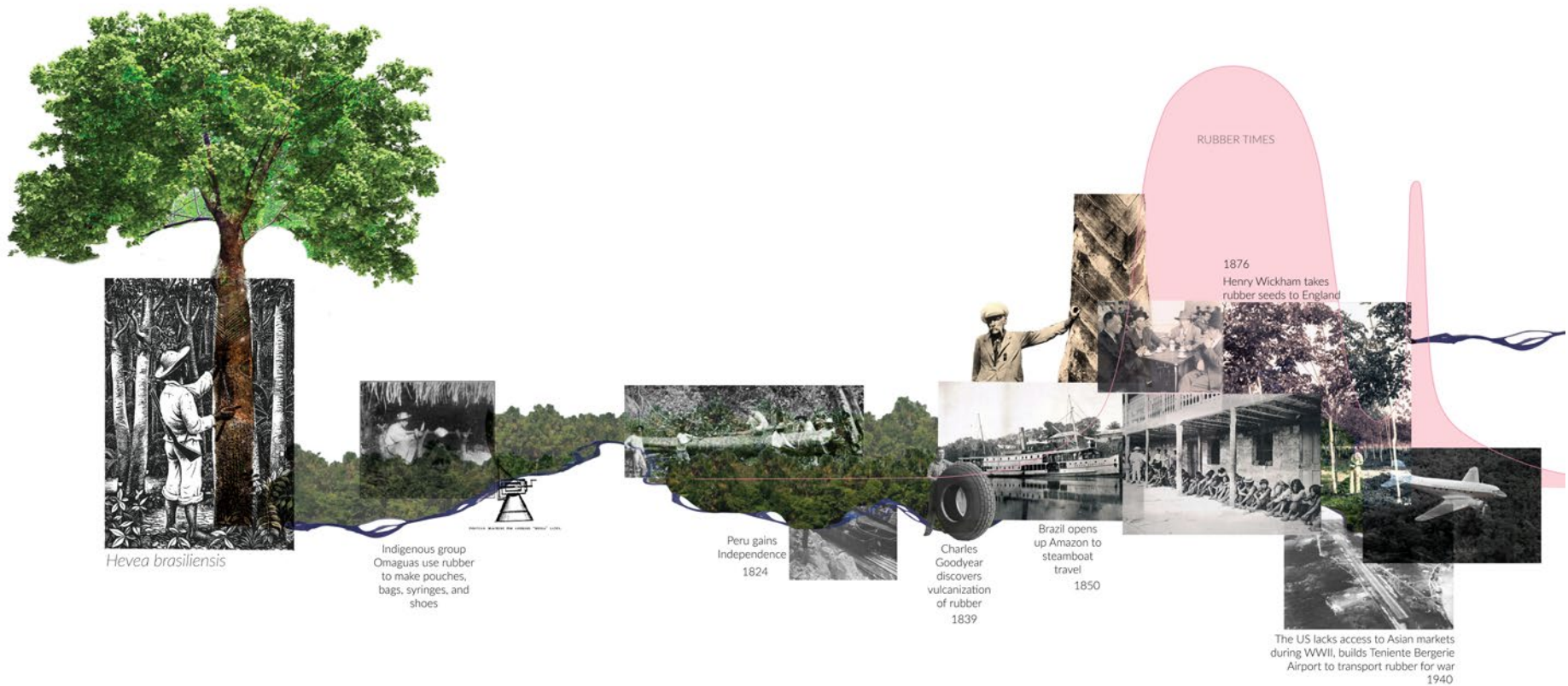
Meanwhile, the Amazon was being primed for participation in this new global industry. Brazil's last monarch, Emperor Pedro II, lifted the restriction of international steamship passage through the Amazon in 1867, a policy that was affecting not only Brazil, but its upstream neighbors as well. Without this

shift in policy, transportation of rubber from the western areas with the most productive trees would have been at a significantly reduced scale (Langer et al., 2010) While Belém had already been exporting rubber goods thanks to its position near the Atlantic, the demand for rubber as a raw material and the new connectivity between Amazonian regions by steamboat catapulted the market to new heights. The effects on the Amazon region were vast and violent.

“Rubber barons” or patrones came to port cities to take advantage of the booming industry—mainly Iquitos, Manaus, and Belém. Patrones in Iquitos came from coastal and highland Peru, and from parts of Brazil, although a few Europeans and people from Loreto (the wider region that encompasses Iquitos) owned commercial estates as well (Chibnik, 1994). Rubber barons set up commercial estates along the river, where they coerced or induced indigenous peoples of the floodplain and forest to work in the rubber trade.

Multiple labor systems existed, but were generally characterized by coercion, violence, slavery, and immense

profit for those in control. Barons relied on locals for their knowledge of the forests, where rubber trees grew dispersed rather than in capitalism-friendly patches. Workers would relocate near these estates and spend most of their time in the forest searching for and tapping rubber trees. This meant they were separated from their means of fishing and farming, and would become indebted to patrones for goods. In Brazil, thousands of northeastern Brazilians migrated to the basin to work as rubber tappers, often displacing native peoples (Godfrey, 1990). Different indigenous groups were also forced to work together, further breaking down their community ties (Chibnik, 1994). Rubber tappers were paid little to nothing for their labor, and many died under brutal working conditions (Chibnik, 1994). The labor conditions were horrific enough that “when the practices of the rubber companies of the Peruvian Amazon were publicized, there was an international uproar,” (Chibnik, 1994) but by the time this scandal was unveiled, the boom was waning. The timeline on page 33 shows the two rubber booms that shook the Amazonian region, nothing events that shaped its course.



*Graphic by Hope Freije. Iquitos urbanized during what's called the Rubber Times, from the mid 1800s until around 1910. Here we see the boom and bust play out: In 1839 Charles Goodyear discovers vulcanization of rubber, in 1850 the Amazon River is opened up to steamboat travel, and a global demand for rubber sends people into the Amazon eager to profit. This was a time fraught with exploitation of local workforce, and the first boom ended when British Henry Wickham took rubber seeds to Asia, where they are able to successfully domesticate it. The second boom comes during WW2, when the US lacks access to this Asian market, and needs rubber to win the war. Many airports are built during this time, throughout the Amazon, to facilitate the transport of rubber.*

After tappers located wild rubber trees and extracted their latex, it took months to get the product from forest to ship to the Atlantic (Penn, 2008). Prices for rubber reflected this time and risk involved to harvest, process, and transport it, so it is no surprise that Rubber

Barons soon sought to grow the coveted trees in plantations, where they could rely on a steady stream of production. Attempts to domesticate rubber trees in the Amazon were met with obstacles such as leaf blight, which rendered these efforts unsuccessful. In 1876, Henry Wickham is said to have been the one who smuggled seeds back to Europe, where efforts to domesticate rubber proceeded on British-owned estates in Asia. This lasted several decades; it was not until 1914 that exports of plantation rubber exceeded wild rubber globally (Penn, 2008). There they were able to grow rubber trees in

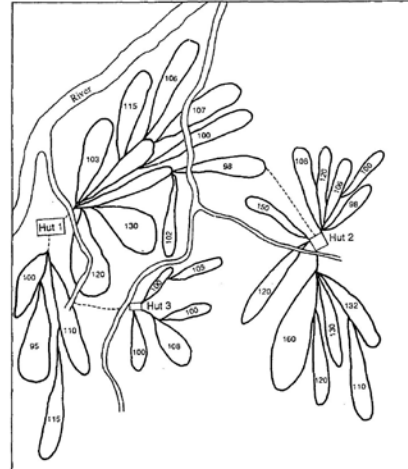


Fig. 3. Plan of Rubber Estate Showing Estradas, Number of Trees in each, and Location of Rubber Tappers' Huts (Adapted from Pearson, 1911: 63).

*Image from  
Denevan & Coomes, 1992*

a controlled setting, without relying on local knowledge to find dispersed trees, and where transport could be more effectively streamlined, leading to a cheaper product. For this reason, the Asia emerged as the global leader in rubber production, and the Amazon industry effectively busted.

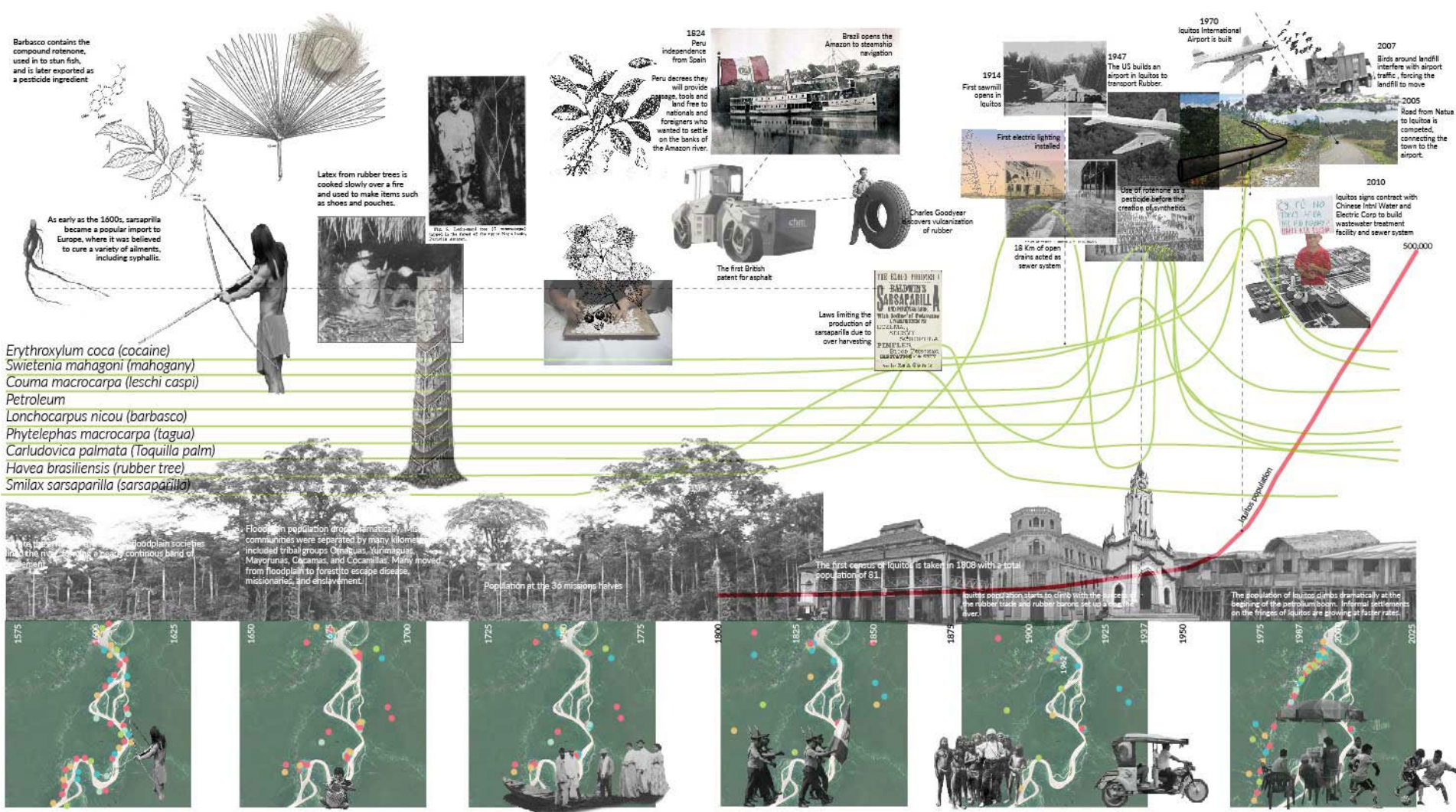
## The Boom and Bust Cycles of Extractive Industries

Before the Rubber Boom spurred the urbanization of Iquitos, the area had long been exporting extracted products and had already experienced boom and bust cycles related to these industries (Chibnik, 1994, Penn, 2008). The sarsaparilla plant, for example, was traded to Brazil after the end of the church monopoly in the late 18th century, in exchange for manufactured goods such as steel, porcelain and clothes. The plant had gained popularity in Europe as early as the 1600s for use in teas and medicine (Penn, 2008). So much sarsaparilla was harvested that by 1859, local government in the Peruvian Amazon found it

necessary to limit its export to curb forest depletion. Its export was later banned altogether (Chibnik, 1994), which did not put a hard stop to the industry but did contribute to its decline.

What sparks a global demand for a product (the belief that a plant cures a disease, an innovation in rubber processing, a burgeoning chewing gum habit) or creates the conditions for its successful exchange (the introduction of a faster mode of transportation) cannot be predicted. But the inevitable decline of these industries can be predicted to occur at some point. Many of the plants pictured on the layered timeline on page 36 are considered 'non-timber forest products,' meaning that they are extracted from the forest (rather than farmed) and are not part of the timber industry. In James W Penn Jr.'s piece *Non-timber forest products in Peruvian Amazonia: changing patterns of economic exploitation*, he writes about some of the key plants that dominated international export from the Amazon, and describes why "to some experts, the economic decline is considered inevitable after a [Non-timber forest

product] enters international markets because of the domestication and cultivation of the product or the development of industrial substitutes for it." (Penn, 2008, p 19). The first was true for the Amazon's rubber industry, which quickly plummeted after rubber tree plantations were established in Asia. This was not for a lack of effort to domesticate the trees in their native forests (Langer et al., 2010). Ford Motors attempted to apply their industrial model to the rubber trade, operating a plantation near the port of Santarém, Brazil from 1927 to 1945, which failed to profit. In addition to the deleterious effects of the leaf blight, some attribute the operation's failure to "Henry Ford's arrogance in trying to impose his vision of a North American rural utopia in the Amazon" (Langer et al., 2010). The year-round labor cycle of the plantation may not have sat well with rubber tappers, who typically would spend part of the year extracting and the other part engaged in fishing, agriculture, or other lifeways. While there is disagreement about what prevented the domestication of *Hevea brasiliensis* in the Amazon, the consensus is that many tried (Langer et al., 2010).



Graphic by Hope Freije and Rhiannon Neuville. Behind each plant in the graphic is a history of local use as medicine, poison, or as raw material. Tracing these products, mostly plants, through time, we see how their use and trade starts locally and then becomes embedded within global structures. Without this context layered in, all we see is the rise and fall of an industry.

The landscape of the Amazon, while home to globally coveted plant diversity, has in ways resisted industrialization. The cost of wild harvesting and transporting plants out of remote areas is not conducive to industrial model, and agriculture has hurdles in the region as well. Amazon soil itself is only fertile near the river, where agriculture is subject to the yearly cycle of the river, which prevents the year round production that capitalism craves. Further, the biodiversity also means an array of predators and pests ready to devour a monoculture to the ground. That does not mean it is impossible, and upland crops such as barbasco, as well as floodplain crops, have become important exports from the Amazon region.

Penn's second caveat about extractive industries is exemplified through the barbasco industry, which boomed starting in 1931 (Chibnik, 1994, Arce-Nazario, 2007). The roots of the barbasco plant (*Lonchocarpus nicou*), have been used by local peoples for fishing, thanks to the compound rotenone, which stuns prey, making them easier to catch. Rotenone also proved useful as a pesticide, leading to the

export of barbasco to the United States. Barbasco was farmed in the upland and thus inherently had a less risky production model than did rubber.

One can imagine, though, that transporting the product along the river to connect with infrastructural pathways to the U.S. still drove up the price led the U.S. to seek out other sources. And seek they did--first, the U.S. gained access to Derris, another plant that produces rotenone. Next, DDT and other chemicals were synthesized, eliminating the need to export plants from remote locations and extract their derivatives (Arce-Nazario, 2007). Consequently, the export of barbasco from the Amazon subsided. The decline due to synthetic replacements can also be seen with Lesci Caspi, an extracted latex used to make chewing gum, and Tagua, the seeds of which were used to make buttons. On the layered timeline on page 36, several busts are seen around World War II, as many synthetics hit the market and removed the need for global shipments of those forest products.

