# Cities in Amazonia

## PEOPLE AND NATURE IN HARMONY


IDB

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Nora Libertun de Duren, Editor
**Inter-American Development Bank**

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# Cities in Amazonia

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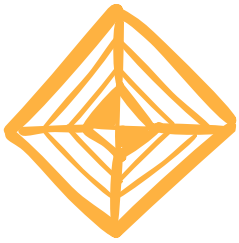
# ABSTRACT

This book explores the complex and rapidly evolving urbanization of Amazonia, a vast, diverse and ecologically critical region undergoing a profound transformation. Amazonia is now home to nearly 41 million urban residents across 895 settlements — and yet its urbanization remains poorly understood, underestimated in scale, fragmented in form and frequently overlooked in policy.

Through multidisciplinary perspectives and contributions from more than 50 experts, this book examines how urban growth intersects with environmental degradation, social inequality and gaps in governance. Despite these challenges, cities in Amazonia are also places of promising innovations, from tailored healthcare services and environmental monitoring to community-led planning and cross-border cooperation.

Rooted in both local insight and regional coordination frameworks, including the *Amazonia Forever* program, this work offers a holistic and evidence-based understanding of urbanization in Amazonia. It argues for urgent, coordinated action to guide sustainable, inclusive development — before current urbanization trajectories lead to irreversible ecological and social consequences. The book invites researchers, policymakers and practitioners to recognize Amazonia's cities not only as sites of vulnerability but as key agents in shaping the region's — and the planet's — future.



# ACKNOWLEDGEMENTS

This book is the result of a collective endeavor by many individuals who generously contributed their knowledge and perspectives, along with their commitment to deepening our understanding of the cities in Amazonia. Our objective has been to explore how these urban areas can help shape a more sustainable and inclusive future for both the communities that inhabit them and the natural environments in which they are embedded.

We are especially grateful to the Amazonia Coordination Unit team at the IDB, under the leadership of Tatiana Schor, including Verónica Gálmez, Yves Lesenfants, Karoline Andrade Barros, Roberto Prato Ochoa and Adam Veprinsky Mehl. Their guidance helped us remain focused on the complexity and vibrancy of cities in the region, underscoring their central role in the pursuit of more balanced and resilient development models.

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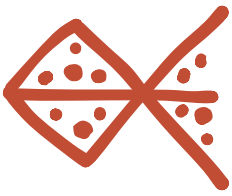
A very special recognition goes to María Camila Uribe, whose coordination and commitment were essential; to Paloma Martín, whose academic rigor and passion formed the backbone of the publication; and to Fernanda Balbino, whose skill in managing the many moving parts of the process helped bring this work to completion.

Although many have contributed to the development of this book, any remaining errors or omissions are the responsibility of the authors and the editor. More importantly, this publication is not intended as a final word, but rather as the beginning of an ongoing effort, a work in progress that aims to inspire further reflection, dialogue, and action in support of cities in Amazonia.



# FOREWORD

Amazonia stands at a crossroads. This dynamic region where cities, people and ecosystems intersect faces unprecedented challenges and immense potential. Informed by insights from diverse disciplines and perspectives, this volume explores the urban realities of Amazonia in all their complexity.

Often seen solely through the lens of its forests, Amazonia is also a deeply urban region. In addition to being the world's largest tropical forest and a global climate regulator, encompassing diverse biomes, Amazonia is home to millions of people whose lives and cultures are tied to its landscapes. By 2020, nearly 70% of its 58.7 million inhabitants lived in an urban settlement, a reality that calls for reimagining how we support sustainable development in the region.

The following chapters examine an urban system shaped by a history of fragmented territorial policies, marked by cities that blend into the natural environment and are often remote from the main economic centers of Latin America and the Caribbean (LAC). These cities, while in need of investment, also tell stories of enduring traditional knowledge, resilience and innovation.

The Inter-American Development Bank (IDB) recognizes Amazonia as a region of hemispheric and global importance. Through the *Amazonia Forever* program, the IDB supports a long-term, inclusive vision that brings together governments, civil society, the private sector and multilateral institutions. The program's five pillars — combating deforestation and illegal activities, advancing the bioeconomy and creative industries, expanding access to education and health, building sustainable and resilient infrastructure and cities, and promoting sustainable, low-carbon agriculture — provide a strategic framework for collective action.

This book is a call to action. It challenges us to move beyond fragmented, short-term responses and to recognize Amazonia as a single, interconnected system. As its cities grow, the challenge and the opportunity is to guide urban development that is equitable, climate-resilient and rooted in the region's ecological and cultural wealth. This volume reflects the IDB's continued commitment to that goal.

***Ana María Ibáñez***
*Vice President for Sectors and Knowledge*
*Inter-American Development Bank*

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# List of Acronyms

| | |
|---|---|
| **ACTO** | Amazon Cooperation Treaty Organization |
| **BLA** | Brazilian Legal Amazonia |
| **DANE** | National Administrative Department of Statistics of Colombia (Departamento Administrativo Nacional de Estadística de Colombia) |
| **DEGURBA** | Degree of Urbanization |
| **ECLAC** | Economic Commission for Latin America and the Caribbean |
| **ESRI** | Environmental Systems Research Institute |
| **GHS** | Global Human Settlement |
| **GRIP** | Global Roads Inventory Project |
| **GROADS** | Global Roads Open Access Data Set |
| **IBGE** | Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estadistica) |
| **IDB** | Inter-American Development Bank |
| **LAC** | Latin America and the Caribbean |
| **LiDAR** | Light Detection and Ranging data |
| **MINURVI** | Ministers of Housing and Urban Development of Latin America and the Caribbean |
| **NBS** | Nature-Based Solutions |
| **OSM** | Open Street Map |
| **RAISG** | Amazon Network of Georeferenced Socio-Environmental Information (Rede Amazônica de Informação Socioambiental Georreferenciada) |
| **UHI** | Urban Heat Island |

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# 1 Why Cities in Amazonia Matter

# WHY CITIES IN AMAZONIA MATTER

*Nora Libertun de Duren (IDB)*

In the vast region known as Amazonia, urbanization is happening at a pace and scale that demand immediate and decisive action.

Yet, the true nature of urbanization in Amazonia is often misunderstood: its scope is underestimated, its diverse forms are mischaracterized, and its significance is often overlooked in policy discussions. From a distance, Amazonia appears as an endless green expanse dotted by a handful of cities. In reality, its urban landscape is far more intricate and dynamic. **By 2020, nearly 70% of Amazonia's 58.7 million residents — over 40.7 million people — lived in 895 urban settlements, only 117 of which had more than 50,000 residents.**

These urban areas are interconnected by a network of waterways, winding paths and highways stretching along rivers, nestled in the Andes and lining the Atlantic coast. With an average density of just 18 inhabitants per hectare — about half the Latin American urban average — these cities reflect not only the abundance of land but also the formidable economic and logistical challenges of developing infrastructure in remote, ecologically sensitive environments (Hausmann et al. 2023).

Despite these obstacles, Amazonia's urban system is growing fast. Since 1975, the urban population has surged by over 8.1 million, raising the proportion of city dwellers by almost 14 percentage points. This growth is driven by both the emergence of new towns and the expansion of existing ones. Although urban land covers a mere 0.2% of Amazonia, its influence extends far beyond city boundaries, reshaping social dynamics, disrupting ecosystems and placing increasing pressure on natural resources.

Harmful urbanization patterns are taking root, and if left unaddressed, their negative impacts may intensify. While not caused directly by urbanization rates, factors such as deepening poverty and inequality, the expansion of criminal networks, and increased exposure to environmental hazards and degradation amplify the adverse effects of unplanned or poorly managed urban growth. Cities are becoming more vulnerable to criminal activity, while rising crime in rural areas drives migration to urban centers (Funari 2024). Climate hazards further strain municipalities already struggling to provide basic services, contributing to the deterioration of fragile ecosystems (Giles Álvarez et al. 2025). These urban challenges are closely linked to broader environmental threats, aggravating ecosystem decline in Amazonia (Nobre and Borma 2009). Amazonia plays a vital role in global climate regulation, storing an estimated 100 billion metric tons of carbon and influencing weather patterns far beyond its borders (Gatti et al. 2021). While cities are not the primary drivers of deforestation, they are embedded with both legal and illegal

economic systems — such as logging, mining, and agriculture — that fuel forest loss and environmental harm. Urban growth often facilitates these activities by providing critical infrastructure, markets, labor and transportation links. Without timely, sustainable and coordinated action to address these interconnected challenges, Amazonia risks crossing critical environmental thresholds, with potentially catastrophic consequences for the entire planet (Lovejoy and Nobre 2019). The urgency to act has never been greater.

Cities in Amazonia have unique knowledge that can benefit the world. Indigenous communities, which have lived in the region for centuries, have developed practices that not only sustain but enrich the forest's biodiversity. **Many of these traditional approaches persist today, offering valuable insights into how societies can better integrate with their natural surroundings and shape cities that become part of the solution, rather than the problem.**

*Manaus, Brazil*
*Photo by Christian Braga*

However, if current trends continue unchecked, conditions will only worsen. This is a pivotal moment. Nearly half of today's urban areas (421 out of 895) did not exist as such in 1975. As urbanization accelerates, especially in frontier towns and cross-border cities, the decisions made today in terms of land use and regional development patterns will shape the region's economic resilience, environmental health, and social equity for generations. Uncontrolled urban growth in Amazonia is not a distant threat; it is unfolding in real time. The challenge is to understand its unique dynamics and respond with thoughtful, coordinated action.