So whether because of domesticated replacements, synthetic alternatives, or simply that a resource is tapped out or becomes protected, extractive industries bust. And during the booms, what has been seen is that the influx of wealth has not led to an investment in infrastructure for human health or in industries like agriculture or manufacturing. This lack of investment has allowed extractive industries to continue be the dominant feature of the Amazonian economy.

# CHAPTER 02

## IQUITOS TODAY

The histories of colonization and extractive industries can be seen in Iquitos today. Throughout the Historic District stand mansions built with rubber money and adorned with tiles sent from overseas, a contrast to the brick and concrete facades and corrugated metal roofs on most of the city's buildings. The city was built quickly, much of it unplanned (*Plan de desarrollo urbano sostenible de Iquitos 2011- 2021*.2010), during sporadic influxes of resources. Growth is restricted by the Amazon River and its tributaries, and much of it has extended out on that water, into communities built on stilts of floating during the wet season. The city does not recognize these homes as part of the jurisdiction, and they are not connected to infrastructure such as electricity or running water. Most

buildings in the upland stop at two stories, a barrier to vertical density and a reflection of the sandy soil conditions. While the city lacks this vertical density, it is described as being high density by a 2018 report by Peruvian urban planning group Periferia and International NGO World Wide Fund for Nature (WWF) (Zucchetti, Freundt, Cánepa, & Carranza, 2019), reflecting the condition where people are living many to an apartment. This is seen with former rubber mansions that have been subdivided into narrow apartments that often house many.

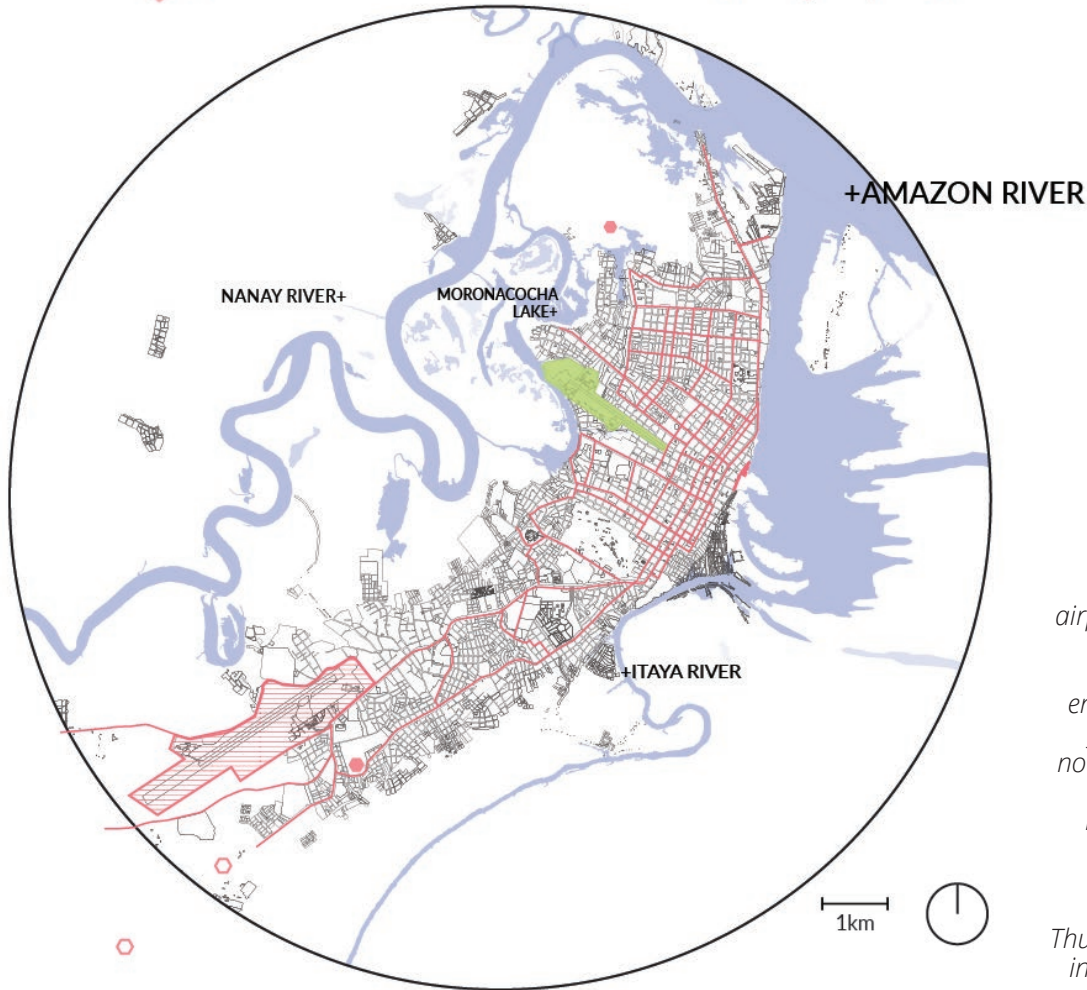
During our first trip to Iquitos, we explored how the built environment conditions in the rural, rural peri-urban, and urban areas around Iquitos were impacting human and ecological health—how living many to an apartment with few windows could be contributing to the city's tuberculosis outbreaks (Alarcón, 2016), how distance from urban centers and barriers from urban centers and barriers to farming has led to malnutrition in peri-urban communities.

1947  
IQUITOS  
MILITARY AIRPORT  
IS BUILT BY THE  
U.S. ARMY

1970  
IQUITOS  
INTERNATIONAL AIRPORT  
IS BUILT

2005  
ROAD BETWEEN  
IQUITOS AND  
NAUTA COMPLETED

2008  
COURT OF MAYNAS  
ORDERS THE CLOSURE  
OF THE MUNICIPAL DUMP,  
DUE TO POLLUTION OF  
NANAY RIVER



Graphic by Hope Freije. The former airport site holds potential for addressing some challenges currently facing the city. The site extends nearly across the entire city east to west, connecting to the floodplain on the northwest end. Right now it acts as a barrier for traffic passing north to south, and there are a higher number of traffic accidents reported at the site's eastern end. It is just south of the sewage treatment plant that was started in 2010 but never completed. Thus sewage from the city flows untreated into waterways such as the Nanay River, the city's source of drinking water.

From our interviews with local experts (See: Methods + Methodology), we developed a greater understanding of what they view as Iquitos' most pressing challenges related to the built environment. Themes that emerged were the prevalence of garbage throughout the city, the lack of ecologically rich green spaces, and the lack of connectivity by road. They saw these issues as both a factor of human wellness as well as a deterrent to tourism, which is currently the second most profitable industry, behind oil, and one of the city's goals for moving forward economically (*Plan de desarrollo urbano sostenible de Iquitos 2011-2021*.2010; La Región, 2020).

The ecological implications of these issues are vast, given the waterways and wealth of biodiversity that surrounds Iquitos. In order to maintain a manageable scope for this thesis, we chose to focus on the impacts these built environment issues have on human health. This also reflects the theory of One Health, which envisions the health of humans, animals, and the environment intertwined (Kahn, 2017); an intervention towards improved health of one faction should thus benefit the

other two as well. As we narrowed in on three main infrastructural conditions to highlight—sewage, garbage, and urban impermeability, we drew first and foremost on their connections to human health.

## Sewer

In 2010, the Loreto province signed a contract with the Chinese International Water and Electric Corp to build a wastewater treatment facility and sewer system (see map on page 40) (Ellis, 2014). By then, 65% of the city was connected to sewer pipes, but without a wastewater treatment plant, waste was being directly into the Amazon tributaries surrounding the city (Ex-ante evaluation - Iquitos sewerage improvement and expansion project.2008). Though a 1913 public health campaign urged for improved conditions of the city's of sewer and water systems, planning came to a halt with the bust of the rubber industry (Converse, 1914). The 2010 plan promised to rebuild 250 miles of domestic sewer lines and add 41,000 new domestic connections, in addition to creating a plant

that would clean the city's sewage before dispelling it into the river (Bloomberg, 2010). The process was riddled with corruption and construction difficulties, spurring protest and resulting in the ousting of the governor (Arellano Valdivia, 2010). While the system did function at 12% capacity by 2012, it ultimately failed, leaving fallow equipment behind as testament. Raw sewage from the city continues to flow directly into the Rio Nanay, the same river that is the source of the city's drinking water.

While public opinion casts blame on floating and stilted communities on the fringe, the entire city contributes to the waste that flows into the waterways. Those living on the fringe suffer most as they come into daily contact with the polluted waters—many use the river to wash dishes and clothes, to swim, and to cook with or drink, as the city is unable or unwilling to connect these communities to public utilities. This lack of infrastructure on a citywide and community wide level contributes to pervasive parasitic infection in Iquitos, especially amongst those living in the floodplain. Establishing a functioning sewage treatment

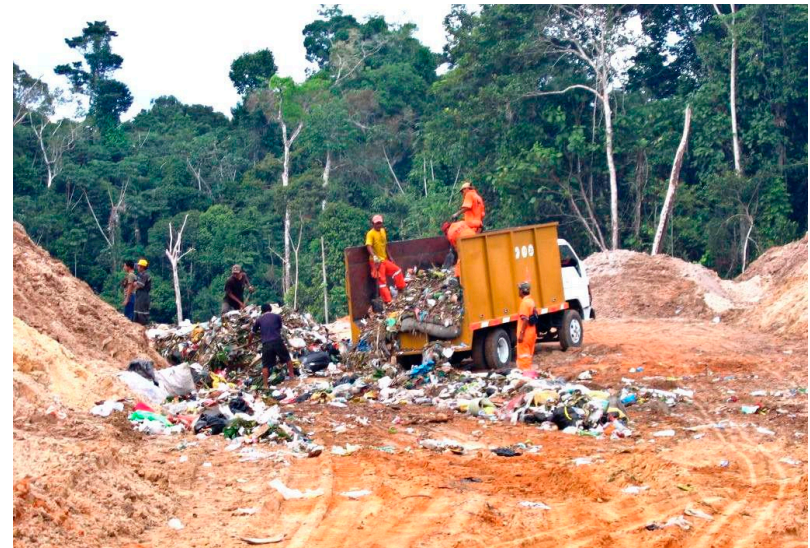
system would thus have a significant impact on the health of those living in stilted and floating communities.

## Garbage

Throughout Iquitos, homemade signs urge residents not to throw their trash in public spaces (see photo on page 43). Whether due to a underserved neighborhoods, lack of service into fringe neighborhoods, or prevalence of single use plastic in the food system, garbage is seen throughout the streets and piled at street nodes. Garbage that does reach municipal landfills is not exempt from complications; the “Botadero Municipal de Maynas” (Municipal Landfill) was first built near the Iquitos International Airport, but was attracting birds at a volume so great that it was interfering with flights in and out of the airport. In 2007, a state of emergency was declared, and the landfill moved 30 kilometers south along the road that connects Iquitos and Nauta. Unfortunately, the new location overlapped with the buffer zone of the Allpahuayo Mishana National Reserve, one of the areas that makes up the National

System of Natural Areas Protected by the State (Actualidad Ambiental). Thus in 2010, the court ordered the company to move the dump again. As of 2018, two new landfills were under construction (La construcción de dos rellenos sanitarios beneficiará a más de 400 mil habitantes de Loreto, 2018), and appear to not have been completed as of this time. (See map on page 40 for past locations of the landfill.)

The Amazon's hot and humid climate means that garbage breaks down at a rapid pace, accelerating the pace at which toxic substances leach into the water table and into the lakes and rivers that surround the city. But before it even begins to break down, garbage poses a problem in the Amazon, as it can act as small reservoirs for water to collect in, creating the perfect habitats for mosquito larvae. This is a serious concern in a city that is infested with mosquito species *Aedes aegypti* and *Aedes albopictus*, which are vectors of dengue, chikungunya, and yellow fever, which have broken out in Iquitos in recent years (Alarcón, 2016). While vector-borne disease is in some



Top: Photo from Actualidad Ambiental - Local landfill in Iquitos.  
Bottom: Photo by Hope Freije - sign urging residents not to throw their trash in a planting strip.

sense inherent to tropical climates, some sources draw links between deforestation brought about by construction and the proliferation of mosquitoes (Knox & Harvey 2015, Alarcón, 2016), who flourish in disturbed habitats at the forest's edge. Mosquitoes have flourished in urban environment like Iquitos, where they have access to dense human populations and puddles to breed in. It is for these reason that the World Health Organization methods lists solid waste management and street cleansing among their recommended strategies for vector control (Spencer et al.,

## Impermeability

Given that the high volume of rainfall in Iquitos and the high percentage of paved surfaces, the stormwater system is responsible for a large volume of water. The trend of plaza design in Iquitos is one of high pavement and low permeability, a missed opportunity to ease the pressure put on the stormwater system after the frequent and intense rain events. Because Coco Alarcón's research has focused on the connections between vector-borne disease and the built environment in Iquitos, our focus on

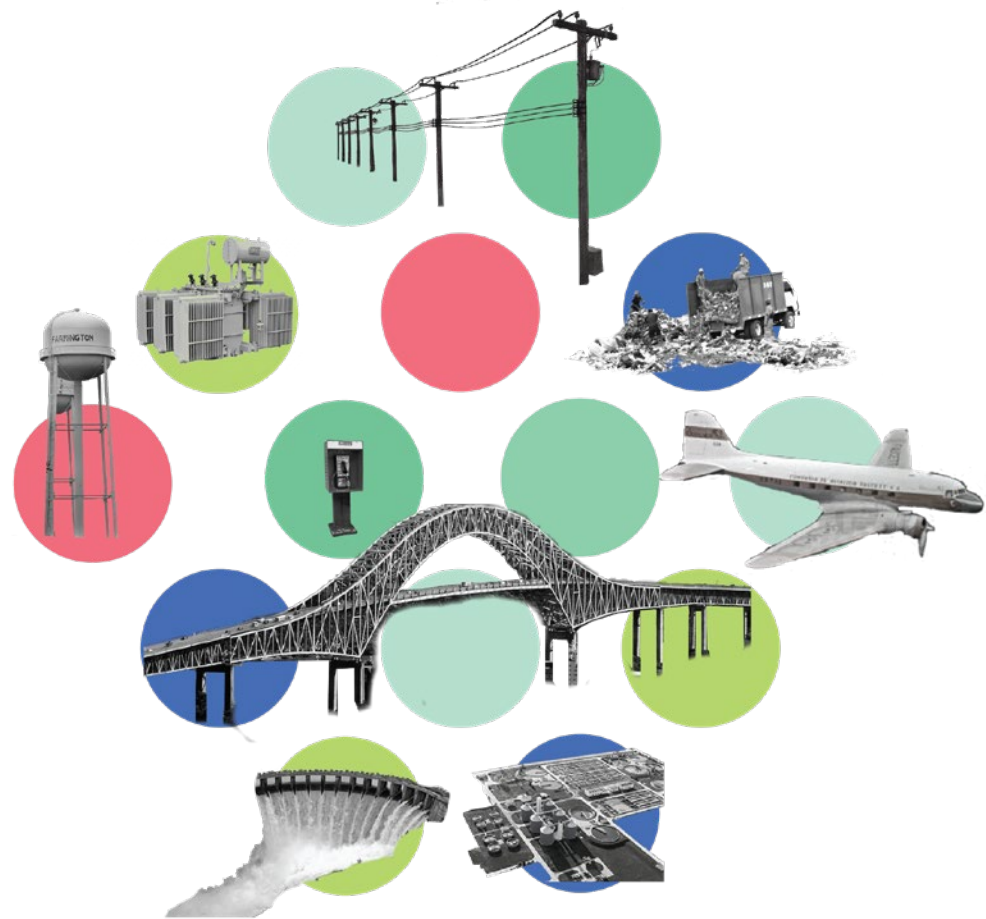
permeability also relates to the issue of standing water. Surfaces that collect water create breeding grounds for mosquitoes, and this can be seen throughout the city where water pools on poorly draining pavement or soil.

A high percentage of pavement, which degrades the environment's ability to percolate water, is of course not limited to Iquitos. Stormwater management is a pressing issue in Seattle and has thus been a central focus of our curriculum at the University of Washington. We thus saw many opportunities to increase the absorptive capacity of the built environment in Iquitos. Of the three infrastructural challenges we zeroed in on, impermeability as one of them stands out as a reflection of our work with Traction and our training as landscape architects.

# PARKS AS INFRASTRUCTURE

Infrastructure is seen through this investigation as a symbol of state presence and an emblem of hope for greater economic prosperity, but functionally, what does infrastructure do? There are many definitions of the word, crossing into meanings of data organization and others that are not relevant to this project. For our purposes, Merriam-Webster's description of 'the system of public works of a country, state, or region' is adequate.

At its root, urban infrastructure is built to clean the landscape, power daily life, and facilitate social and economic connections. It has become the scaffolding that humans build in order to make the environment suitable to their increasingly dense settlement patterns and thirst for efficient and round the clock production. Where wetlands once filtered out waste, they cannot keep up with the waste produced by

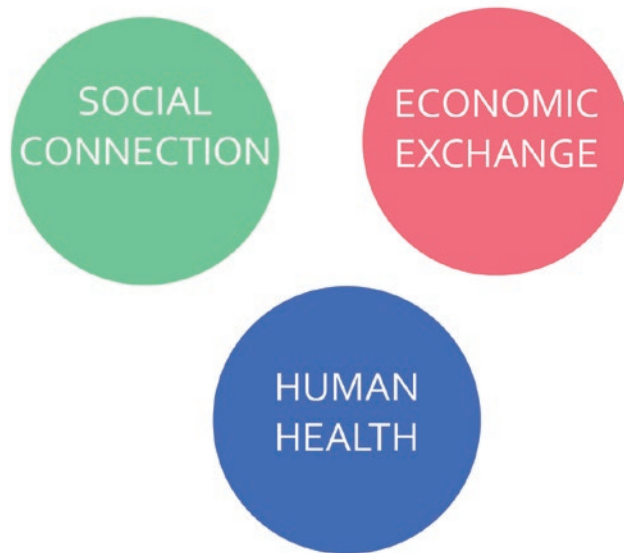


*Graphic by Hope Freije.  
What does infrastructure do?*

large cities. Where rivers once served as the jungle's highways, something faster took its place. Essentially, the landscape had to be industrialized.

The work of Pierre Bélanger has been seminal in the conversation about infrastructure for the 21st century.

Trained as a landscape architect, he critiques the approach to building infrastructure to serve a single function:



*Graphic by Hope Freije.  
What does infrastructure do?*

*“Historically, mono-functional approaches to the design of infrastructures have typically segregated the basic provisions of water, waste, transport, food, and energy into separate, unrelated departments. At large regional scales, bureaucratic separation of infrastructural services is proving costly and ineffective. Over long periods of time, it can also be dangerous.”*  
(Bélanger, 2009, p85)

The separation of infrastructural functions from each other was concurrent with an attempt to separate infrastructure from the surrounding ecology, much like was done with cities. This allowed for an industrial, one-size-fits-all approach, where a sewage system could look the same in New York as in Arizona; landfills would be identical, regardless whether the city's waste stream was dominated by scrap lumber or single-use plastics. Civil engineers have been the main designers of infrastructure in the past century of city building in the United States, using what Bélanger describes as their approach of “isolation of variables and exclusion of social dynamics to reduce complexities down to verifiable quantities, certainties, and solutions” (Bélanger, 2009). In one sense, this has worked—

we have successfully collected sewage from homes and cleaned it, we have stored water in towers and distributed it to homes, we have crossed waterways using bridges. But as we reach a point where the infrastructures built post WWII near the end of their lifespans, he argues, we have a chance to rethink “single-purpose infrastructure” that buys into the illusion that it can exist separately from the landscape it occupies (Bélanger, 2009).

Bélanger calls for a mental reframing where landscape both informs the design of infrastructure and acts as infrastructure itself. His work draws upon the work of designers, economists, and environmentalists who have questioned the model of infrastructure as “a mere collection of public utilities,” and looks to poly-functional systems, which promise lower cost over their lifespan, while solving multiple challenges at once (Bélanger, 2009). The problem of cleaning water then widens—we consider what we are removing from the water and where might it be useful in the landscape. We ask whether this function can be embedded within another process. We envision how

the process could serve to educate the public and create space. Bélanger relates the emergence of more flexible and circular systems with the emphasis on geography and ecology that has emerged in the 21st century. Here he describes how landscape architects, who are increasingly embracing both fields, are finding their place in urban design, away from the shadows of architecture and into their own niche. Many landscape architects indeed are now calling for designs that embed functions typically relegated to mono-functional infrastructure within systems that also consider ecological health and contribute to a neighborhood sense of place (McMahon & Benedict, 2006).

## Green infrastructure

One of the most notable contributions of landscape architecture to the re-visioning of infrastructure has been in green stormwater infrastructure, also called low impact development. This wave of interventions is aimed at rethinking stormwater systems, where rather than relying on drains and pipes alone to accommodate storm water

runoff, the landscape is designed to slow, clean, and absorb water, essentially moving closer to the pre-development condition where the ratio of infiltration to runoff was considerably higher. Parks, backyards, right-of-way planting strips and city plazas become part of the city's stormwater system, with designs aimed at increasing the capacity of the urban landscape to clean and filter water. This has put landscape architects at that table, where they are able to envision how these spaces can serve the public and surrounding ecology, in addition to their base functionalities.

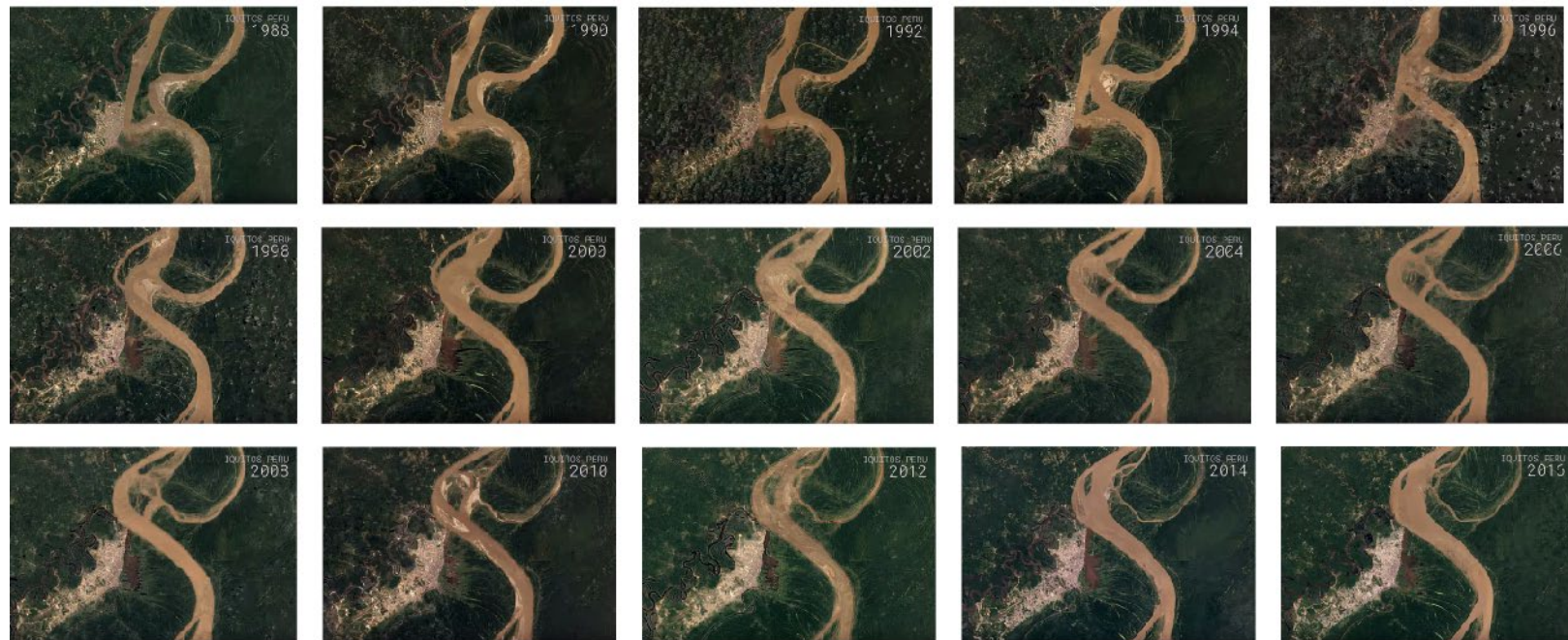
In Seattle, these small-scale interventions have been part of the strategy to address the issue of combined sewage overflows. Most of Seattle, like Iquitos, treats stormwater through the same system as sewage. During some rain events, the influx of stormwater into the system causes overflows, and a combination of sewage and stormwater flows into the Puget Sound and other water bodies. In 2017 and 2018, King County, which encompasses Seattle, exceeded pollutant limits 18 times at its four wastewater

plants that treat CSO discharges (Department of Ecology), resulting in fines to the country in addition to the ecological damage suffered. Large scale infrastructure has been a key component to Seattle's response to CSO's, but these projects tend to be very expensive (Puget Sound, Washington State University. Extension, & Hinman, 2005), and can lack the ecological, social, and human health benefits possible with green infrastructure (McMahon & Benedict, 2006). stormwater infrastructure is a key strategy the city has employed to reduce these outflows. By increasing the city landscape's ability to absorb water, they offset the volume of water that flows into the piped system, while also providing opportunities for water to filter through soil and other cleansing mediums. The City's stormwater infrastructure is thus spread out across the city.

There is a resiliency to decentralized infrastructure that can apply to any city. Yet the Amazon's environment makes it a particularly apt candidate that can accommodate change. The yearly floodplain cycles of the Amazon tributaries bring

one dynamic quality to the landscape, while the Amazon River itself whips and winds through time, lending an element of unpredictability that industrialized infrastructure simply cannot accommodate. What happens to the city's one sewage treatment plant if the river decides to flow through it?

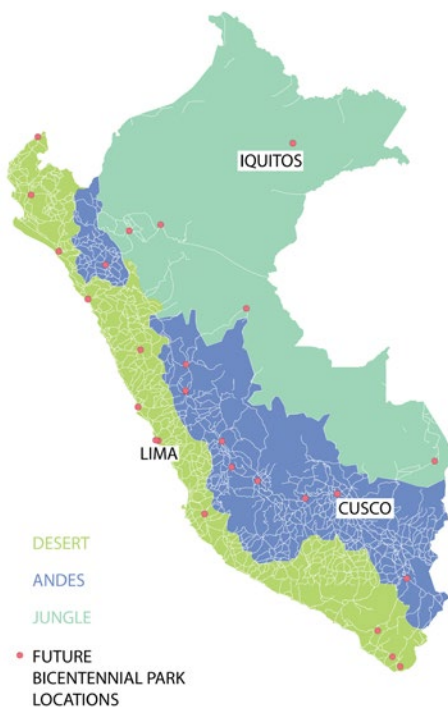
This paper does not argue against the need for a sewage treatment plant in Iquitos. The need for sanitation is urgent. Rather, we ask what poly-functional infrastructure might look like in the urban Amazon, and in Iquitos specifically. How can the landscape be a part of the systems that clean, power, and connect the city? And how can layered functionality support a vibrant, healthy city?



*Graphic by Hope Freije. The movement of the Amazon River over time.*

## Peru's Bicentennial

In 2020, Peru announced that it would be celebrating its 200 years of freedom with 26 bicentennial parks—one in each province of the country. The vision is that they will create a network of parks, each reflecting the culture of the region and considering the local ecology. Each park is meant to have the following five components, as described on the initiative's website:



*Graphic by Hope Freije. The 26 Peruvian cities to build a Bicentennial Park.*

1. An ecological area that connects people with nature, promotes the value of local biodiversity, and includes recreational spaces for young children and people with disabilities.
2. Cultural esplanade where social, cultural and productive activities will take place and an amphitheater to host craft, food fairs, and interscholastic festivals, rehearsals of cultural groups, concerts, and others events.
3. Resource Center for Citizenship, an interactive space made up of exhibition rooms focused on citizen values that promote dialogue, tolerance and coexistence. It will have a creative laboratory that encourages the creation of projects and ideas according to local interests.
4. Community Library to promote reading, research, and the generation and exchange of knowledge, with inclusive spaces for adults, children and people who are differently abled.
5. Cultural Center to promote creative development and cultural diversity, consisting of an auditorium, and a multipurpose room for workshops, artistic presentations, talks, classes, and other programs.

This initiative sends a strong message about Peru's values—of green space, of biodiversity, culture, and education. It aligns with a document published in 2018, by Peruvian urban planning group Periferia and International NGO World Wide Fund for Nature (WWF) (Zucchetti, Freundt, Cánepa, & Carranza, 2019), which outlines Peru's goal of increasing green space per capita—among many other goals and challenges. The report compares Peruvian cities, noting that there is a significant gap between the country's highest (Lima, with 3.9m<sup>2</sup>) and lowest cities (Chachapoyas, with .1m<sup>2</sup>), but that as a whole, Peru's cities are far from meeting the WHO's recommended 8.9 m<sup>2</sup>. In Iquitos, currently measured as having 1.2 m<sup>2</sup> of greenspace per capita, the Bicentennial Park could become the city's largest park, acting as resource for constituents and an attraction for visitors.

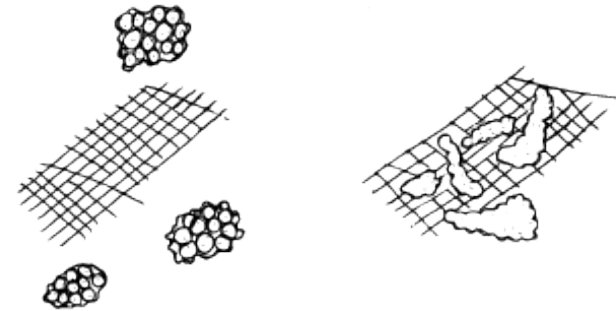
The cities throughout Peru have different challenges related to human and ecological health, different levels of economic opportunity and unique histories—and the Bicentennial Park will thus mean something different in

each place. And while increasing green space per capita is likely to be positive across the board, there are a spectrum of futures for how the park designs weave into the ecological, economic, and cultural fabrics of the Bicentennial cities. What does this initiative mean for Amazonian cities, which have historically been left out from national interest and investment?

The Loreto region, the province that encompasses Iquitos, and also the largest province in Peru, has visions of sustainable development for Amazon cities. A report from planners and designer in Lima and Iquitos expressed some goals and visions for the region, including a reconnection with the Amazonian identity, a move away from extractive industries, and creating people-centered cities that are secure, compact, inclusive, resilient, and sustainable (Belén Desmaison et al., 2018). In their vision, every city should serve as a platform for climate compatible development. These visions are powerful and ambitious for any city, but for a region situated among a globally important ecosystem, that has been the subject of global demands for

both exports and conservation, sustainable city development becomes a radical move.

The Cities of Peru document also draws from the 2030 Agenda for Sustainable Development put out by the United Nations Department of Economic and Social Affairs in 2015. The 17 Sustainable Development Goals laid out by this report are simultaneously lofty and intuitive—they speak to the inherent connections between economic development, environmental degradation, and human health. Goals such as “end all forms of malnutrition” stand alongside “provide access to safe, affordable, accessible and sustainable transport systems for all” and “develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure.” It reflects a holistic approach, where instead of simply conserving swaths of land to save the environment, cities are part of an environmental strategy for allowing humans to live in dense settlements that are healthy for them and the planet.