**Addressing the challenges facing urban territories in Amazonia demands action that matches the scale and complexity of the problem** — beginning with a clear and comprehensive understanding of the region's realities. This book seeks to provide that foundation by looking beyond national borders to examine how urbanization intersects with Amazonia's diverse territories, ecologies, and institutions. The aim is to inform policies through a common and holistic understanding of Amazonia, moving beyond fragmented, short-term solutions, and instead recognizing the region as a diverse and heterogeneous natural and social system, interconnected and complex.

No single country can tackle these challenges in isolation. A coordinated regional and international approach is essential. Collaborative frameworks — such as the *Leticia Pact*, the *Belém Declaration* and the *Bogotá Declaration* — are working to harmonize policies, strengthen environmental protections and promote sustainable development across borders. The Inter-American Development Bank's (IDB) *Amazonia Forever* regional program, including its *Amazon Cities Forum*, plays a vital role in fostering cooperation, strengthening local capacity and encouraging sustainable investment throughout the region.

## Urbanization without Urbanism

Urbanization in Amazonia faces many of the same pressures as cities across Latin America and the Caribbean (LAC): limited infrastructure, under-resourced local governments and increasing vulnerabilities to climate hazards. Yet these challenges manifest differently here, shaped by Amazonia's unique geography and history. This is not merely a forested region dotted with cities; it is a network of urban settlements deeply embedded within one of the world's most complex ecosystems. **The environment itself shapes urban development in ways that challenge conventional models.**

Historically, Amazonia's integration into national economies was driven not by planned urban growth but by extractive cycles — such as rubber, timber, and gold — that brought people in and often left them behind. This uneven development created cities that served national and international markets but remained profoundly distant from them in practical terms. Unlike the dense, centralized urban networks

*Manaus, Brazil*
*Photo by Christian Braga*

found elsewhere in LAC region, Amazonia's cities are dispersed across vast distances, linked more by rivers and informal paths than by highways. This geography has produced a fragmented urban system with cities defined by hybridity, and remoteness.

**FRAGMENTATION.** Amazonia's urban system is shaped by competing and often conflicting forms of territorial control, resulting in a patchwork of disconnected development paths. Instead of forming a cohesive whole, the region is marked by remnants of riverine settlements, colonial and port towns, railway corridors, company towns, newer settlements along highways, and informal economies — including illicit networks. Each has left a distinct spatial imprint, often driven by short-term resource extraction rather than sustainable long-term planning. This has led to what might be called urbanization without urbanism: growth propelled by immediate needs yet disconnected from community aspirations and environmental stewardship.

**HYBRIDITY**. Cities in Amazonia blur the boundaries between urban and natural environments, creating a tightly linked urban–nature continuum. Residents move fluidly between these spaces, and many urban areas are lie within landscapes shaped by geomorphological features such as rivers and mountains. This hybridity appears in mixed economies where agribusiness, informal labor and traditional practices coexist. Indigenous and Afro-descendant peoples, who comprise over half of the population, play a vital role in sustaining and adapting these systems. For example, *amphibian cities*, accessible only by river or air, feature floating neighborhoods and stilt houses. These unique forms demand planning approaches tailored to their specific social, cultural, and ecological contexts.

**REMOTENESS. Many urban areas are located hundreds of kilometers from major economic centers,** with limited access to markets, public services and government support. Travel times to the nearest large city often exceed three and a half hours, and rivers serve as the primary connections for many communities. This reliance on waterways makes them vulnerable to seasonal and environmental disruptions. More tha half a million

people in 38 urban areas along the region's rivers live more than five kilometers from the nearest road, highlighting the logistical challenges posed by isolation. This geography continues to shape how cities develop, function and connect, relying on riverine networks across the region.

**These three traits — fragmentation of the urban system, and cities marked by hybridity and remoteness — pose persistent challenges to urban areas in Amazonia.**

**Fragmentation** weakens the presence of the state across the region. Local and intermediate governments often lack the resources and capacity to manage scattered and diverse urban areas. As a result, basic infrastructure and public services are delayed or absent, leaving many communities isolated, underserved, and vulnerable. This governance gap creates opportunities for illegal and transnational actors to operate, undermining public safety and harming the environment.

**Hybridity** enriches urban areas with cultural diversity but complicates planning and service delivery. The blending of rural and urban lifestyles, especially among Indigenous populations, requires flexible, culturally attuned approaches. Seasonal mobility linked to traditional activities can disrupt consistent access to healthcare and education. Meanwhile, the close relationship between cities and their natural surroundings heightens the risks posed by inadequate sanitation and waste management, threatening public health and ecosystems, while also offering the potential to support sustainable livelihoods.

**Remoteness** drives up infrastructure costs and limits the economies of scale that typically support urban productivity. Poor connectivity restricts access to markets, jobs and essential services, trapping many areas into cycles of low economic performance and reliance on small-scale, often unsustainable extractive activities, like informal mining and logging, that degrade both the environment and residents' quality of life.

These dynamics constrain the ability of Amazonia's cities to achieve their full potential as drivers of sustainable prosperity, which involves reducing poverty and promoting economic activities that are environmentally sustainable. Low population densities and high levels of informal settlement reflect ongoing economic and governance challenges, which deepen poverty, especially among Indigenous communities, and cause further environmental harm.

Despite these obstacles, there are promising developments and opportunities for building a more sustainable, resilient and inclusive urban future in Amazonia. When social services are tailored to the unique needs of the region's communities, they can deliver meaningful improvements in quality of life. For example, customized healthcare programs for riverine populations have expanded access and improved health outcomes.

Environmental health is also gaining prominence, supported by a growing network of actors at local, national and international levels. Stronger legal frameworks and more effective enforcement are helping to combat

environmental crimes, while innovative technologies are empowering local governments to detect climate hazards and respond proactively.

Local institutions are increasingly building their capacity to design and implement development strategies that balance economic inclusion with environmental sustainability. Strengthening governance is not just about efficiency; it is also about empowering communities to manage their territories and shape their own futures.

These positive developments show that change is possible. By building on these successes and fostering collaboration among governments, communities and other stakeholders, Amazonia's cities can overcome many of the barriers that have held them back and can move toward a more resilient and equitable future.

## A Book Shaped Like the Cities Themselves

**The creation of this book mirrors the collective intelligence and diversity that defines urban life in Amazonia.** Rather than distilling complexity into a single narrative, the volume brings together a rich tapestry of voices, disciplines and perspectives to offer a nuanced, evidence-based understanding of the region's urban realities.

More than 50 experts have contributed to this book, including professionals from the IDB as well as academics and practitioners from universities and NGOs, many of whom are based in Amazonia and have deep, firsthand experience with its ecosystems, communities and urban dynamics. Their combined expertise offers a multidimensional portrait of a region that resists simple classification and still requires better and more updated quantitative and qualitative data to be fully understood.

This volume draws on the insights of archaeologists, anthropologists, historians, economists, sociologists, journalists, political scientists, statisticians, environmentalists, urban planners, architects, geographers and artists. Each discipline sheds light on a different aspect of Amazonia's urban complexity, revealing layers that cannot be captured by a single lens. The methodological approaches are equally varied, combining qualitative and quantitative tools — words, numbers, maps and images — to capture the subtlety and richness of urban life in Amazonia. These include cartographic analyses, photography, original research and specially commissioned essays that synthesize existing knowledge. Every contribution has undergone rigorous peer review, ensuring both analytical depth and practical relevance. Many chapters introduce innovative methods for identifying and measuring urban areas, offering fresh perspectives on remoteness, connectivity and access to essential services such as healthcare and education.

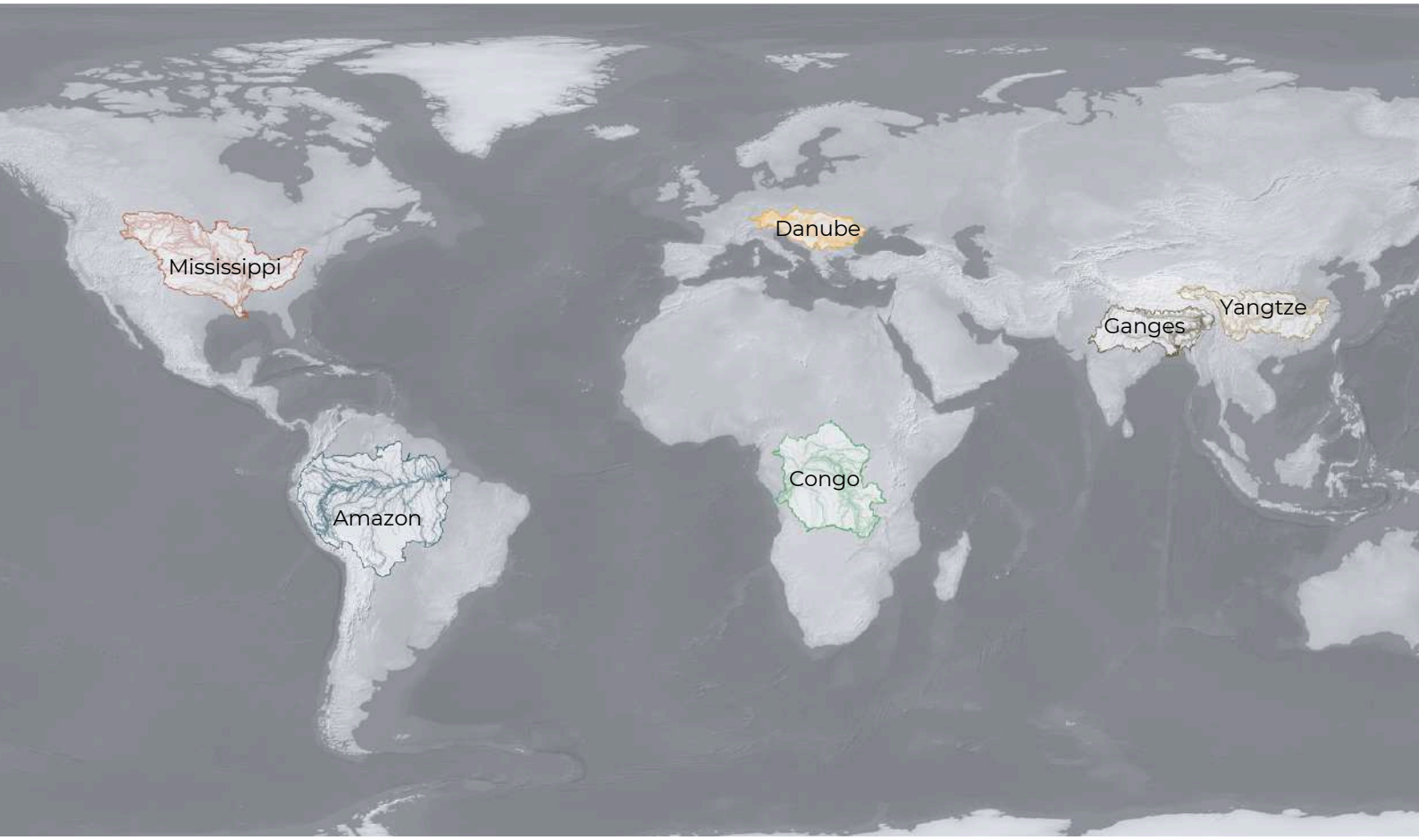
This book is part of broader efforts led by the IDB, under the *Amazonia Forever* program, to advance sustainable development across this region. Amazonia region is defined by the IDB's

Amazonia Coordination Unit through the AmazoniaForever360+ initiative, aligning with definitions from the Amazon Cooperation Treaty Organization (ACTO) and the Amazon Network of Georeferenced Socio-Environmental Information (RAISG).

Spanning more than 8.3 million square kilometers across eight IDB member countries — Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela — this area is based on the concept of Pan-Amazonia. This transboundary, continental socio-ecological approach supports integrated policy and investment for sustainable development, conservation and regional cooperation (Appendix 1). The studies in this volume focus on this region.

**Collectively, these studies address a central question: What is the state of urbanization in Amazonia today — and how can its cities evolve to benefit both their inhabitants and the natural environment that sustains them?**

***Map 1.1:* Selected River Basins of the World**

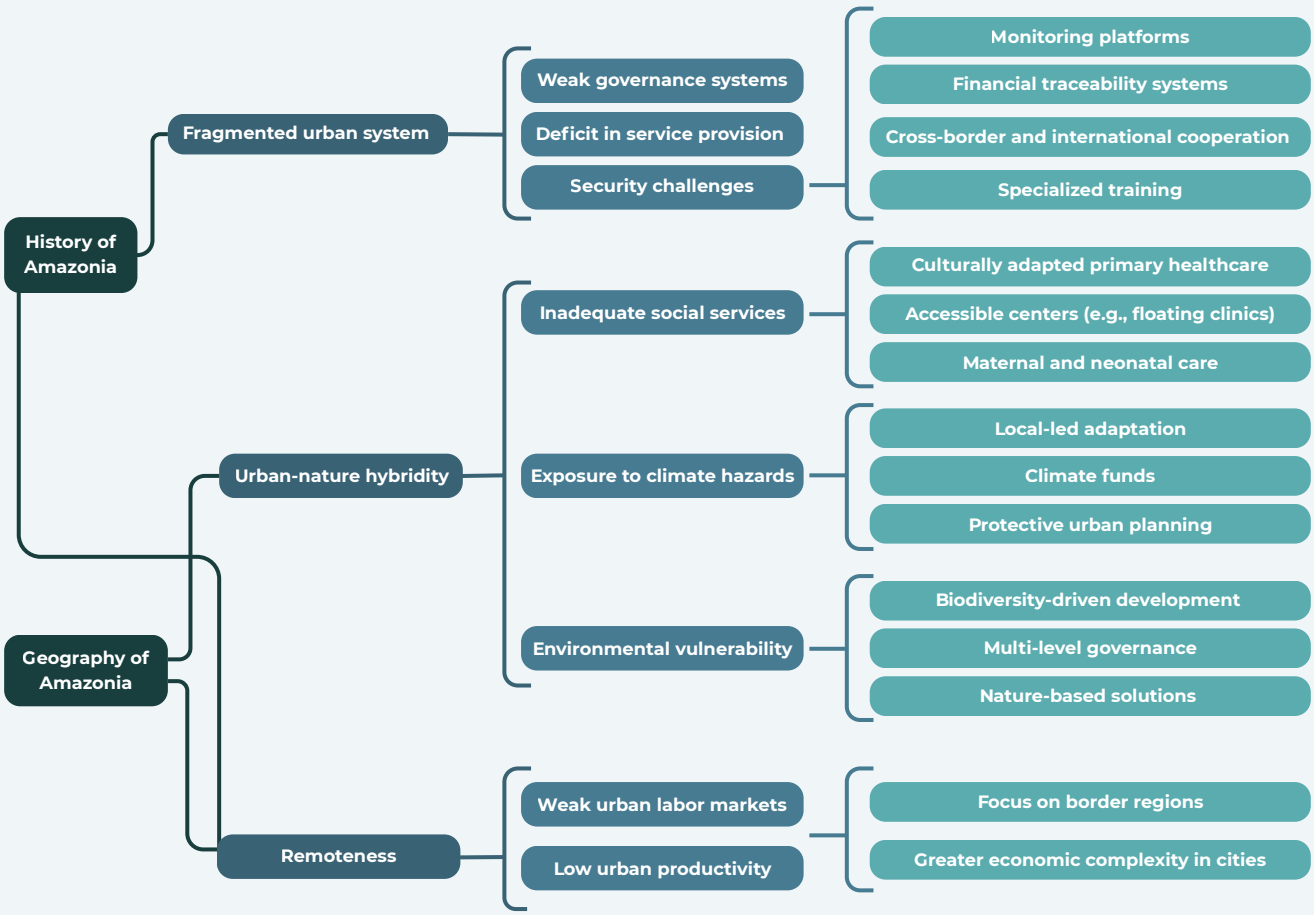



*Source: Prepared by Gabriel Kozlowski, based on US Geological Survey 2019, Deltares 2018 and Lehner and Grill 2013.*

## Book Overview: Mapping the Path Through Cities in Amazonia

This book is structured as a journey from understanding to action. This first chapter introduces the key themes of each chapter and looks at why urbanization in Amazonia demands attention. The second chapter examines the region's cities, the third explores related challenges and the fourth presents innovative policies to address them. The final chapter outlines the dilemmas and decisions for a more inclusive, sustainable and resilient urban future. The figure below illustrates how each chapter builds on the previous one, highlighting the connections between its main themes as well as the overall narrative structure (Figure 1.1).

***Figure 1.1:** Mapping the Path Through Cities in Amazonia*




*Source: Prepared by the author.*

## Chapter 2

Lays the foundation for understanding the cities in Amazonia, tracing their history from Indigenous settlements through colonial and modern times — explaining today's fragmented urban systems and territorial legacies. The second section explores their hybrid nature, deep ties to forests and remoteness, factors that shape spatial and social experiences.

## Chapter 3

Analyzes the negative consequences of fragmentation, hybridity and remoteness, linking them to a weak state presence and gaps in governance, infrastructure and public security. Hybridity reveals challenges for delivering healthcare and education, especially in places with seasonal accessibility, limited mobility and scattered populations, and shows increasing climate vulnerability and environmental harm. Remoteness is tied to limited economic opportunities, high poverty and weak labor markets, along with low wages.

## Chapter 4

Highlights successful practices and innovative approaches that address this region's urban challenges. Some focus on people, improving healthcare and mapping needs for *riverine communities*. Others emphasize environmental care, with cities leading sustainability efforts, nature-based solutions, partnerships and ecosystem restoration to boost resilience. It also stresses the importance of increasing prosperity by finding opportunities even under difficult, cross-border conditions.

## Chapter 5

Calls for strengthened research and policy on urbanization in Amazonia. It summarizes key lessons for future research and outlines major paradigm shifts for building sustainable urban futures. Rather than calling for rushed solutions, it emphasizes the importance of understanding trade-offs and facing complex challenges with care and deliberation.

Together, these chapters chart both the progress made and the complex road ahead for the cities in Amazonia. They reveal that while local, practical and environmentally focused initiatives are making a tangible difference, a broader transformation requires ongoing commitment, inclusive and multilevel dialogue, and the courage to address difficult questions. As the region continues to urbanize, the challenge is to ensure that cities are fair, resilient and deeply connected to Amazonia's ecological and cultural wealth.