### Conservation vs. Layered functionality

Beginning in the 1980s, stories of “unparalleled onslaught on the Amazon rain forest by cattle ranchers, colonists, dam builders, and gold miners” (Coomes & Barham, 1997) emerged into the news cycle. The biodiversity that first attracted outside interest in the Amazon was exposed as being under threat. Conservation was, in a sense, the second wave of global interest in the Amazon. Children in the United States learned about “saving the rainforest,” a distant place that provided them with oxygen and clean water; initiatives to save paper and trees did so with a glance south to ‘the world’s lungs.’ To the movement’s credit, it quickly adapted to include the human populations of the Amazon in its efforts, whether or not that issue

made it into the dominant rhetoric. The “parks, benches, and fines” approach to conservation adapted to include “the dual aim of assisting forest peoples and protecting the rainforest” (Coomes & Barham, 1997). One such strategy was the economic model of sustainable extraction, seen as a way to boost or create local economies while conserving the forest (Coomes & Barham, 1997; Penn, 2008). In contrast to the mining, cattle ranching, and timber extraction that was credited with deforesting the Amazon, these strategies aimed to tend to the Amazon and its peoples by extracting in ways that were less destructive and connecting them to global markets.

Such efforts continue today. During our first trip to Peru, our group visited a community in the Pacaya Samiria, a nationally protected land in the Amazon, where locals are participating in a program that allows them to bypass laws that prevent hunting turtle eggs provided they cultivate (hatch) the eggs and return a portion back to the river. The other portion is sold to local and international (mostly Asian) markets. This strategy has been regarded

as successful, helping to restore a struggling species while providing income to rural Amazonians. Yet it also highlights the policies and structures that have made life in the Amazon a battle. Before the Pacaya Samiria and other national lands entered protected status, communities of people were already living there. Regulations aimed at restoring land back to a previous condition impede the ability of the communities living there to make a living and survive. They are restricted from cutting down trees and hunting, yet too far from the urban centers to access those amenities. Mattias Borg Rasmussen, whose work focuses on the Andean region of Peru, writes “Like extractive industries, conservation makes claims to territories and landscapes based on particular forms of valuation” (Rasmussen, 2018). Conserving land is another way of claiming space.

The Peruvian Amazon has suffered considerably less deforestation than Brazil, in part because there has been less of a national focus on road building and cattle ranching. (Godfrey, 1990; Chibnik, 1994). There is a network

of protected areas, large swaths of forest free from roads and other paved surfaces. And while this amounts of preserving ecosystem functions that keep the globe healthier, there is a hypocrisy of the global north's plea for the Amazon to remain intact, forgoing the economic opportunities that the north enjoyed while it mined and paved and ravaged its landscape. The work being done in the Amazon to envision sustainable cities is a testament to the deep connection to their landscape, where they are not simply interested in accessing the resources they need to be healthy and thrive, but doing so in a way that preserves the biological resources that they have been stewarding for centuries.

Amazon peoples have inhabited the forest and managed its resources for at least 5000 years (Coomes & Barham, 1997) but as borders have been drawn around their homes and claims to their land made, whether through conservation, extraction, or urbanization, accessing resources and working within these new structures has become a losing battle. The lifeways of rural Amazonians were ravaged by

historic violence including targeted killings of community leaders in attempts to destroy knowledge and resilience, disconnecting them from the lifeways that made life in the rural Amazon possible. For those in more urban areas and those who want to access urban amenities, the fall out from exploitation and extractive industries has impeded their ability to access resources. While conservation groups have included Amazonian people in their efforts to foster resilience, there is a dearth of attention placed on urban Amazonians, with target groups defined by "discrete categories, such as 'rubber tappers' or 'native peoples'" (Coomes & Barham, 1997). Whether or not the assistance programs are the correct approach, their target groups reflect a vision of the Amazon as not being urban, when in fact over half of the Loreto region (the largest in the Pervuian Amazon) resides in cities (Belén Desmaison et al., 2018). Extraction from the rainforest is viewed as its biggest threat, but the condition of the urban cities along the Amazon River is a threat to the ecosystem in its own right.

## Landscape Architecture and the Amazon

Thus far, landscape architects have not been at the table when it comes to designing Peruvian cities. While urban planners, architects, and what are referred to as forestry engineers have similar skill sets, landscape architecture is not taught or practiced in Peru. Architects take the lead in designing public spaces in Iquitos, and though they have similar skill sets, their framework lacks the foundation in ecology that many landscape architects have adopted in recent years. During an interview with Gabriela Vildolsola, the dean of the Colegio de Arquitectura in Iquitos, she expressed her desire for more interdisciplinary collaboration in their municipal processes. When we spoke to botanists, they lamented how native plants were absent from public spaces in the city. Therein lies a space where landscape architecture framework could be useful, for moving towards public spaces in Iquitos that are designed with ecology in mind.

During the 1800s, some in the growing profession of

landscape architecture were responding to the realization that the urban landscape was unhealthy for humans. Integral to Frederick Law Olmsted's seminal design of Central Park was the idea that landscapes could promote human health through the reduction of miasma, what was believed at the time to be the root of illnesses (Yocom, Rottle, Wolf, Zunt, & Andrews, 2018). Though the miasma theory was later abandoned, the understanding of parks as a way to foster healthy conditions in urban areas remained part of the basis for landscape architecture. Parks large and small began to create spaces for respite from noise, pollution, traffic, and other urban phenomena that had come to characterize cities. One result of this approach is the hard distinction between what is park and what is city, where trees create a visual and symbolic barrier between areas of respite and greenery with the rest of the city fabric.

As Iquitos and other cities in the Amazon explore new meanings of urban growth amidst a critical ecosystem and during a critical time for action in the face of climate change, there are frameworks from landscape architecture

that lend themselves to exploring solutions rooted in ecological design. While setting aside spaces for nature to exist sans humans is important, ecological design is critical for the Amazon, where people are increasingly moving to urban centers—55% of people in the Loreto region are reported as living in cities (Belén Desmaison et al., 2018). In addition to being an important strategy for dense human populations to live without infringing on the surrounding ecosystem, it is critical for maintain a healthy human population as well. The next phase of this project asked how the Bicentennial park could serve Iquitos in their mission to create a sustainable Amazonian city.

# CHAPTER 03

## THE SITE

There are two major plots of land in Iquitos that lend themselves to large park design. These are both military owned, and while they host considerable wildlife and are the more permeable spaces in the city in terms of water absorption, they are fenced off from the general public. The more northern site is a former military airport, with its defunct runway spanning halfway across the District of Iquitos. The more southern site borders the districts of San Juan, Belén, and Iquitos, and hosts military buildings. Local designers recognize both of these spaces as potential future parks, and the development of one of these sites is planned for the Bicentennial. If developed, either site would become the largest park in Iquitos.

Given that the former airport is entirely within the District of Iquitos, we had walked along all sides of its lengthy expanse during our 2019 field survey, peaking into its

walled off exterior where cracks would allow. Occasionally, people we encountered during our walking surveys would mention the space, asserting their visions of its use for agriculture, or simply noting that it was a big space with unused potential. During our meeting with the Ministerio de Vivienda, Construcción y Saneamiento, their architects showed us their vision for the site, a park bursting with rides and other attractions. It became clear that there was momentum towards assigning new functions and meaning to the site.



*Graphic by Hope Freije. Aerial photo showing possible sites for the Bicentennial park*



*Photo from Google Street View. A wall separates the public from the former airport site.*

There were several reasons Rhiannon and I chose to focus on the former airport site. In addition to our greater familiarity with it, its overall was another draw—its narrowness, while constraining possibilities, offered the potential as a corridor for foot traffic east to west, with a floodplain edge that inspired thinking about how to engage with it. Ultimately, the history of the airport's inception was a clear indication of the site's aptness for our project. The airport was built by the US during WW2, when the allied powers lacked access to the Asian rubber plantation market, and needed rubber to win the war. Many airports

were built during this time throughout the Amazon, to facilitate the transport of rubber. In a city whose history is intertwined with the rubber industry, this site presents a poetic potential to propel the city towards its next era of sustainable growth.

### Diving Deeper into Site

Jorge Tapullima provided us with a series of maps from the City's planners, which provided crucial information about topography, sewer and water access, plazas and green spaces, and several other features that were significant to our analysis. We were not, however, able to access current photos of the site—Google Maps does not allow users to even drop a pin within a block of most parts of the site. We were in that sense limited, but the goal was not to create a construction document that the city could use to build their park, but rather to offer a vision for how the Bicentennial park could act as a critical piece of infrastructure. Much of our site analysis was thus at a district level, looking at the effects of struggling infrastructures on human and ecological health.

Through the provided maps, review of local theses, planning documents, and our own observations, we gathered information about the site's challenges and opportunities.

The following were key focuses of our site analysis:

- Floodplain agriculture + floating communities
- Neighborhood context
- Road Connections + Pedestrian experience
- Water cycles
- Climate + microclimates
- Urban canopy and vegetation
- Design and programming of plazas



*Graphic by Hope Freije. The former airport site borders the water on the west side of Iquitos, where stilted communities live in the floodplain and the lumber businesses line the shore.*

## The Floodplain + Floating Communities

The body of water at the northwest tip of the site is an oxbow lake, created by the movement of the Nanay River. During the wet season, a band of about 700 feet of water floods between the shore of the site and the adjacent land area. Over time, oxbow lakes become less connected to the river over, maintain less of a current, and eventually dry up. This dynamic quality inspired design thinking around how to maintain an engaging space along the edge as the water

wanes over time.

There is an outlet pipe flowing into the Moronacocho, depositing untreated sewage from the city. Since at least 1995, research institution IIAP has been recording levels of fecal coliform and other pollutants in this waterway (IIAP, 1995). Those living in the stilted community north of the site are at risk from the resulting bacteria and parasites in the water. The lumber industry, which is concentrated on the west side of the water, also contributes to pollution in the Moronacocho.

Traction has worked closely with the floating community of Claverito, on the floodplain of the Itaya River. Their team tests this water for fecal coliforms and other pollutants, and have been implementing landscape-based solutions to clean it. One of their approaches has been to work with the community to plant camu camu trees (*Myrciaria dubia*), a species native to the Amazon's wetlands that produces a fruit that contains thirty times as much vitamin C as do oranges. The stands of camu camu trees help to buoy

floating plants, which filter out pollutants and excess nutrients from the water. The trees also serve as a physical filter to garbage, which gets stuck in the web created by the branches, holding it there until the community can collect and dispose of it during the dry season. While many we spoke to cast blame on floatings communities for polluting the waterways, Clavarito has been leading efforts to clean it. Beyond this ecological value, the community sells the camu camu fruit to local markets. During the 1990s, the planting of camu camu trees boomed as governmental and NGO's promoted the industry, with the goal of exporting to lucrative markets in Japan (Blare & Donovan, 2018). The underperformance of these initiatives has been ascribed to the lack of local labor force available to maintain young trees, and that coveted riverine lands were already planted with other high value crops, and the lack of processing facilities (Penn, 2008). As the population of Iquitos has increased, selling produce to local markets has become a more common mode of making a living (Denevan & Coomes, 1992), yet the ability to export these crops would be more lucrative.



Graphic by Hope Freije. Schools, parks, homes, and areas of commerce.

## Neighborhood Context

The area surrounding the former airport site is largely residential, though in Iquitos, homes may also sell food or other goods, and bodegas tend to be scattered throughout every neighborhood. Iquitos does not have distinct neighborhoods in terms of wealth, but the Historic District is where you will find hotels and restaurants for tourists, as well as repurposed “rubber mansions.” Here the touristic boardwalk or “malecón,” overlooks the Itaya Floodplain. During the day, Artists sell their wares, and tour guides

offer travelers deals on excursions into the jungle. At night, locals flock to watch comedians, live artists, and other performances.

On the west side of the city, lumber stores are prevalent. While there are restaurants and plazas, the area does not cater to travelers. While there are plazas, they are less formal and central than those close to the Historic District.

Max Augustin Stadium north of the site can host a crowd of nearly 25,000 for soccer games.



Photo by Erick Romero, from Iquitos City Facebook page. Plaza Sargento Lorez was recently remodeled.



*Graphic by Hope Freije. Primary, secondary, and tertiary roadways in Iquitos, many of which are blocked by former airport site.*

## Road Connections + Pedestrian Experience

At a basic glance, the airport site reads as a barrier to traffic flowing in the north-south direction. Spanning nearly the width of the city, its presence is felt by vehicles that must circumvent it. The city's maps note a high concentration of traffic accidents around the southeast end of the site, perhaps reflecting a high amount of traffic build up. While there are relatively few cars in Iquitos, there are some 30,000 mototaxis on the road, as well as two-wheeled motorcycles

(Gaviria Navarro, 2016). One can quickly flag a ride from anywhere in the city, and this a common form of transportation among locals.

The prevalence of motorcycles contributes to a high level of noise (Aldo Silva López, 2016), which negatively impacts the pedestrian experience. This is exacerbated by precarious sidewalks and inconsistent tree canopy, making a trip on foot uncomfortable and risky. For those on crutches or in wheel chairs, these sidewalks are additionally prohibitive. Speakers at the Congreso Nacional de Arquitectos XVI echoed these sentiments, calling for an improvement to the pedestrian experience as a way to encourage walking as a form of transportation.

In a meeting with architects from the Ministerio de Vivienda, Construcción y Saneamiento, they noted the Ministerio's goal to bring tourists into other parts of the city, beyond the Historic District. Most tourists in Iquitos are on their way to jungle excursions, and neglect to spend time enjoying the city itself. In addition to increasing the overall

number of visitors to Iquitos each year (La Región, 2020), there is an opportunity to bring tourists into more parts of the city.

The Bicentennial Park could be both a feature that attracts tourists as well as the conduit through which they move across. Given the site's narrow shape, which spans 2.25km (1.4 miles) across the city, there is a potential to create a pleasant pedestrian experience along its borders as well as through the park itself.

Currently, the city is not well set up for runners and joggers—the noise, sidewalk terrain, and difficulty crossing streets make it an unsafe activity. During our 2019 trip to Iquitos, we did participate in a run for charity that attracted over 1000 participants in the city, blocking off streets to accommodate the event. This is one indication in a citywide interest in jogging, despite the rarity of runners throughout the streets on a normal day. Gyms in the city are also actively used for weight lifting, jogging on treadmills, and dance classes. We believe thus that a running track within

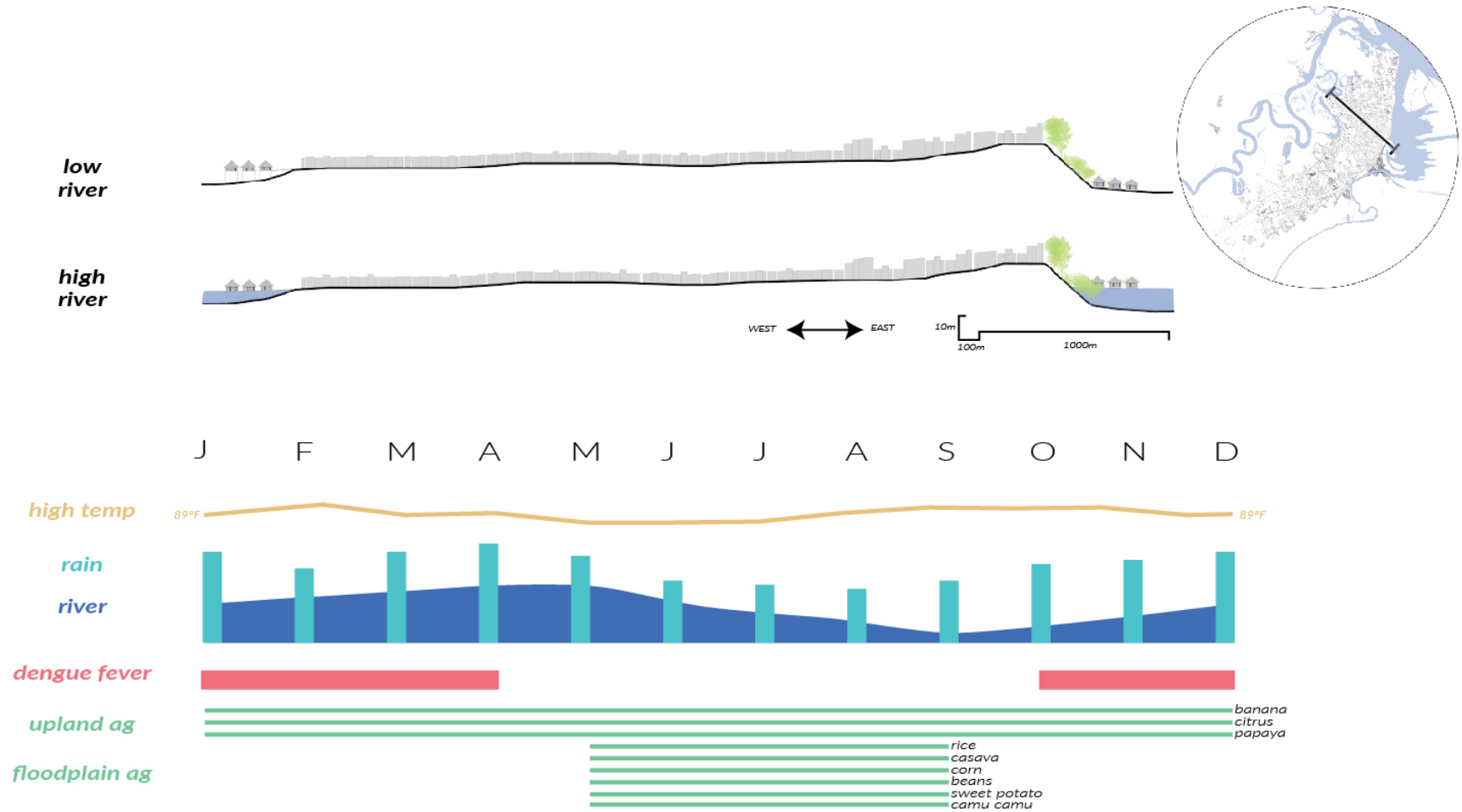
the park would serve the city—in addition to being within the park limits and away from traffic, canopy would line the edges to provide shade to runners.