**This journey calls for innovation, humility and collaboration across disciplines, sectors and communities — reflecting the very spirit of urban life in Amazonia.**

# 2 Charting the Cities in Amazonia

# 1. THE FORMATION OF THE URBAN STRUCTURE OF AMAZONIA



# 2. CHARACTERISTICS OF THE CITIES IN AMAZONIA



# 3. PHOTO ESSAY

# THE FORMATION OF THE URBAN STRUCTURE OF AMAZONIA

## Cities Before Cities: The Profound Legacy of Indigenous Peoples

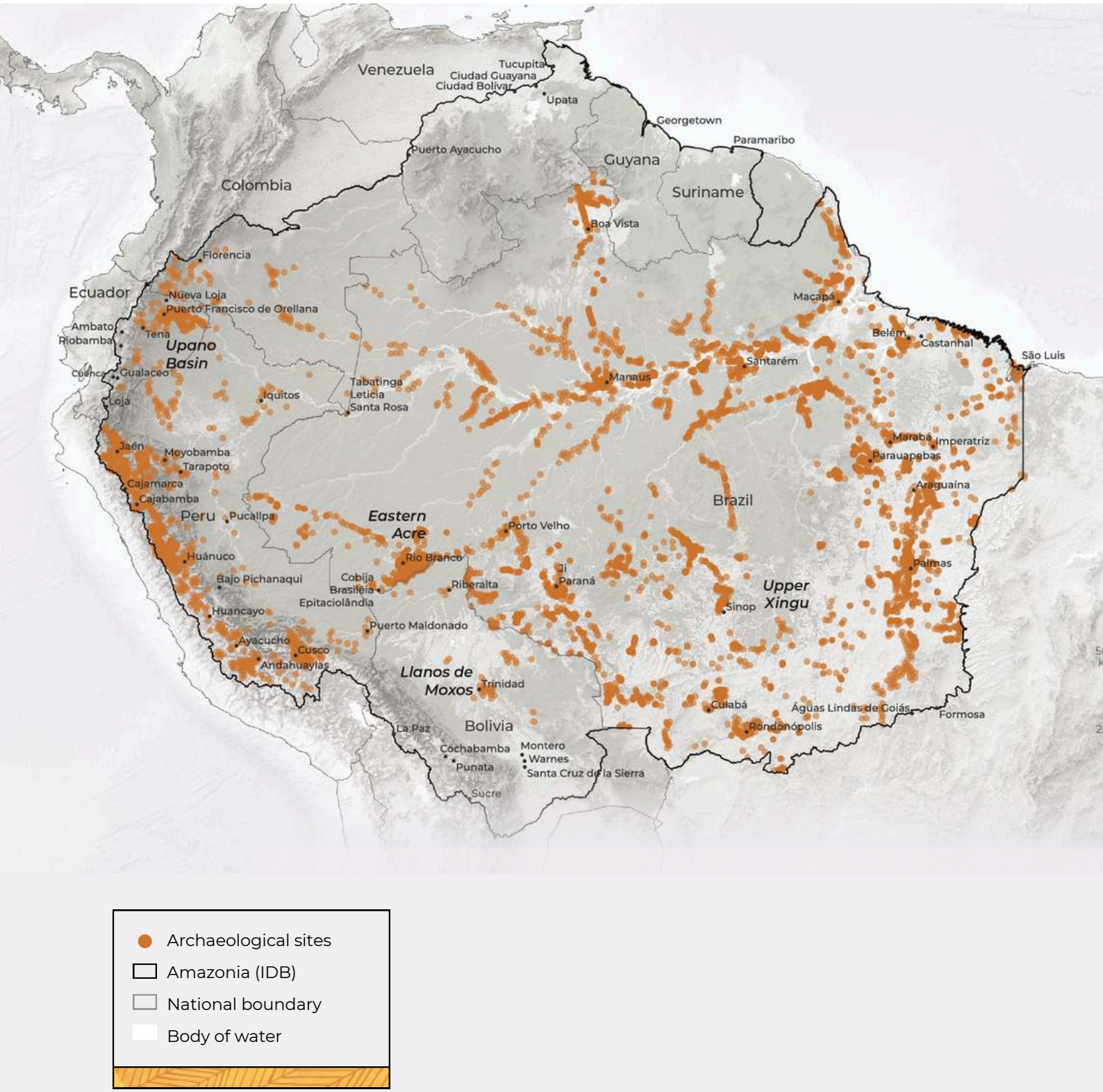
*Eduardo G. Neves (Universidade de São Paulo)*

Amazonia has been continuously inhabited by Indigenous peoples for at least 13,000 years, a legacy marked by unique cultural and ecological achievements that have shaped the biome as we know it today. Among the earliest artistic expressions in the Americas are cave paintings found in Cerro Azul along Colombia's Guaviare river and in Monte Alegre, Pará, Brazil. These ancient inhabitants pioneered plant cultivation and selection, laying the foundation for Amazonia's status as a global center of agrobiodiversity. Iconic crops such as *manioc* and cacao, to name just two examples, were initially cultivated in western Amazonia (Neves et al. 2021).

**Prior to European contact, Amazonia was densely populated, with estimates of eight to ten million Indigenous inhabitants across the region (Amazonia, Orinoco Basin and the Guianas) in 1492.** Tragically, 90% of this population perished due to disease, slavery and warfare in the centuries following colonization (Clement et al. 2015; Koch et. al 2019). Despite vast unexplored areas, the database of the Brazilian National Institute of Historical and Artistic Heritage (Instituto do Patrimônio Histórico e Artístico Nacional) registers over 10,200 archaeological sites in the Brazilian Amazonia (Map 2.1), (Mapbiomas 2025). A recent study based on data collected using LiDAR (Light Detection and Ranging) — which allows for the recognition of archaeological sites in areas covered by vegetation — estimates that more than 10,000 earthworks are still hidden beneath the forest canopy (Peripato et al. 2023).

*São Gabriel da Cachoeira, Brazil*
*Photo by Christian Braga*

## *Map 2.1:* Current Cities and Archaeological Sites in Amazonia




*Sources: AmazonArch Database; Lombardo et al. 2011; RAISG.*
*Notes: For more information, see Appendix 1, Box A1: Maps, Data Sources and Geographical References. This map was traced because the original source was not available to re-edit it.*

**The relationship between Indigenous peoples and flora in Amazonia is so profound that it has reshaped the region's contemporary biome.** Of the 16,000 tree species described in Amazonia, just 227 — known as hyperdominant species — account for nearly half of all trees in the region (ter Steege et al. 2013). These include economically and culturally significant plants like *açaí*, *paxiúba palm*, rubber tree and cacao. Archaeological evidence reveals that many of these species have been cultivated and managed for millennia, contributing to their current dominance (Levis et al. 2017).

The South American neotropics are recognized as an independent center of plant domestication, with a remarkable list of species now cultivated across the globe: cassava, tobacco, peanuts, cacao, papaya, sweet potato, coca, *guaraná*, guava, cashew and *jabuticaba*, among many others. Amazonia has been — and continues to be — a hub of agrobiodiversity, not only through the domestication of plants but also through the ongoing cultivation of wild species such as the Brazil nut and *açaí* palm (Iriarte et al. 2020). Indigenous peoples in ancient Amazonia domesticated or cultivated over 130 plant species (Clement 1999). Most of this knowledge was lost during the devastating population decline that followed the European colonization.

Indigenous peoples have also transformed Amazonia's soils. While most soils in the region are acidic and nutrient-poor, fertile exceptions exist in the floodplains of whitewater rivers, which carry nutrients from the Andes. Historically, poor soil fertility was thought to limit population growth and encourage the mobile lifestyles of settlements (Meggers 1954). However, the widespread presence of *terras pretas* — anthropic dark earths —contradicts this view. These are highly fertile and stable soils created by Indigenous management of organic waste. Formed as early as 5,500 years ago and widespread 2,000 years ago (Neves et al. 2003), these soils now cover 2–3% of Amazonia and remain vital for agriculture (Kern et al. 2003). The merging of natural and cultural heritage in Amazonia has created a unique biocultural legacy (Neves et al. 2021) with Indigenous lands today serving as the most effective barrier to deter deforestation and promote forest regrowth in the region (Baragwanatha et al. 2023).

## Archaeological Sites and Road Networks

**Evidence indicates that large settlements and extensive road networks began forming in Amazonia around 2,500 years ago, becoming more prevalent in the last 1,500 years.** Some of these settlements were so extensive that they were considered cities. In the Upper Xingu region (southern Amazonia), for example, 15 clusters of settlements dating to the early first millennium of the Common Era (CE) spanned 20,000 square kilometers and supported more than 50,000 people — fewer than 2.5 persons per square kilometer. These clusters included larger towns of 2,500 inhabitants, smaller towns of 800 to 1,000, and smaller, non-walled villages of 100 to 250 people (Heckenberger et al. 2008), with cultivated gardens and forests occupying the spaces between settlements.

In Santarém, Pará, a different urban pattern appeared, characterized by a dense nucleus resembling a central place. Recent research has found that eight neighborhoods of the modern city sit atop 200 hectares of *terras pretas* along the Tapajós river (Gomes 2025). Continuously occupied since the 13th century, Santarém predates its official founding in 1661 by three centuries, making it Brazil's oldest city. While ancient cities' building materials were primarily wood and straw, remnants include exquisite ceramics, stone artifacts and extensive *terras pretas*. The nearby Belterra plateau features earthen structures such as wells, likely related to the city's occupation.