*Photo by Rhiannon Neuville. A street in Iquitos with deteriorated sidewalks that pose a hazard to pedestrians.*



*Photo by Rhiannon Neuville. A sidewalk without street buffer.*

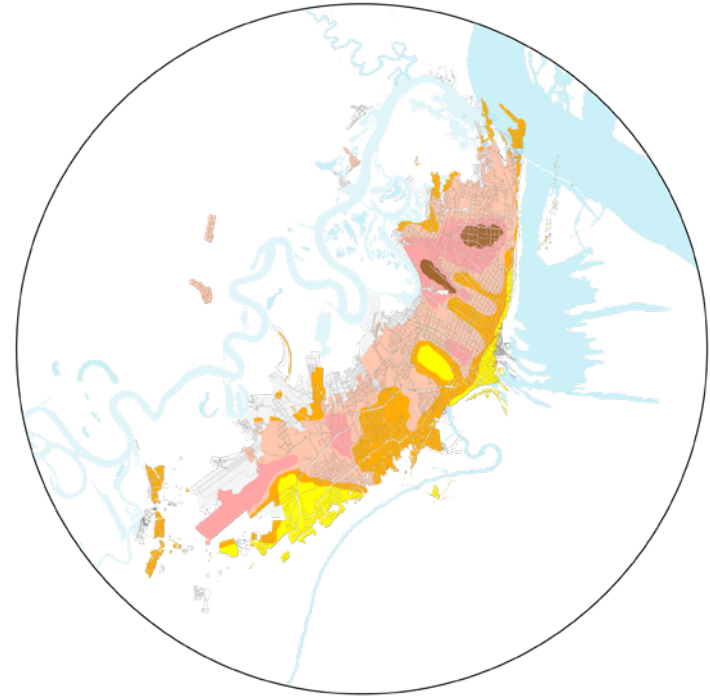


*Graphic by Hope Freije and Rhiannon Neuville. Water features centrally in Iquitos. Seasonality here is the wet and the dry seasons, while temperature remains consistent year round, with a high of 89°F throughout the year. While there is not a distinct growing season in terms of heat and rain, floodplain farming happens with the rise and fall of the water levels. Other systems are less intuitively connected to the water cycle, such as outbreaks of vector borne disease dengue fever, which tend to happen in the wetter months.*

## Climate + Microclimate

In addition to having a generally hot climate, Iquitos suffers from the urban heat island effect that affects many cities. According to data collected in the thesis work of Francis Darbin Villacorta Roca (2015), this effect is seen on our site, especially during the strong sun that hits the site in the afternoon. Urban heat island effect results from the high amount of pavement and reflective surfaces that trap and magnify heat. This is exacerbated by lack of urban canopy, which mitigates the heat island effect through shade and evapotranspiration.

In a climate that experiences high temperatures throughout the year, hotter microclimates can make spending time outside during the day unbearable. It is no wonder that we noticed parks with less tree canopy were virtually unoccupied during the day.



*Graphic from Francis Darbin Villacorta Roca, 2015. Urban heat island is seen to affect the former airport site.*

## Tree Canopy + Urban Greenery

Tree cover is inconsistent throughout Iquitos. Plazas tend to have spaced out or sparse canopy cover, which maintains a sense of openness and formality but misses an opportunity to provide relief from the strong equatorial

sun. When we interviewed local biologist Juan Ruiz, he lamented not only the absence of trees from the city scape, but the lack of native species as well. Like many US cities, Iquitos has trended towards ornamental, nonnative plant species, despite the estimated 5000 plant species that are native to the Loreto region (Belén Desmaison et al., 2018).

In interviews with Gabriela Vildolsola, she expressed that many in the city had concerns about trees in the streetscape interfering with the sidewalks and overhead cables. In conversations with people in Iquitos, including during a one-day questionnaire we set up on the street, several confirmed this concern, and expressed the push and pull between the city, which owns the streetscape planting strips but only maintains them in select areas. Thus, while many voiced the desire to see more urban greenery throughout the city, they felt it was the municipality's duty to tend to street planting beds. Some spoke of the Iquitos they knew just a decade or so prior, which they described as having more urban greenery and more diversity.

## Design and Usage of Plazas

In Iquitos, the most common park typology is the plaza. Plazas are important spaces in Iquitos, and in many other places in Latin America. In Iquitos, they are places where people sell goods, children practice dance routines, and moto taxi drivers rest between rides. During our three months living and studying in Iquitos, we passed through plazas every day, especially Plaza Sargento Lores and the Plaza de Armas. During our two week walking survey, we observed nearly every plaza in the District of Iquitos, noting those with stages erected for Saturday concerts, those with standing water or missing bench boards, those with built in gym equipment but no canopy, and those that filled at night with friends and family.

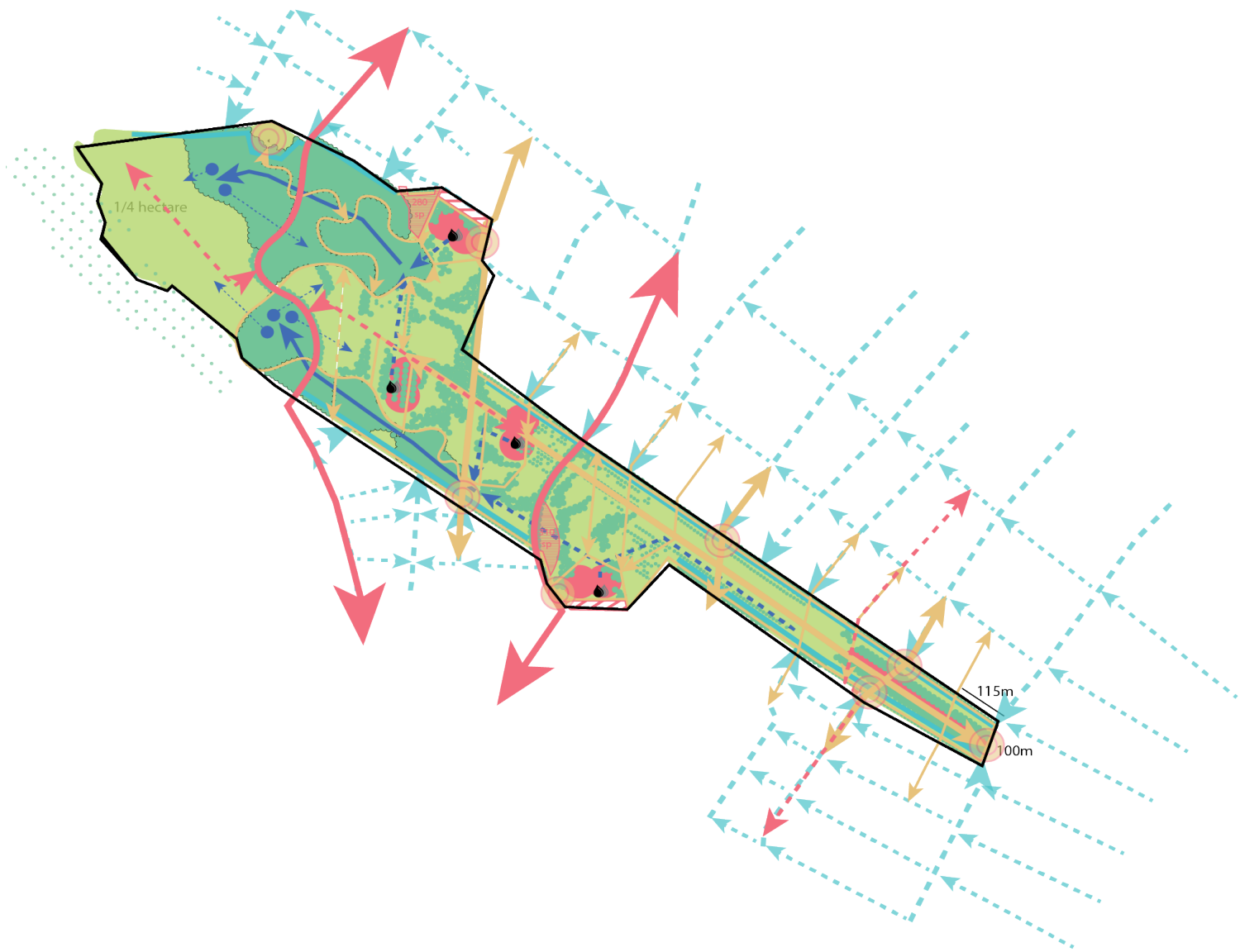
The Spanish plaza reads as a continuation of the urban fabric, inviting the city in with its open edges and central gathering areas. Geometric lines create pathways through, the shapes of which are emphasized by formal plantings and tree alleés. A strong focus, often a statue or fountain in

the middle. Some spaces break free of this pattern, though this colonial design language has become standard through Iquitos.

Newer plazas in Iquitos seem to be breaking away from the traditional form. Plaza Bolgnesi houses two spherical structures, designed as butterfly gardens but, as of our last visit, they had been tampered with and were not functioning. This plaza also includes a crescent-shaped drainage system decorated with stones. Public gym equipment seen in one plaza also invokes a new identity. There is an opportunity to push the Iquitos plaza towards a design that considers the ecological concerns of the city by increasing biodiversity and permeability. As the city pushes for more green space, they can also work to define a new plaza design language that embraces the stunning biodiversity of the Amazon.



*Photos by Hope Freije.  
Above: Plaza Bolognesi features two domes  
intended to be used for butterfly gardens.  
Below: A pyramidal structure serves as a  
foci for a traditionally geometric plaza in Iquitos.*



*Graphic by Rhiannon Neville. In this layered design approach, systems of water, canopy, and circulation are woven into healthy, productive spaces that celebrate the culture of the Amazon.*

# CHAPTER 04

## DESIGN: THE BICENTENNIAL PARK AS INFRASTRUCTURE FOR IQUITOS

The analysis of Iquitos' extractive history and current site conditions generated both concrete goals and layered cultural meanings. As a former airport created to transport rubber, it presents the opportunity to reference this formative history. With vast surface area, it has the potential to interface with the surrounding residential neighborhoods and offer ecological amenities. Its floodplain edge invokes the tradition of farming the river's shores, as well as the present challenge of mitigating the urban pollution flowing into the waters. Add onto these possibilities the criteria for the Bicentennial park: a museum, a library, and a community center, among others.

There are a myriad of possibilities for any site, thus the design process necessitates a distillation of goals. As a piece of infrastructure for Iquitos, what would this park do? Human health and economic diversity were goals from the beginning of this project, and through our studies of infrastructure we began to see its role as such—an ecological system that promotes human health and facilitates exchange and production. Through the exploration of extractive histories and current literature (Belén Desmaison et al., 2018), the goal of increasing economic diversity became, more specifically, to move away from extractive industries and towards an economy that benefits the local population. How can a park aid this process of moving Iquitos toward a sustainable economy?

And beyond these two goals, a Bicentennial park should be a celebration of culture. The Amazon region has a rich history that is not always celebrated in the built environment in Iquitos, and this park design has the

opportunity to challenge this. The three main goals of this design are thus: Eco-health, Eco-culture, and Eco-industry. The park becomes a poly-functional piece of infrastructure that works to clean water and create spaces for comfort and exercise, while layering in commercial spaces and drawing in tourists. Each goal is carried out in a way that considers the surrounding ecology, resulting in an interconnected system.

## Goals

### Eco-Health:

- Collect and filter stormwater
- Collect and treat black water
- Infiltrate standing water
- Provide opportunities for recreation
- Create cooling spaces and green corridors
- Capture garbage in the floodplain

### Eco-Culture

- Create space for performance
- Celebrate Amazonian diversity
- Reveal history of airport and rubber industry

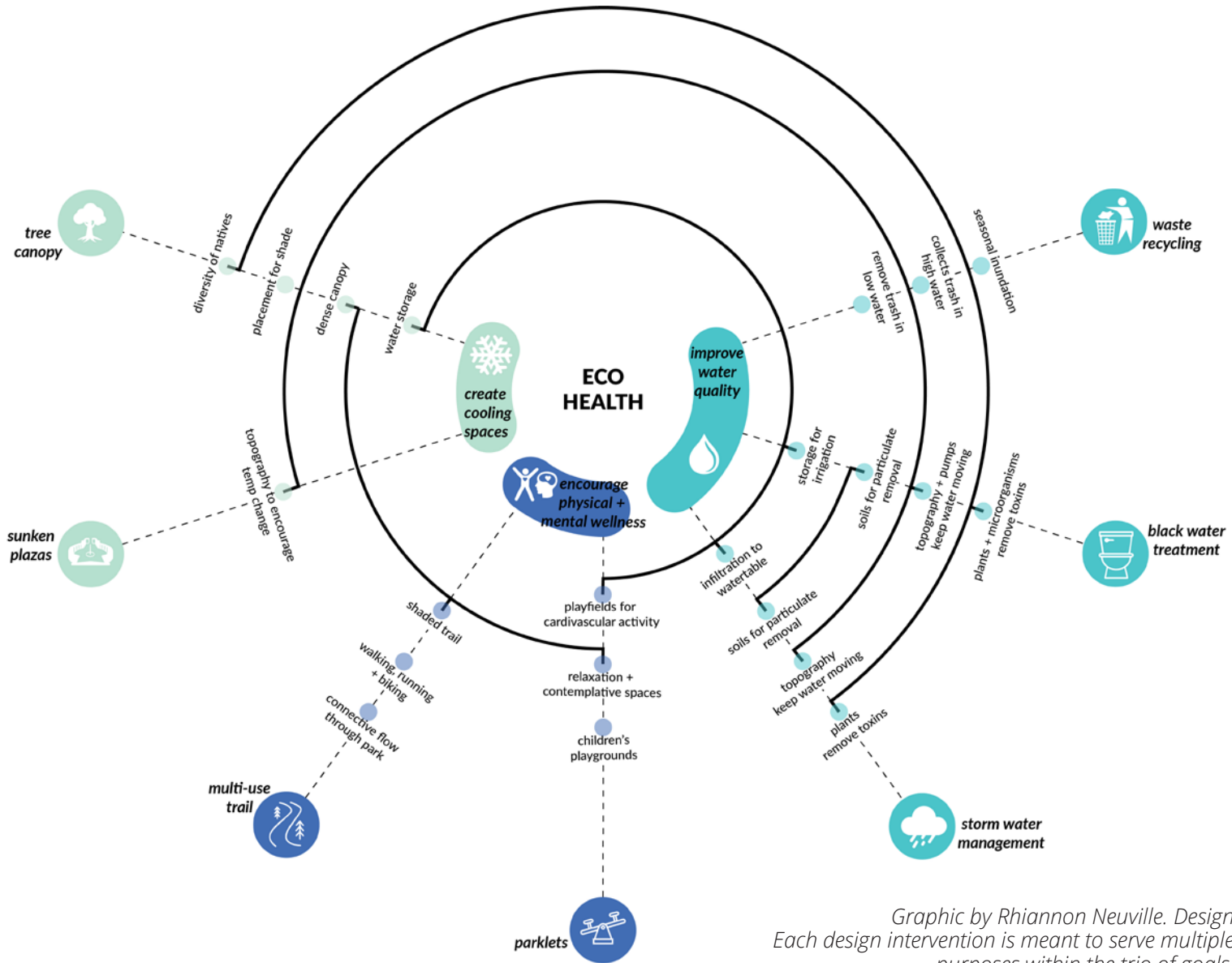
- Host museum with botanic garden
- Create welcoming edges
- Layer histories of ethnobotany and floodplain agriculture