These ancient cities were part of a broader urban network. In 1887, Col. Antonio Labre traversed 200 kilometers on foot from the Madre de Dios river, in present-day Bolivia, to the Acre river, near today's Rio Branco city in Brazil (Pessoa 2017). Labre's published account of the trip noted the presence of well-cleared roads surrounded by fruit trees and many villages and gardens, some of them abandoned. Archaeological work in Acre has confirmed the ancient origins of these roads, with structures dating to around 1,000 CE. Recent studies have revealed extensive road networks connecting settlements separated by kilometers (Saunaluoma et al. 2018). **These networks — known as *varadores* — are still used today by Indigenous peoples and *riverine communities*,** such as in the Juruá and upper Purus river basins in the state of Acre.

In eastern Acre and southern Amazonas, intricate road networks connect hundreds of geometric earthworks, or geoglyphs, constructed over more than 2,000 years (500 BCE to 1700 CE). These include circular and square ditches, villages of mounds arranged around plazas, and square mounds built from smaller earthen structures (Saunaluoma et al. 2018).

Research from the Upper Xingu and Acre shows that along these roads, Indigenous peoples cultivated forests, replacing species like bamboo with palm trees (Watling et al. 2018). These life-building practices in the forest stand in stark contrast to contemporary methods, where vast biodiversity is replaced by deforestation, reducing Amazonia's rich biodiversity to a limited number of non-native plant and animal species. The sophisticated knowledge systems of forest peoples and emerging archaeological data underscore that life in Amazonia must be rooted in ensuring diversity and managing abundance — fundamental lessons for preserving its rich biocultural heritage.

## Regional Perspectives on Indigenous Urbanism and Settlement Patterns

Historical and archaeological evidence reveals that the long history of Indigenous occupation in eastern Acre and the Upper Xingu, is best understood regionally, encompassing settlements, gardens, connecting paths and extensive landscapes. Understanding the forest as a network of settlements offers a fundamentally different perspective than the traditional image of small, isolated villages, a misconception rooted more in the colonial view of urbanization than in the actual lifeways of Amazonia.

In the last centuries before European colonization, Amazonia supported a diverse array of Indigenous ways of living, from highly mobile, small-scale groups to large, sedentary urban centers. There was no single model of ancient urbanism. In Bolivia's Llanos de Moxos, massive earthworks such as Loma Cotoca — which reaches 22 meters high and is surrounded by large platforms, ditches and roads — suggest organized labor and regional hierarchies in the late first millennium CE (Prümers et al. 2022). There is substantial evidence of roads both in the monumental mound area centered around the contemporary city of Trinidad and farther north in the Baures region (Erickson 2001). Each earthwork cluster is interpreted as a distinct political entity, with size differences among them potentially showing a form of regional hierarchy (Prümers et al. 2022).

In Ecuador's Upano basin, LiDAR data collectedover a 300-square-kilometer area has revealed over 6,000 rectangular earthen platforms — typically 10 to 20 meters long and two to three meters high — which were likely used for residential purposes. The platforms generally appear in groups of three to six around a central plaza, forming complexes of about 1,600 square meters. The largest known complex, found at Kilamope, covers 10 hectares and features a monumental platform measuring 140 by 40 meters and 4.5 meters high. Between these platform clusters are sets of perpendicular drainage channels, likely designed for cultivation (Rostain et al. 2024).

These examples justify characterizing clusters of settlements and earthworks as urban, moving beyond the limitations of terms like mega-sites or large villages. Instead, these settlements should be understood through a broader lens that recognizes their complexity and significance.

## Rethinking Ancient Urbanism in Amazonia

**Traditional definitions of cities emphasize clear boundaries and masonry structures, but urbanism in Amazonia was characterized by landscape modification — dark soils, drainage canals, mounds and roads — rather than by stone walls.** Surrounding forests were transformed into agroforests, in contrast to modern patterns of deforestation for pasture.

Analyzing contexts where urban centers shaped forests and where boundaries were fluid presents a unique set of challenges and opportunities. Urbanism in ancient Amazonia should be understood not just through individual settlements, but through the interconnected roads, gardens, tree groves, fallows and camps that surrounded them.

In these societies, boundaries between living spaces and their surroundings were permeable. Permanent structures — earthworks, platforms, stilt-house complexes — were not always occupied year-round, challenging binary sedentarism versus mobility. The surrounding landscape formed a gradient of use, with productive gardens, abandoned plots filled with medicinal and fruit plants, and networks of paths lined with useful species. These paths were central to the interconnected nature of urbanism in Amazonia.

**The legacy of ancient Indigenous peoples challenges conventional notions of cities and urbanism. Rather than ruined walls, their heritage consists of fertile soils and earthen mounds that supported wooden and straw houses.** Ancient management practices offer valuable lessons for contemporary urban life: integrating orchards, trees and forests into cities, and composting organic matter to produce fertile soils. Indigenous Peoples have practiced these methods for millennia. By embracing these traditions, new garden-cities can grow and flourish atop their ancient foundations.

# Historical Processes and Urbanization Trends

*Ana Claudia Cardoso (Universidade Federal do Pará)*

The urbanization of Amazonia has evolved from ancient patterns that integrated human activities with the forest, to modern models that concentrate populations and separate them from nature. Today, both forms coexist, adding complexity to the region's urban landscape. **Over time, diverse historical, geographical and institutional hierarchies have been layered onto the landscape of Amazonia, shaping the territorial dynamics that continue to define its contemporary cities.**

Early European travelers described the Amazonas river merely as a navigation route, overlooking the presence of thriving Indigenous settlements (Gondim 2019). These narratives contributed to the belief of Amazonia as a primitive, empty land. This idea was further reinforced by the widespread decimation of Indigenous Peoples in the early stages of colonization (Souza Cruz 2018). Institutionalized racism deepened this erasure, denying the achievements of Indigenous civilizations and failing to recognize their alternative urban forms, which played a crucial role in sustaining and enriching the environment (see Chapter 2.1.i). Understanding this legacy is essential to tracing the trajectory of urbanization in Amazonia, from the Laws of the Indies to the present, with a focus on a territorially rooted view of this process.

## Determinants of Colonial Urbanization: The Law of the Indies and the Amazonas River

The Laws of the Indies, issued in 1573 and reissued in 1680, guided urban design in Spanish colonial territories. They mandated a central square for civic, commercial, religious and administrative functions, orthogonal street layouts based on sun and wind exposure, and a preference for elevated sites for protection (Carrasco 2024). Meanwhile, in Portuguese colonies, early colonization efforts focused on building forts (Ravena and Marin 2013). Following the unification of Portugal and Spain (1580–1640), the Laws of the Indies were also adopted across the Portuguese territories in Amazonia, influencing urban planning and territorial organization across the region. These cities reflected European views of civilization, often disregarding Indigenous values and peoples (Barroso and Júnior 2017).

**European colonizers often relied on existing Indigenous settlements to set up their own quarters along rivers,** taking advantage of the ecosystem's richness by extracting forest products and introducing new plantations (Costa 2019). In Spanish-speaking areas, these settlements were typically found in

Andean valleys (Correa 1987), while in the Brazilian Amazonia, Portuguese colonizers established cities along riverbanks (Wagley 1953), drawing on Indigenous territorial knowledge, especially related to food sources from the river. Santarém, Pará, is a notable example, built directly atop an ancient Indigenous city (Gomes and Cardoso 2019).

**Geography, especially the confluence of rivers and fertile floodplains, shaped the location of ancient and colonial cities, creating a *dendritic urban network* along the Amazonas river and its tributaries.** Larger urban centers sit on main rivers, while smaller towns lie on tributaries, forming a hierarchical system linked by branching waterways (Correa 1987). This network featured small settlements linked to a primary city, which during colonial times served as the main point of contact with Europe. Later, major urban centers like Belém and Manaus in Brazil, Iquitos in Peru, Cobija in Bolivia and Leticia in Colombia became key ports for exporting forest products and materials (Killen 2022). Even today, a city's position relative to major rivers continues to shape its role in the urban hierarchy. Belém, for instance, has influenced the Brazilian Amazonia for over 300 years, overshadowing smaller towns that supported forest extraction and served isolated populations (Cardoso et al. 2015).

***Map 2.2:* *The City of Iquitos in Peru***


*Source: Prepared by Gabriel Kozlowski, based on Google (2015), ESRI, OSM (2025).*

## Commodities Boom and Highways in the Formation of Urban Amazonia

The second half of the 19th century marked a turning point in Amazonia's urbanization, as economic cycles increasingly tied the region to global markets. The *rubber boom*, fueled by global demand for wild rubber used in manufacturing industrial goods such as car tires, drove rapid urban growth and immense wealth. Historic river ports like Manaus and Belém in Brazil, and Iquitos in Peru, became centers of affluence, importing architectural styles from Europe. During this period, more than 20 cities were founded along the Amazonas river delta, where rubber merchants transported their goods. This era also saw substantial migrations from Europe, China, India, and other regions, enriching the population's ethnic composition (Guevara and Corbin 2024).

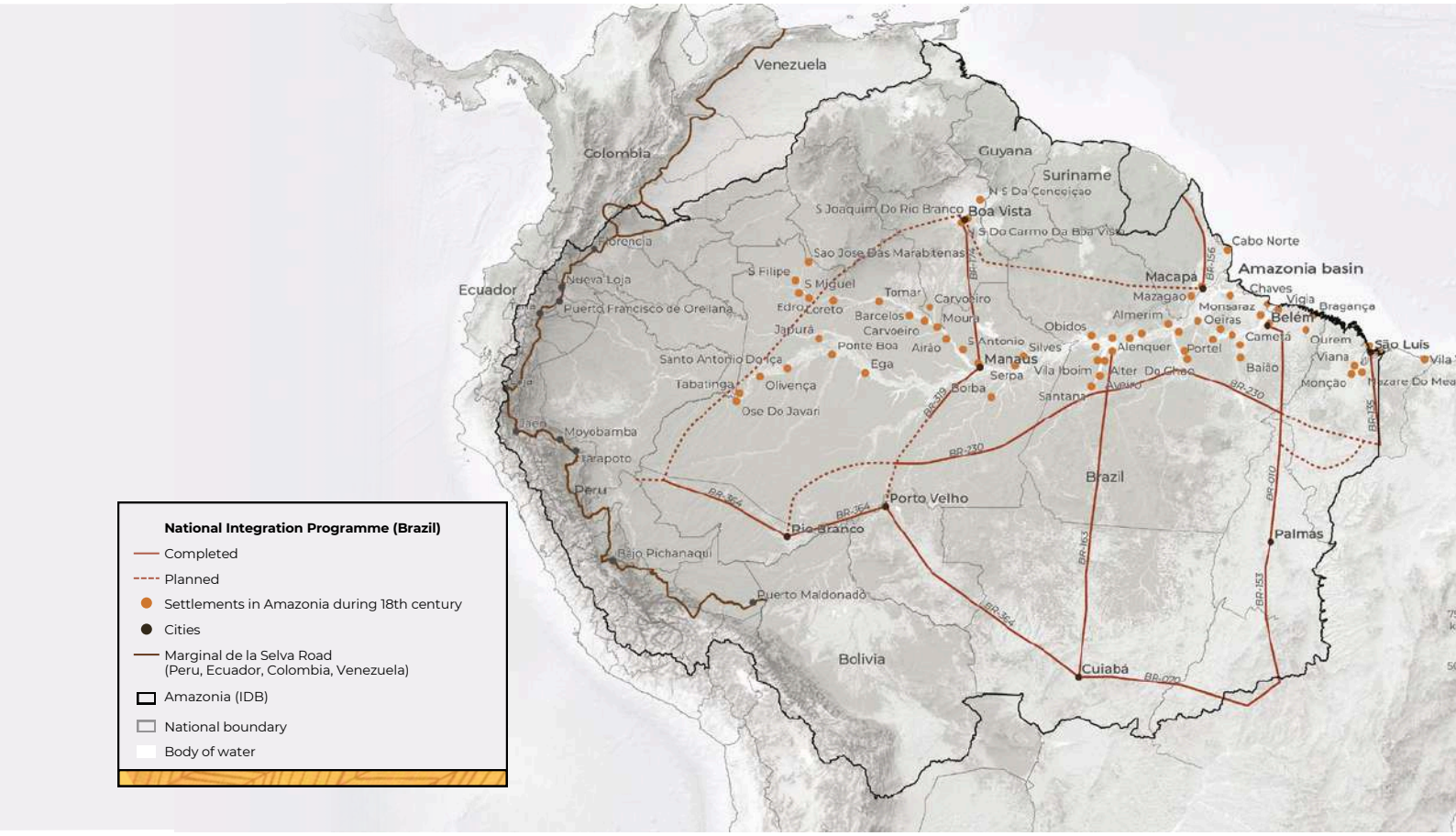
However, the prosperity of cities built during the *rubber boom* rested on fragile foundations. The rise of plantation rubber in Asia, followed by the introduction of synthetic alternatives, triggered the collapse of the wild rubber market in the early 20th century, leaving several trading hubs and their satellite towns economically stranded. Yet the demand for commodities did not end there. In the first half of the 20th century, new waves of oil and gold exploration appeared in Venezuela, Colombia, Peru, Ecuador and Bolivia. Still, cities developed around single-commodity economies often declined rapidly once demand faded, exposing their vulnerability and lack of economic resilience.

Rapid urbanization in Amazonia accelerated with expanding transport infrastructure. Early railroads supported agricultural colonization and led to the emergence of new urban areas (Cardoso 2024). For example, Porto Velho was built to support the Madeira-Mamoré railroad, intended as an alternative route connecting Brazil, Peru and Bolivia to bypass the Panama Canal (Morelato 2021). While these railways complemented river-based systems, post-1960s road development severed the link between rivers, cities and the forest.

Since the mid-20th century, national projects such as road construction, mining, hydroelectric development and rural colonization have laid the foundation for the region's *reticular urban network*. Characterized by a mesh-like network of intersecting roads, this system enabled new settlements, economic activities and multidirectional connectivity independent of river routes. It complements the existing *dendritic urban network* and contributes to a complex and dynamic urbanization pattern that also includes diffuse and disarticulated forms of land occupation[1] (Map 2.3).

[1] Diffuse urbanism involves low-density, uneven growth without clear boundaries, while the phrase *reticular urban network* refers to a web-like system linked by transport routes rather than central nodes. This results in a dynamic, fragmented urban system where cities are loosely connected to each other but strongly tied to global trade, especially exports. Medium-sized and subregional centers have become key hubs for services and migration, often bypassing state capitals and aligning more with global commodity flows than national or local networks (Trindade and Cordeiro 2015). Disarticulated urbanization lacks a centralized or hierarchical structure; rather, it consists of a constellation of cities and settlements linked in irregular, shifting ways without a unifying logic. It reflects layered historical development, where older riverine cities from the colonial and *rubber boom* eras coexist with newer settlements along highways and resource frontiers (Browder and Godfrey 1997).

***Map 2.3:* Dendritic and Reticular Urban Network**




*Source: Prepared by Gabriel Kozlowski based on da Costa Tavares 2011.*
*Note: For more information, see Appendix 1, Box A1: Maps, Data Sources and Geographical References. The orange dots on the Amazonas river reflect the dendritic urban network, and those cities connected by roads reflect the reticular urban network.*

**During this time, national governments launched modernization and development plans that included large-scale highway projects to better integrate the region into national and global economies.** The construction of the Belém–Brasília highway (BR-010), completed around 1960 as the first major road to cross Brazil's central and northern regions, played a crucial role in integrating northern Brazil with the rest of the country. It supported settlements and economic development along its route, fostering the growth of cities such as Imperatriz, Paragominas, Araguaína, Palmas, Redenção and Marabá. This period also saw the emergence of company towns in Brazil and major state-led investments in Venezuela's oil sector. Government incentives promoted settlement, with Brazil's 1967 designation of Manaus as a Zona Franca, which set up the first urban industrial park in Amazonia and strengthened its ties to global markets.

In the Andean countries, the Marginal de la Selva highway began in the early 1960s as a visionary transnational project aimed at connecting Amazonia to the rest of the continent. Initiated by a 1963 Andean Community agreement, it sought to drive economic growth, agricultural expansion and cross-border connectivity by establishing a corridor along the eastern Andes from Venezuela to Bolivia. In Peru, this development spurred the rapid growth

of cities such as Tarapoto, Moyobamba, Tingo María, Pucallpa and Yurimaguas. That was alsothe case in, Nueva Loja (also known as Lago Agrio) and Francisco de Orellana in Ecuador, which underwent intense migration and urbanization linked to new roads and agricultural colonization.

***Map 2.4:* The City of Nueva Loja in Ecuador**


*Source: Prepared by Gabriel Kozlowski, based on Google (2015), ESRI, OSM (2025), Global Energy Monitor, Global Oil and Gas Extraction Tracker, 2025.*

By the 1970s, the new roads had reconfigured the landscape of Amazonia. In Brazil, the Troncal Amazónica highway and the BR-319 pushed deep into the forest; in Ecuador and Colombia, the Troncal del Piedemonte road; and in Peru, the Pucallpa — Contamana road — all opened remote areas to settlement, urbanization and deforestation. Alongside this, the expansion of mining, hydroelectric projects and cattle ranching led to some of the most profound economic, social and environmental changes in the Brazilian Amazonia. These processes particularly affected the states of Mato Grosso, Rondônia and Acre, forming the so-called *Arc of Deforestation* and ushering in a second wave of demographic explosion in the region (Cardoso 2024).

## Late Urbanization Processes

**In the late 20th century, advancements in detecting hydromineral deposits sparked national interest in the Amazonia biome.** Forgotten rivers and settlements were converted into hydroelectric sources and logistical corridors. In Brazil, resource exploitation led to new towns and land uses, often ignoring the perspectives of local residents. In Ecuador and Peru, new extractive activities led to residual urbanization (Jimémez and Durán 2023). Rising mineral demand made railways, pipelines and highways vital for new urban settlements. For example, the Carajás railroad notably reshaped the regions it crosses (Galvão 2023), while highways converted rural areas into urban zones, often resulting in precarious cities lacking proper infrastructure. Regionally, the Initiative for Integration of Regional Infrastructure in South America, an evolution of the Marginal de la Selva Project, aims to boost economic activity by improving transport, energy and communication links across the continent, though several components remain to be developed.