### Eco-Industry

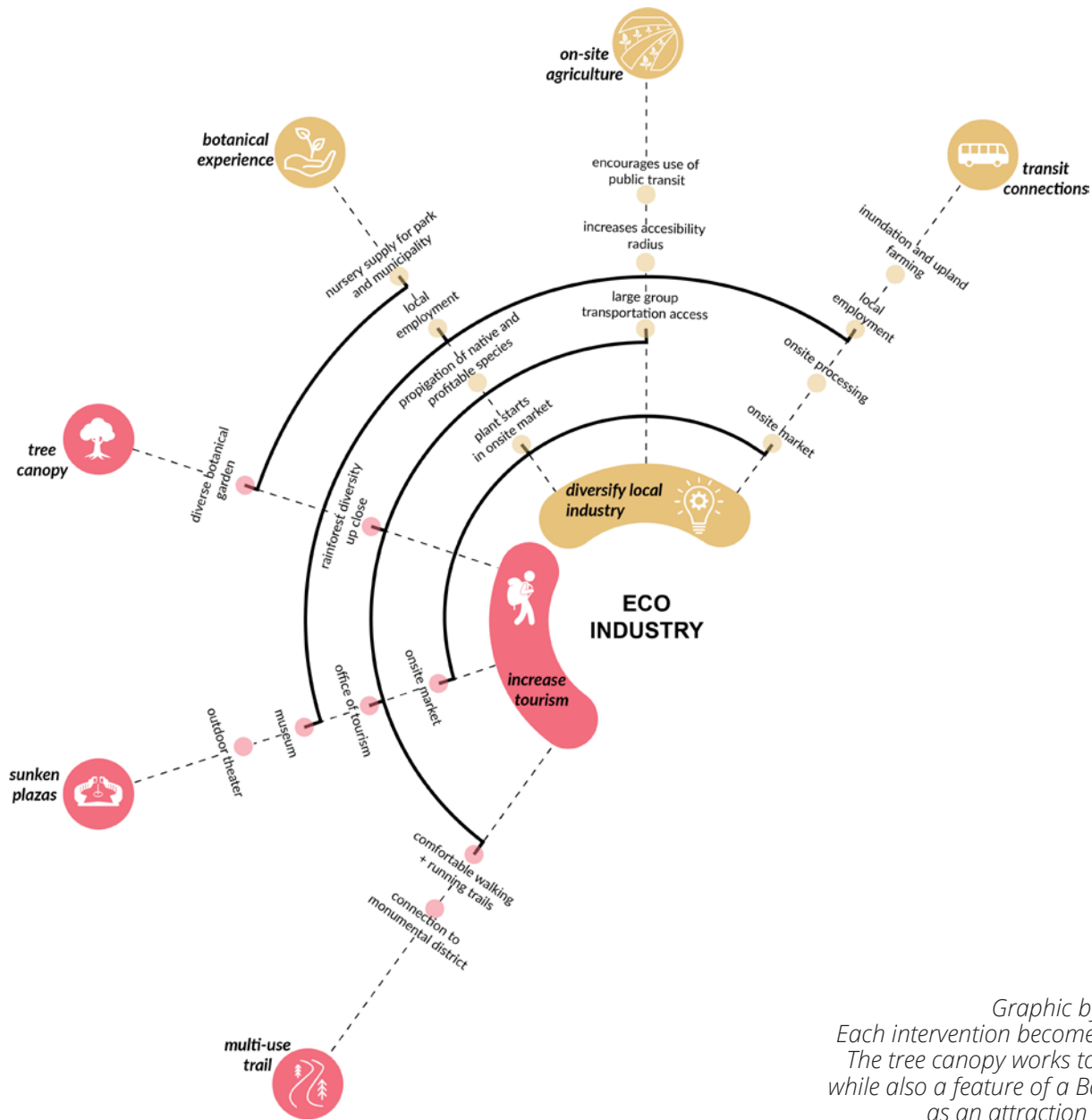
- Reserve majority of floodplain for agriculture
- Create plant nursery
- Encourage tourism
- Provide venues for artists
- Accommodate informal commerce

## Developing a Design Language

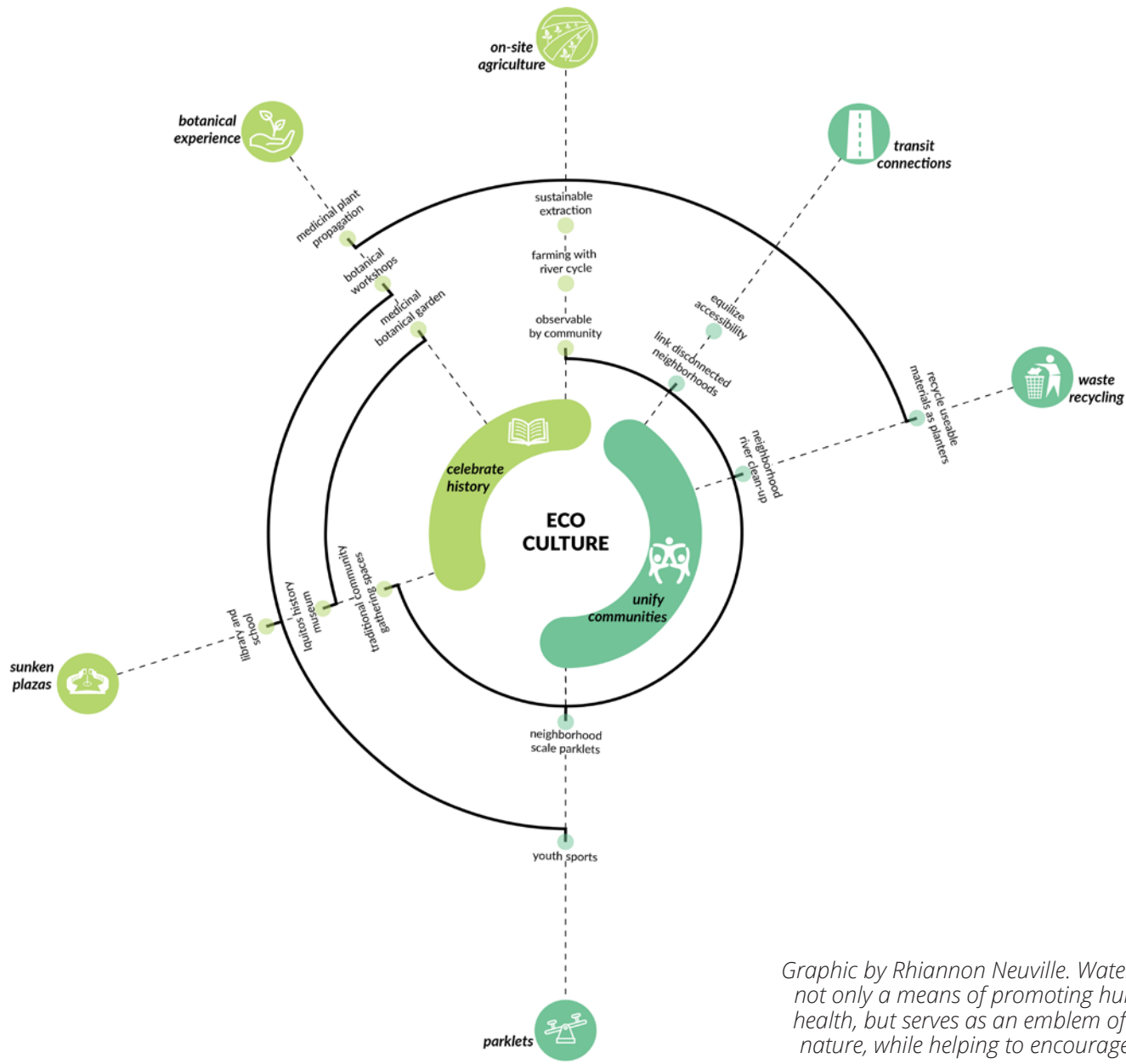
The process of recognizing that our own experiences of parks are different from a Peruvian was key to developing our design language. An urban park in the U.S. is often a space carved out of the city, where people go for respite, recreation, and a daily dose of nature. In Seattle, this manifests in designs such as Volunteer Park, where a tree-lined perimeter frames gathering lawns within, as well as a reservoir, museum, and repurposed water tower.



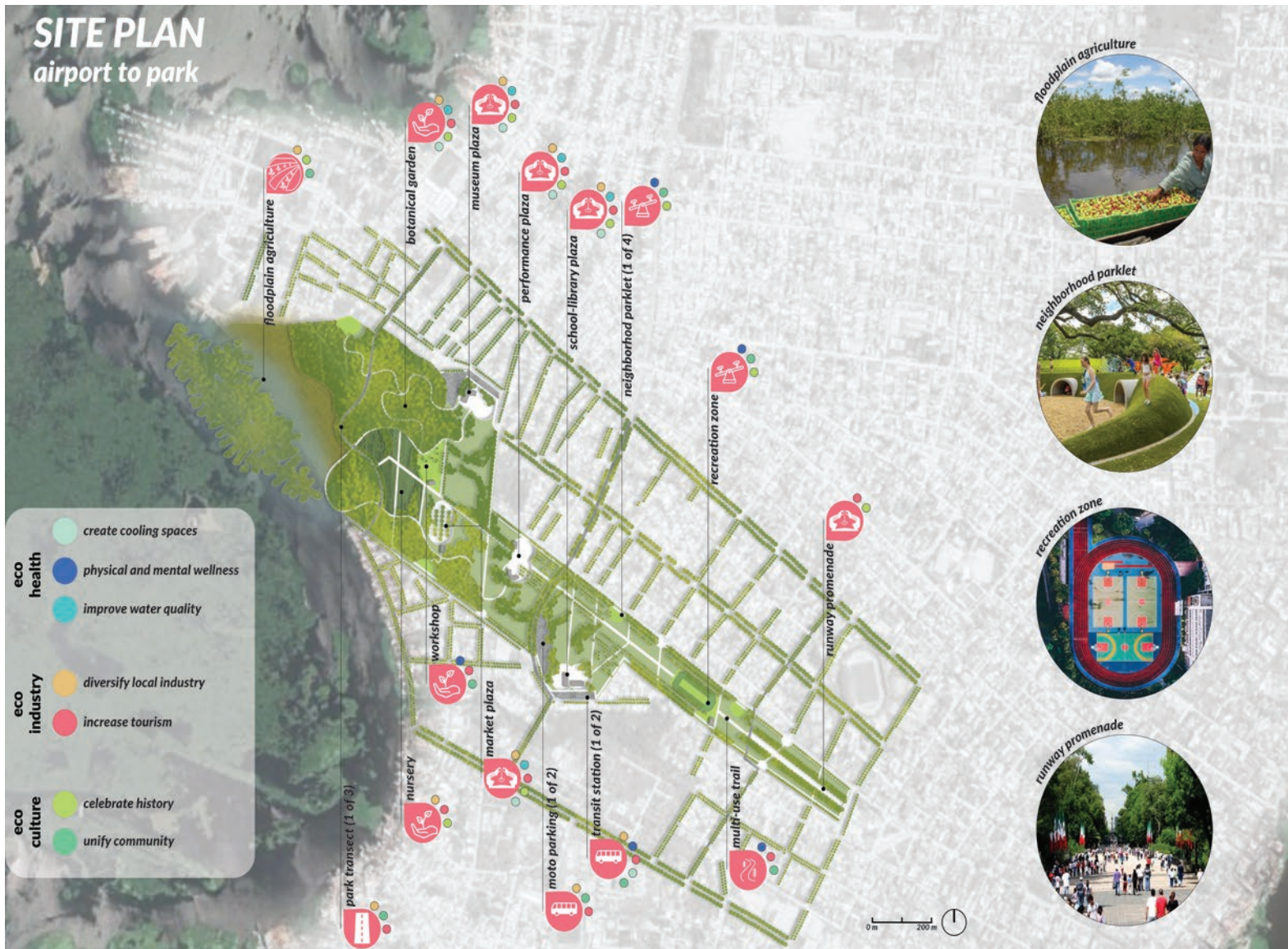
Graphic by Rhiannon Neuville. Design Each design intervention is meant to serve multiple purposes within the trio of goals.



Graphic by Rhiannon Neuville. Design  
 Each intervention becomes layered with functionality.  
 The tree canopy works to provide shade and habitat  
 while also a feature of a Botanic Garden, which serves  
 as an attraction for locals and tourists alike.



Graphic by Rhiannon Neville. Water recycling becomes not only a means of promoting human and ecological health, but serves as an emblem of local connection to nature, while helping to encourage a culture of reuse..

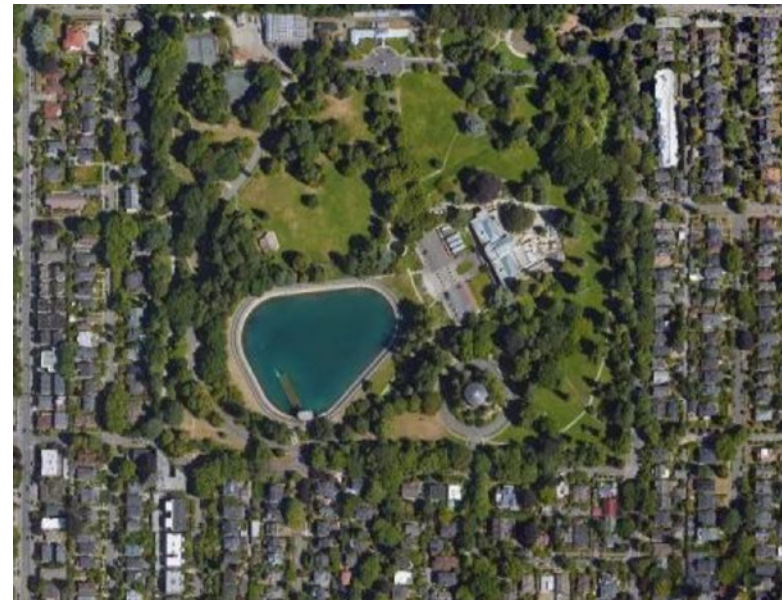


Graphic by Rhiannon Neuville. The programs described on pages 71-73 are specialized here in plan and coded according to the goals they address. The airport runway is seen as the park's main access, which yields to a network of boardwalks towards the floodplain.

Curved paths traverse gentle grading, and as one walks along, the mature evergreens invoke a sense of history. At Discovery Park, a more heavily wooded edge frames a journey of prospect and refuge down to the water's edge. Curved paths simulate a natural meander through moments of dense canopy, open grasslands, and historic military buildings. Our experiences in parks shape how we envision what parks should look and feel like. This was apparent when our first design iteration employed winding paths and dense canopy that felt familiar to us, but lacked a connection to the design language of Iquitos.

We also recognize how our education at the University of Washington in Seattle has guided our values toward public space as a venue for addressing issues in the urban ecology. We have been trained to see opportunities to incorporate green infrastructure to mitigate stormwater, and to use native plants to attract local wildlife. While these approaches are rooted in research and are applicable to many sites, they reflect

our values, as designers in the Global North, as students of the University of Washington, and as coastal city dwellers. While we cannot shed our biases, understanding them helped inform our design language. We sought to blend our idea of park design with the formality and geometric lines customary in Iquitos, while embedding ecological infrastructure into the forms.



*Image from Google Maps. Volunteer Park, Seattle. Tree canopy forms a border from the surrounding city, creating an experience of respite.*

## GATHERING

## WILDING



explore through the voids  
ecologically complex  
thoughtful productivity

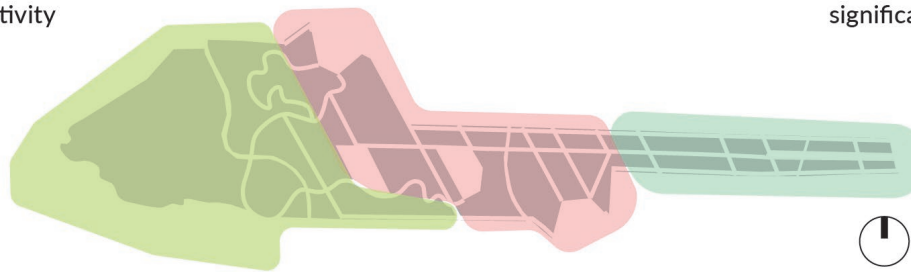


network  
social interactions  
embrace and frame space

## CONNECTING



traditional promenade  
formality and symmetry  
significance of connectivity

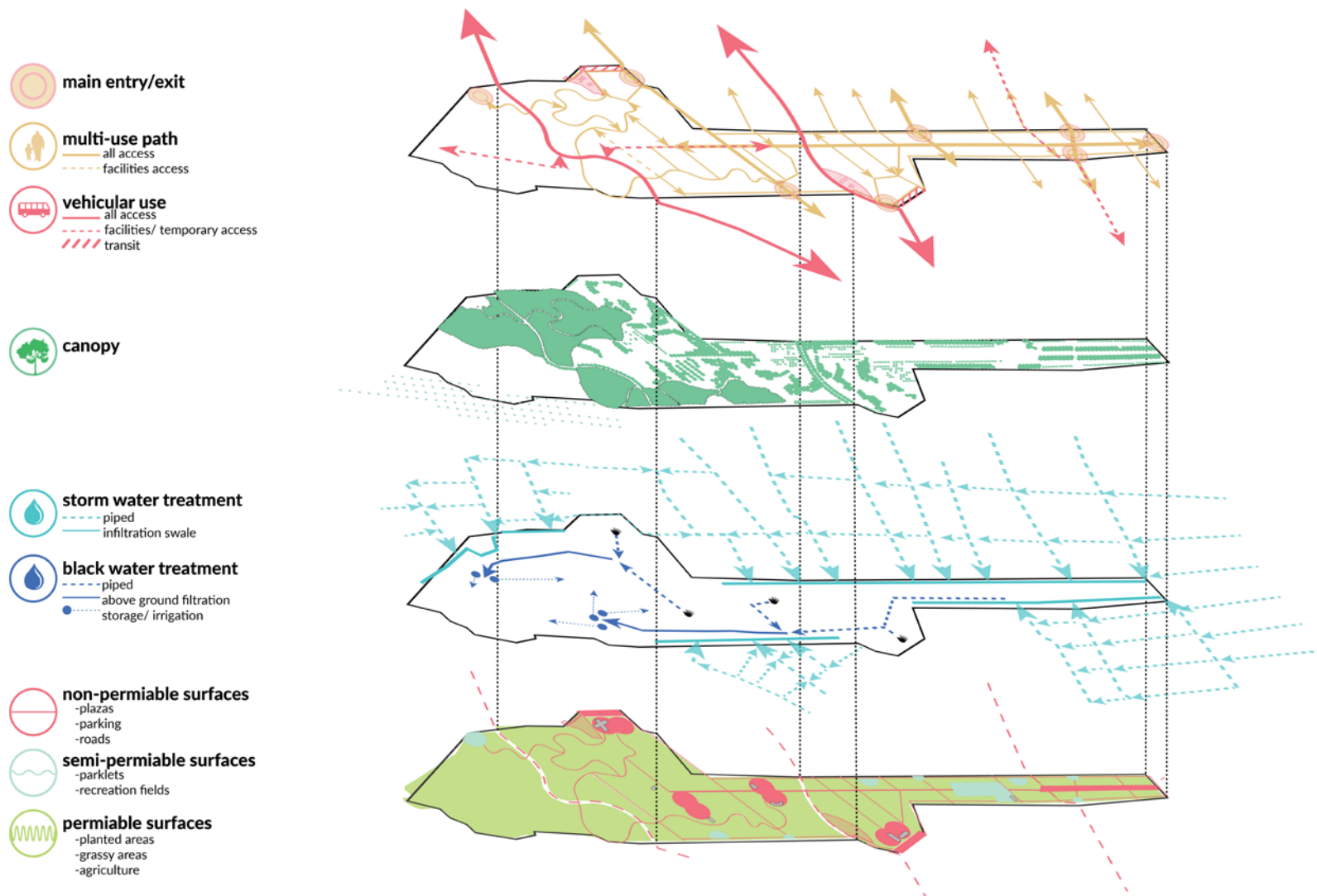


*Graphic by Rhiannon Neville. The park is used to bridge the gap between the common interpretation of a park as a prescribed interaction with nature through controlled organization of elements to our own vision for parks as pieces of urban infrastructure which mimic and embrace the ephemerality and resilience of natural systems.*

The resulting form reflects the site's history as an airplane runway, with a strong spine defining the main pathway. As one moves east to west along this central axis, the experience transitions from a traditional promenade into a network of paths and canopy that shape spaces for education, performance, and commerce. Finally, the landscape shifts from an urban refuge into an ecologically complex habitat that celebrates native species and thoughtful productivity of the land. Along the western floodplain edge, people are no longer prioritized, but rather invited to explore through the voids carved through dense vegetation. While the park can be experienced in any number of ways, the linear progression helps to blend the urban fabric into the floodplain.

Layered on top of this linear progression are poly-functional networks of circulation, canopy and water, which work to shape space while performing ecological functions. Rather than acting as a barrier to movement across the city, the park invites people in with extended tree-lined arms, welcoming edges and neighborhood "pocket parks,"

and allows the movement of motor vehicles through at key points, balancing the accessibility of people on foot with the need to connect neighborhoods, businesses and resources on either side of the park. Neighborhood-facing nodes act as conduits for storm water, which is quickly infiltrated through a filtering system, preventing it from pooling on the surface. The entire park acts as a sponge through extensive canopy and permeable surfaces, while using the transition from formality to wildness to blend within the surrounding urban fabric. These three typologies of space—connecting, gathering, and wilding—came to define the programs and design language of the park design.



*Graphic by Rhiannon Neuville. Networks of circulation, canopy, and water are embedded into site programs. The surface of the park maintains a high level of permeability, acting like a sponge for frequent tropical rains.*



## Connecting

At the park's southwest entrance, the site's recent history is preserved as the airport runway becomes a grand promenade entrance. The 6m wide path acts as a thoroughfare gathering space, accommodating vendors and benches while maintaining a flow of foot traffic. Like a local plaza, the promenade blends in with the urban fabric, and footpaths connect to the surrounding grid at every block. Trees with dense canopy are arranged in aleés to emphasize the promenade feel, while also acting as a buffer to road noise and pollution, providing habitat to support urban biodiversity and easing diseases exacerbated by heat, such as respiratory disease. A display of rubber trees or other plants that were key extractive industries would enhance the historic meaning to this entrance.

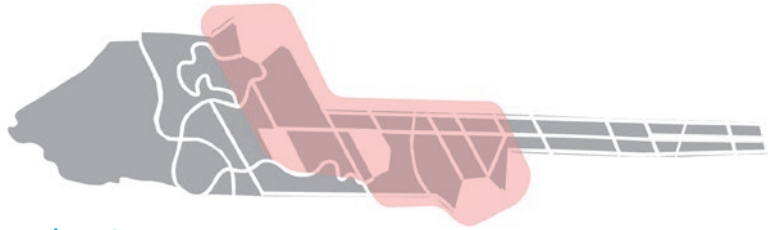
The promenade ends with, a recreation area, which speaks

to the culturally adored tradition of playing soccer and volleyball on fields and in the streets throughout Iquitos. A 1km, tree-lined running track provides a shady experience for joggers while working to absorb runoff directed away from the sports fields, preventing soggy game conditions.

This section of the park is this about movement through and movement within. The promenade ends with a thoroughway for traffic, which is also lined with trees, which act as a buffer for noise and pollution, while also creating a momentary park experience for those just driving through.



*Image from Grupo de Diseño Urbano. The Bosque de Chapultepec, in Mexico City, was a precedent for the feel of the airport runway promenade.*



## Gathering

In the middle of the park, the central axis remains but is intersected by a network of paths and canopy that shape spaces for gathering. Hints of formal aleés remain, but patches of trees also appear and create large rooms within the park's expanse, also serving as denser areas of habitat for local biodiversity. Pocket parks, plazas, and areas for parking are all within the embrace of canopy, creating comfortable moments for those enjoying the park or simply resting in their moto at its edges.

The plaza appears in this section—situated on the edges, they become conduits for the park, inviting people in an encouraging them to trickle in to enjoy the rest of the park. Each features a main attraction—a library, performance amphitheater, museum, and market space—which bring in tourists and locals alike to shop, learn, and gather.

These plazas become part of daily life for many in Iquitos—those who sell their produce at the market, those who study at the library—as well as a special moment for those who come to watch a performance or learn something new at the museum. While each part of the park represents cultural aspects of Iquitos and the Amazon, it is in these spaces that culture is on display, celebrated, and cultivated.



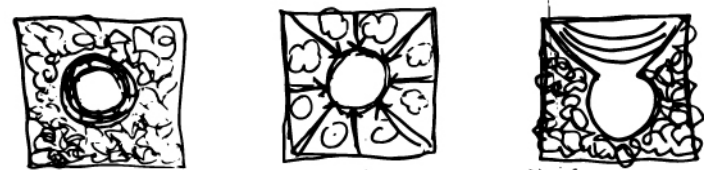
*Graphic by Rhiannon Neville. The park's four plazas each feature unique programming.*

The intention was to design a plaza that spoke to the traditional Spanish plaza while embracing other forms and layering in additional function. A form seen in rural Amazonian communities was the inspiration for the plaza floor's shape, a circle of community space carved out of the Amazonian thicket. This circle form becomes the plaza floor, which is embedded within the geometric language of the Spanish plaza, but this formality is interrupted with topography. The Amazonian thicket becomes a hug of canopy that provides shade, while preserving visibility into the plaza.



*Image from Haiman el Troudi. An aerial view of a village in the Amazonian rainforest.*

The sunken plaza is a space lowered 3m below the surrounding grade to create a cooler microclimate, while also directing stormwater into a filtration system that is embedded within the plaza itself. The plaza becomes a piece of infrastructure, cleaning water, reducing standing water, and easing the stress caused by heat.



*Top: Image from Dezeen. Sunken brewery designed by SuperLimão Studio uses gabion walls to reduce energy usage.*

*Bottom: Concept sketch for the central plaza by Hope Freije. Carving out, focusing inward, welcoming in.*

# WELCOMING IN

+create cooler microclimate to reduce urban heat island effect and chronic diseases exacerbated by heat

+minimize standing water to reduce vector and water borne diseases

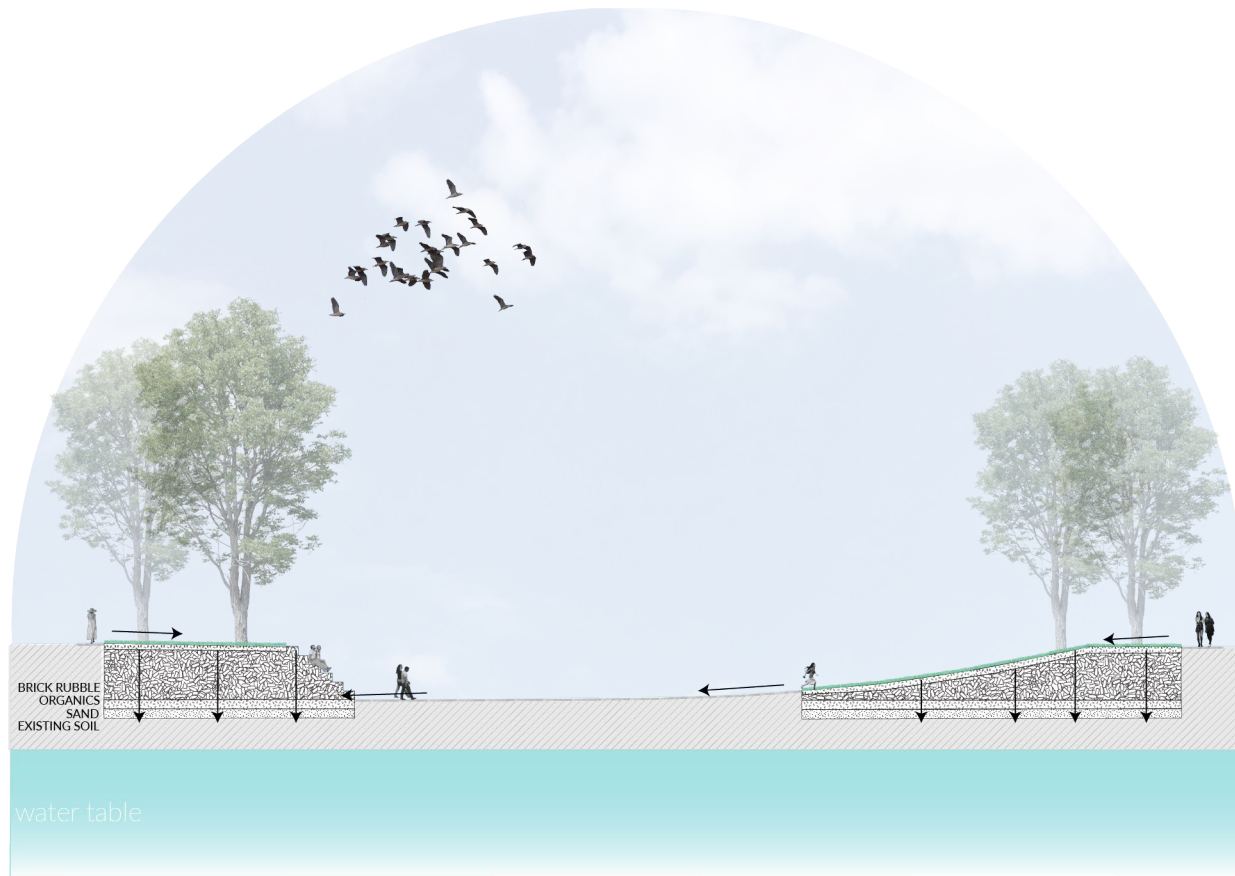
+layer traditional and colonial forms to celebrate the cultural diversity and complexity of Iquitos

+interface with the neighborhood to promote community

+Support tourist economy and celebrate culture by creating a space for large performance events



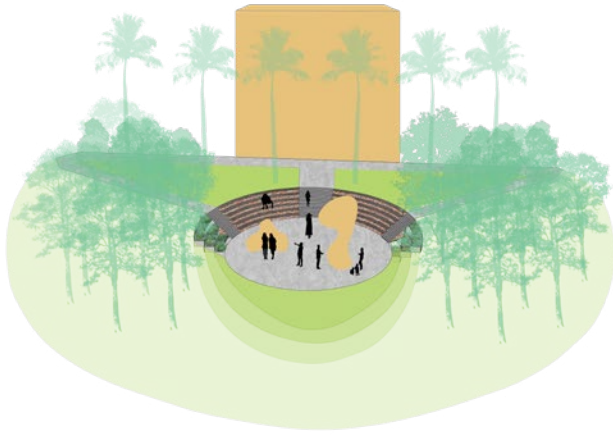
Graphic by Hope Freije. The performance plaza features an amphitheater, a space largely missing from Iquitos. The performance plaza acts as theater 'foyer,' as well as a practice space where children can practice dance routines and local comedians can perform their routines, as in seen in other public spaces in Iquitos. The vegetation surrounding the plaza serves as the first stage of filtration, using plants to clean the water before it flows into the plaza system.