**The spatial reconfiguration of Amazonia has gone hand in hand with a transformation of its social fabric.** In Guyana, the 1970s marked the start of large-scale emigration to North America. A similar trend occurred in Suriname, with significant migration to the Netherlands (Gomes and Cardoso 2019), accelerated by deforestation and environmental degradation along the coast. Since 2000, residents of Peru, Ecuador and Colombia have increasingly moved to major cities on the coast or in the Andes (Jimémez and Durán 2023), while Brazil has experienced growing migration to both large and small urban centers (Van Vliet et al. 2016). Other forces have also shaped territorial occupation, such as guerrilla activity, which prompted the relocation of public institutions — judicial, military and federal — into Amazonia, as well as the exodus of residents from small forest settlements to larger cities (Rocha and Moore 2018). More recently, the presence of criminal networks has also reshaped internal migration patterns and urban dynamics (Funari 2024).

By the early 21st century, large estates for cattle, biofuels and monoculture production further contributed to deforestation. Urban areas involved in supporting extractive activities or tourism showed population growth rates above national averages. In contrast, settlements not integrated into these markets appeared stagnant, often lacking access to basic services.

Today, the urban structure of Amazonia includes both large cities and a complex network of smaller urban settlements, towns, villages and *riverine communities*. Ancient knowledge persists in small urban agglomerations of diverse social groups, including Indigenous Peoples, *Quilombolas*, riverside dwellers and campesino communities. This network, still connected to its precolonial ecological knowledge, offers valuable insights into building urban models better aligned with the biodiversity of Amazonia.

# Contemporary Urbanization

*Paloma Martín, María de los Ángeles Scetta (IDB)*

There is no shared definition in LAC countries of what constitutes a city, and official criteria for urban areas in Amazonia vary widely.[2] Bolivia and Venezuela set population thresholds for determining an urban area — 2,000 and 2,500 inhabitants, respectively — while Brazil, Colombia, Ecuador, Guyana and Suriname rely on administrative designations often tied to municipal or political boundaries. Peru combines both approaches, classifying urban areas as districts with 100 or more contiguous dwellings — averaging 500 inhabitants — and district capitals. For instance, Guyana's urban areas include Georgetown and nine townships, while Suriname's encompass the districts of Paramaribo and Wanica.

This lack of consistency complicates the understanding of urban phenomena, particularly regarding the size and density of urbanized areas, resulting in significant differences in the spatial expanse officially classified as urban. In Ecuador, incentives to keep a rural status may entice localities to underreport their population. Conversely, in Brazil, many urban settlements — such as Eirunepé in Amazonas state, along the Juruá river — lack formal urban designation despite showing urban characteristics. Additionally, census data typically classifies areas in a binary urban–rural framework, which does not capture the urban–rural continuum. Census data may classify peri-urban zones, such as towns and low-density settlements, as urban in one country but rural in another. This inconsistent understanding of the true scale of urbanization is especially problematic in Amazonia, given the direct impact of urban footprints on the biome and the hybrid nature of its urbanization process.

The Degree of Urbanization (DEGURBA) method offers a way to address these inconsistencies (UN Statistics Division 2020). DEGURBA assesses the actual area occupied by the population by dividing the territory into grid cells ofone square kilometer and classifying each of them based on population density, size and spatial contiguity, thus avoiding distortions due to varying spatial-unit sizes. Unlike traditional urban versus rural binaries, DEGURBA identifies three degrees of urbanization within clustered grids:

**1. High-density zones:**
Populations of 50,000 or more inhabitants and a density of at least 1,500 people per square kilometer.

**2. Moderate-density zones:**
Populations of 5,000 or more inhabitants and a density of at least 300 people per square kilometer.

**3.Low-density zones:**
Populations of 200 or more inhabitants and a density of at least 150 people per square kilometer.

[2] Sources by country: Bolivia (INE 2012); Brazil (IBGE 2022); Colombia (DANE 2018); Ecuador (INEC 2022); Guyana (Guyana Lands and Survey Commission Bureau of Statistics 2012); Peru (INEI 2017); Suriname (UN Demographic Yearbook 2022); Venezuela (UN Demographic Yearbook 2022).

***Box 2.1: Defining Urban Areas in Amazonia with DEGURBA***

**Urban areas** are polygons containing at least one high- or moderate-density cluster, with populations of 5,000 or more and densities of at least 300 people per square kilometer. The urban population includes all residents within these polygons.

**Cities** are urban areas with 50,000 or more inhabitants.

**Non-urban areas** lack high or moderate-density clusters and have populations between 200 and 5,000 inhabitants and densities of at least 150 people per square kilometer.

**Dispersed areas** consist of grid cells with fewer than 200 inhabitants and densities below 150 people per square kilometer, which are too small or sparse to form polygons.

For further methodological details, see Appendix 2A.

The DEGURBA method answers four key questions about the urbanization process in Amazonia:

**1)** How many people live in urban areas?

**2)** Where are these urban areas located?

**3)** Is the urban population in Amazonia growing or shrinking?

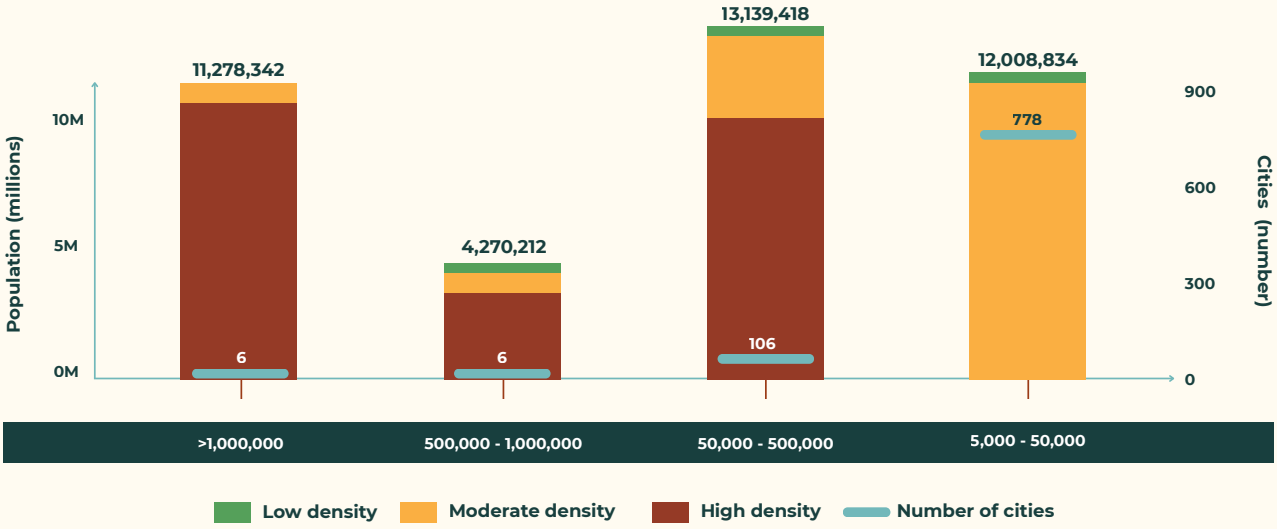
**4)** Is the urban footprint in Amazonia expanding or contracting?

## How many people live in urban areas?

The DEGURBA method identifies 895 urban areas housing nearly 40.7 million people, 69.3% of Amazonia's total population of 58.7 million. Only 117 of these are cities with over 50,000 inhabitants. Collectively, urban areas cover just 19,000 square kilometers, approximately 0.2% of Amazonia's territory.

**Large and medium-sized cities account for the majority of the urban population.** As of 2020, four cities over one million inhabitants — Manaus, Belém, Santa Cruz de la Sierra and São Luís[2] — accounted for 20% of the urban population, while the 778 urban areas with fewer than 50,000 inhabitants were home to only 30% of the region's urban population (Figure 2.1). By country, Ecuador and Suriname have a higher proportion of their population living in cities, while Colombia, Guyana, Peru and Brazil have many smaller urban areas.

***Figure 2.1:* Urban Areas and Population by Size Range**




*Source: Prepared by the authors based on the Global Human Settlement Layer (GHS-BUILT, GHS-POP, GHS-LAND version 2023).*
*Notes: Population refers to urban population.*

**On average, urban areas in Amazonia have a population density of 18 inhabitants per hectare — almost half the density of urban areas located outside the region within the same countries,** which average 32 inhabitants per hectare. Amazonia's large cities, though few in number, tend to have significantly higher population densities. In contrast, smaller urban areas tend to have fewer than 16.6 inhabitants per hectare. These differences may reflect variations in land values, with higher densities showing more expensive land markets commonly found in larger cities, which serve as key hubs of employment and economic activity (see Chapters 3.3.ii and 4.3.ii).