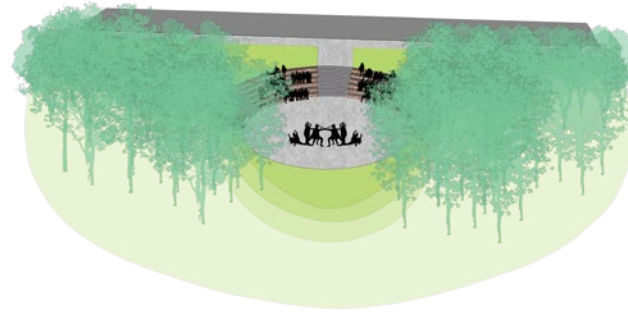
*Graphic by Hope Freije. Terraced rock gabions serve as seating as well as a filtration medium. Gabions are filled with brick rubble, a plentiful material in Iquitos that offsets concrete use, while also slowing and filtering water. A layer of soil and sand starting below ground level are the final stage of filtration before the water reaches the water table. In addition to acting as a storm water runoff filtration system, this system serves to keep water from pooling on the service and becoming breeding habitat for mosquitoes. The layer of brick rubble maintains efficient drainage, encouraging the water to move away from the surface. As the water filters through this rubble layer, the clay bricks absorb some water, which provides a cooling effect as it evaporates back into the atmosphere.*



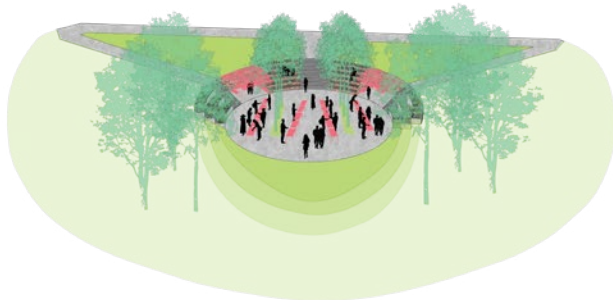
*Graphic by Hope Freije. The plaza invites the neighborhood in to enjoy shade, seating, and beautiful Amazonian plants. The shaded edge makes space for parking motos, where many in Iquitos spend time napping or socializing.*



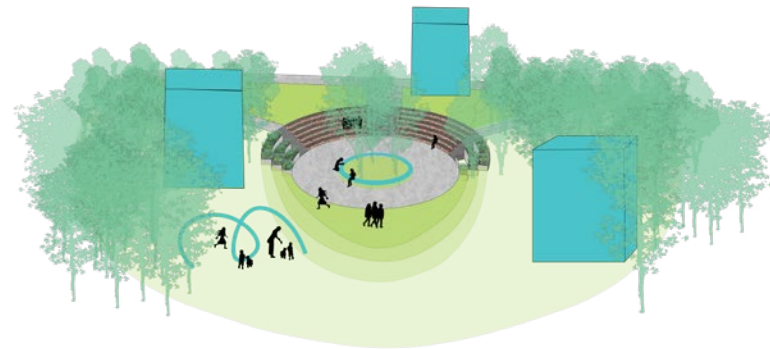
museum



performance



market



education

*Graphic by Hope Freije. Each sunken plaza faces an edge of the site and is associated with one of the park's attractions—a museum, an center, the market, and a performance amphitheater, welcoming the neighborhood in with stairs down to its shady space, which spills out into the interior of the park, encouraging them to explore the other spaces. In this way, the plazas serve as the foyers for these main attractions, while also carving out space for the informal commerce that proliferates in the streets of Iquitos. Around each plaza, swaths of canopy shape space and provide shade, creating the feeling of large 'rooms' while introducing a more wooded feel. As one continues along the park's central axis, they soon find themselves enveloped in Amazon green.*



## Wilding

The section of the park nearest the floodplain celebrates the botanical splendor of the Amazon. The central spine of the park ends, yielding to a winding experience carved out of dense canopy. Raised boardwalks meander through the thick jungle, creating opportunities to peer down at nursery operations and floodplain agriculture below. Plants become the area's main attractions, featured as an emblem of the region's past, present, and future.

In the botanic garden, attached to the site's museum, signage tells the stories of historic uses of plants as medicine, as well as the region's history of extraction. It acts as a living tribute to the deep indigenous knowledge that has allowed peoples to thrive in the Amazon. Tourists flock to witness the Amazonian splendor up close, and locals

come to connect with ethnobotanic traditions.

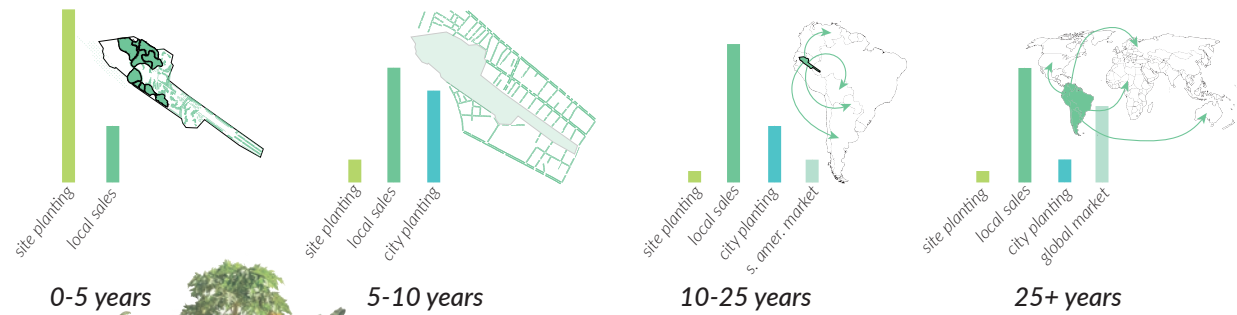
Along the floodplain, space is designated for agriculture, where neighboring communities can grow crops to sell in local markets. This simultaneously serves as an economic strategy, a testament to the tradition of floodplain farming, and an ecological intervention that replenishes biodiversity along the urban edge. The grove offers its highly nutritious fruit, which is used in concessions on site, sold to local markets in Iquitos, and over time, investment in a processing facility for the fruit would open up the possibility of exporting to lucrative international markets. Meanwhile, the network of branches captures trash during the high river season, allowing the community to gather and dispose of it when the water goes down. Some materials such as plastic water bottles are reused as planters for the nursery.

A raised path winds through the islands of camu camu trees and their webs of floating plants during the wet season. When the water level goes down, the boardwalk becomes a canopy experience. By raising the path, the

productive land is shielded from foot traffic, but visible by park goers, who can witness the fertile floodplain in action. Throughout this path experience are opportunities to sit and take in the splendor of the Amazon around you.

As the floodplain produces fruit and other crops, the nursery begins to grow plants to populate the botanic garden and other areas on site, and for sale in the market plazas. The park itself then becomes advertising for the nursery's goods, showcasing native plants and inspiring others to bring them home to their gardens.

**% of production**



**production focus**

**agricultural trees**

- Carica papaya* (papaya)
- Musa x paradisiaca* (plantain)
- Myrciaria dubia* (camu camu)



**medicinal botanics**

- Bidens pilosa* (spanish needle)
- Croton lechleri* (dragon's blood)
- Jatropha curcas* (bubble bush)
- Scoparia dulcis* (sweet broom)
- Tynanthus panurensis* (clove vine)
- Uncaria tomentosa* (cat's claw)



**home-garden starts**

**popular house plants**

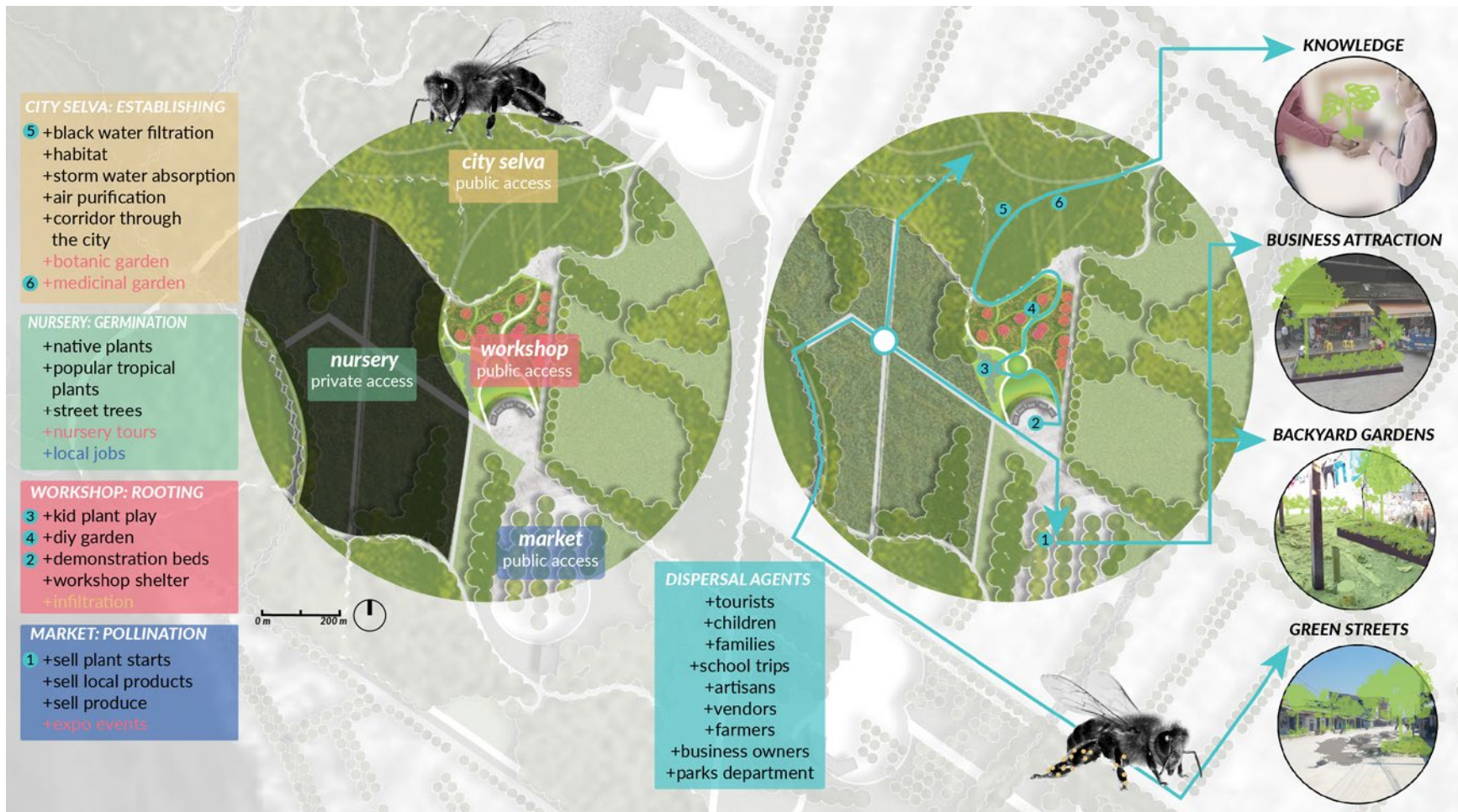


**street trees**

- Albizia saman* (rain tree)
- Amburana cearensis* (ishpingo)
- Bixa orellana* (achitoe)
- Couroupita guianensis* (cannonball tree)
- Humiria balsamifera* (bulletwood)
- Swietenia macrophylla* (mahogany)



Graphic by Rhiannon Neuville. The nursery first works to provide plants for the park itself. Over time, it begins to nourish the city by growing street trees for the municipality. Eventually, crops started in the nursery are distributed to global markets, providing revenue for farmers and processors in town.



Graphic and caption by Rhiannon Neville. In the urban environment, the people are the species who live, work and interact in every corner of the city and so it is them who will be the dispersers of the urban forest to ensure new generations of a greener city.



**1 market**



**2 demonstration beds**



**3 plant playground**



**4 diy garden**



**5 6 botanic garden + black water treatment**

Graphic and caption by Rhiannon Neville. The four spatial elements at play and attracting a wide range of people to the site are the city selva or botanical garden, the plant nursery, the workshop space, and the market. The nursery is closed to the public, but is the point of germination, where plants starts are produced for use on-site or sold in the market. The market is where pollination occurs, as people come to buy produce from the agricultural fields, crafts from artisans and plant starts for their home or business. The workshop is a place to share information and let ideas begin to take root. There are demonstration beds, DIY garden ideas, and a play space focused on learning about plants. The fourth space is the city selva, a series of botanical gardens that show the growth structures of the rainforest, medicinal plants, and the blackwater treatment system up close. As people come and go from this space they leave with not only plants, but what they've learned about plants and all the systems they are a part of.

# CHAPTER 05

## REFLECTION

There is a lot at stake in Iquitos. Its dynamic rivers and lush forests are more than simply providers of ecosystem services for the globe—they are symbols of the lifeways that have existed in the Amazon Rainforest for thousands of years. In addition to hosting over 5000 species of plants, the Loreto region is home to 60 of the 76 ethnic groups in Peru. In the wake of global exploitation and continued isolation from economic pathways, the hope is that Iquitos can move forward while regaining some of its lost connection to its biodiversity.

Many of the struggles in Iquitos do not look much different than from other cities—the pavement dominated surfaces, the lack of urban biodiversity, the pollution of local waterways—these are characteristics we see across cities in the U.S. However this city happens to be nestled within a

globally critical ecosystem, making its successful evolution as a sustainable city all the more crucial.

Though there are eyes on the Amazon and its ecological fate, those who live in the Basin itself will be the ones who suffer most from the pollution, deforestation, and effects of climate change. An ecological approach to urban growth should treat humans as a critical piece of the ecological web, understanding that socioeconomic factors cannot be disentangled from human health. A move away from extractive industries would benefit both the local human and nonhuman inhabitants of the Amazon, making it a radical step towards resiliency.

Creating healthy, vibrant, and culturally significant public spaces could be a key strategy for moving forward in this way, offering a platform to showcase biodiversity and cultural values to tourists and locals alike. The Bicentennial Park in Iquitos thus holds true potential to bring these changes in Iquitos. For those living in the floodplain, it could mean cleaner water and new amenities. For those with

stores and restaurants on the west side of the city, it could mean an influx of tourists spending money at their businesses. For the next generation of Iquitos, they could spend their free time in the City Selva playground or practicing dance routines in the sunken plazas. For those we spoke to during our one day survey in Iquitos, who lamented the destruction of city canopy, it could symbolized a revival of the city they once knew and loved.

The Bicentennial Park could also serve as justification for eradicating informal communities from the floodplain. It could manifest as an expanded Spanish style plaza, with high amounts of pavement and low biodiversity. It could miss an opportunity to connect with local neighborhoods and support human health. It is therefore necessary for many voices to be at the table as the City moves forward with this design. Ecologists, botanists, and advocates for the fringe communities must be able to weigh in on this design, in order to create a design that promotes health for the human and nonhuman residents of Iquitos. Through a layered a approach that prioritizes the health of these

entities, the growth of sustainable economies, and the celebration of the rich Amazonian history, the Bicentennial Park can serve as a piece of infrastructure to move the city towards the resilient future they envision. As the city changes, perhaps welcoming in more cars, tourists, and urban amenities, and urban amenities, there will be new opportunities and challenges, and there will no doubt be local leaders advocating for these changes to happen in partnership with nature. Publicly accessible, ecologically rich and poly-functional green infrastructure should be a critical part of this process.

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