## Where are Amazonia's urban areas located?

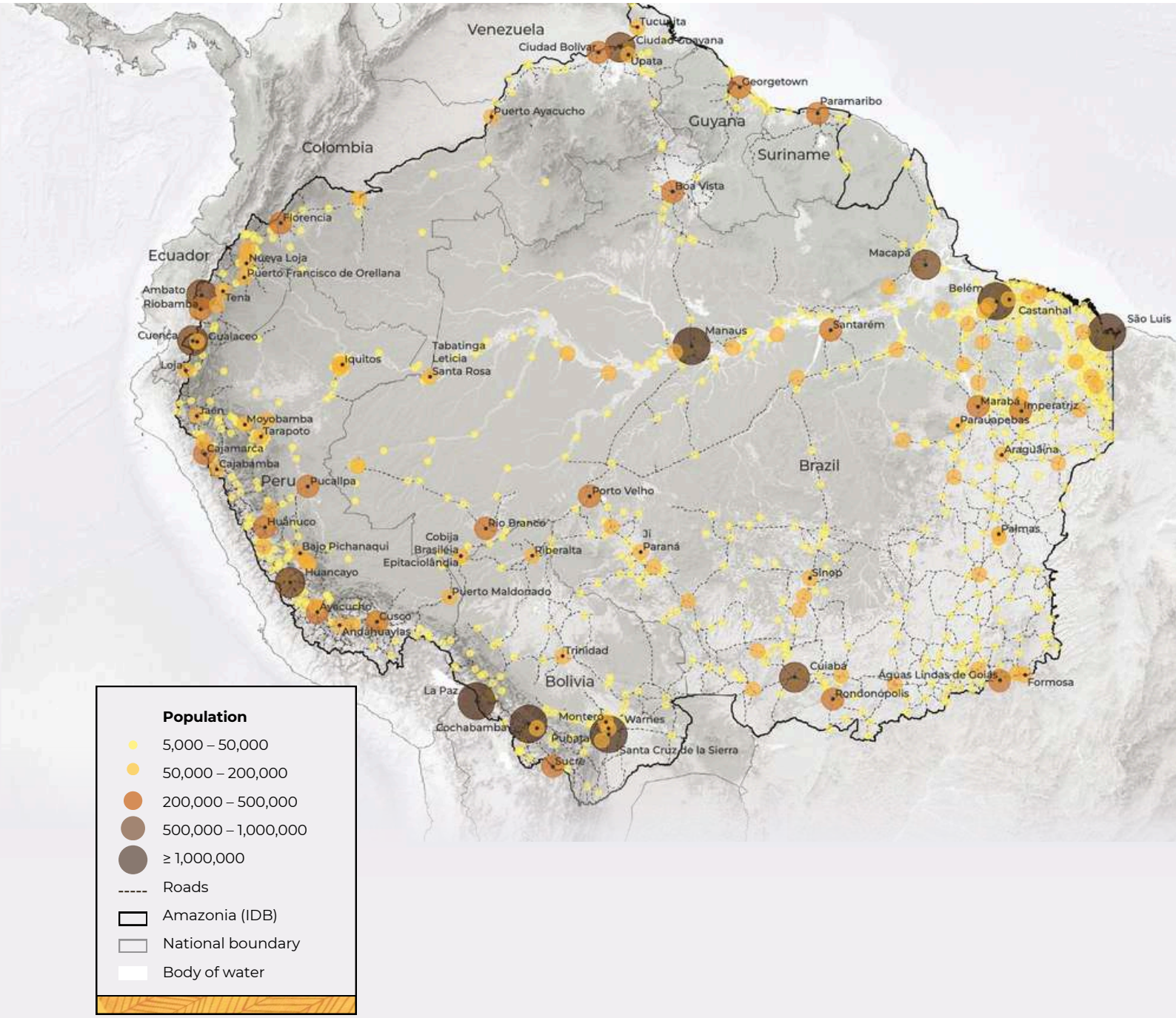
Most urban areas in Amazonia fall into two subregions: a peripheral belt connected to national urban systems via major transport routes, and a central, largely forested zone with scattered urban centers. Guyana and Suriname are exceptions, with Georgetown and Paramaribo lying along the Atlantic coast.

In Brazil, urban areas tend to follow two main patterns. The first is along the Atlantic coast and the Amazonas river delta, which hosts major cities like Belém, Macapá and Manaus, as well as medium-sized cities such as Santarém. The second is found in southern Amazonia, where urban growth has developed along road corridors linking Porto Velho to Mato Grosso (BR-364) and Santarém to Cuiabá (BR-163), anchoring a network of expanding urban centers along Brazil's agricultural frontier. In western Amazonia, urban areas are primarily situated along the Andes foothills and major rivers. In Bolivia, Cobija and Riberalta sit along key river corridors. In Peru, Iquitos and Pucallpa are along the Amazonas and Ucayali rivers, espectively, while others

such as Jaén and Tarapoto are next to the Marginal de la Selva highway. Ecuadorian towns like Tena and Nueva Loja connect to the highlands via the Troncal Amazónica highway.

Colombian cities, including Leticia and Florencia, form a settlement ring near the Andean foothills, while Venezuelan urban centers concentrate near the Orinoco river. Together, these patterns reflect how geography, transportation networks and economic activities shape distinct urban landscapes across Amazonia (Map 2.5).

***Map 2.5:* Urban Areas by Population Size**

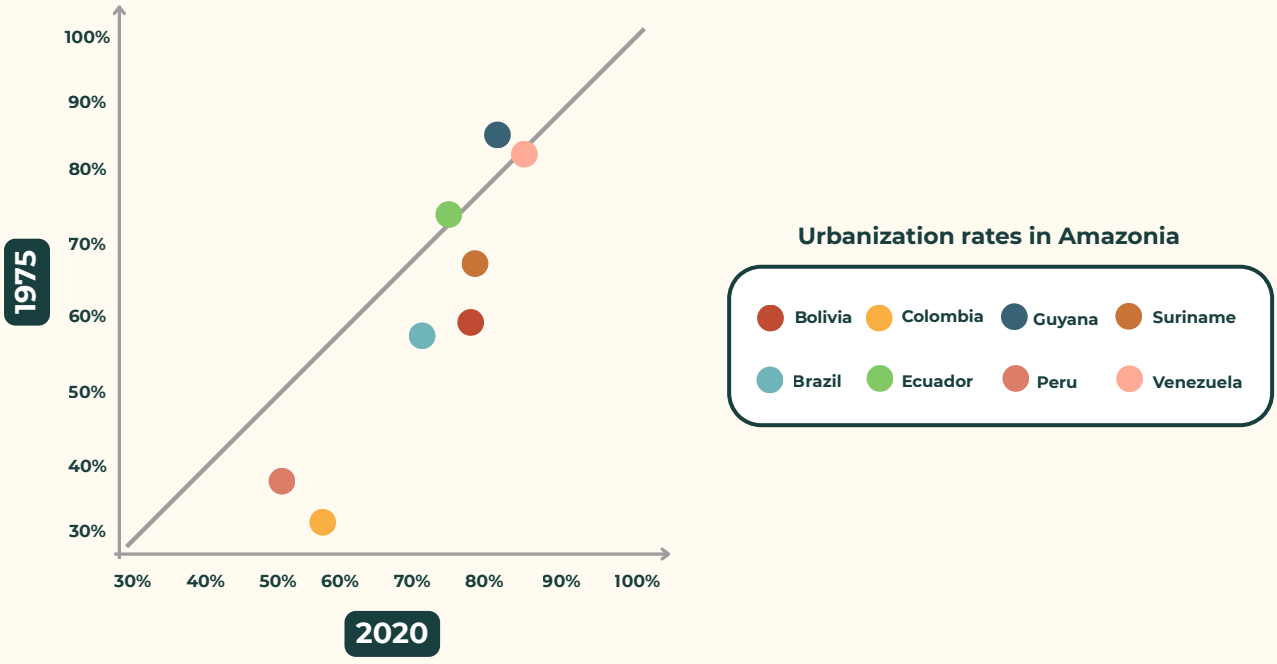



*Source: Prepared by the authors based on the Global Human Settlement Layer (GHS-BUILT, GHS-POP, GHS-LAND version 2023).*
*Note: For more information, see Appendix 1, Box A1: Maps, Data Sources and Geographical References.*

## Is the urban population in Amazonia growing or shrinking?

**Amazonia's population has become increasingly urban, rising from 55.5% in 1975 to 69.3% urban today.** The rate of change varies by country. The fastest urban growth occurred in Guyana and Venezuela, where urbanization climbed from around 60% to over 80%. Colombia and Peru began with lower urbanization levels — about 30-40% in 1975 — and have expanded significantly to roughly 55–60% by 2020. Brazil, Bolivia and Ecuador started with relatively high urbanization rates — approximately 57% for Brazil, 60% for Bolivia and 75% for Ecuador — and have seen more gradual increases, reaching around 70% in Brazil, 80% in Bolivia and 85% in Ecuador by 2020 (Figure 2.2).

***Figure 2.2:* Urbanization Rates in Amazonia by Country, 1975-2020**




*Source: Prepared by the authors based on the Global Human Settlement Layer (GHS-BUILT, GHS-POP, GHS-LAND version 2023).*

By country, urban growth in Amazonia outpaces national averages in Brazil, Colombia and Venezuela. Bolivia, Ecuador, Guyana and Suriname show similar rates to their national levels, while urban growth in the Peruvian Amazonia lags its national average (Table 2.1).

***Table 2.1:* Urban Population Growth Rates by Country, 2000-2020**

| COUNTRY | URBAN POPULATION GROWTH RATES BY COUNTRY, 2000–2020 | | |
|---|---|---|---|
| | In Amazonia | Outside Amazonia | National |
| **Bolivia** | 2.01% | 2.10% | 2.02% |
| **Brazil** | 1.68% | 0.97% | 1.15% |
| **Colombia** | 3.02% | 1.58% | 1.60% |
| **Ecuador** | 1.68% | 1.77% | 1.75% |
| **Guyana** | 0.11% | N/A | 0.11% |
| **Peru** | 1.27% | 1.60% | 1.52% |
| **Suriname** | 1.27% | N/A | 1.34% |
| **Venezuela** | 1.03% | 0.72% | 0.74% |
| **Average** | 1.64% | 1.13% | 1.20% |

*Source: Prepared by the authors based on the Global Human Settlement Layer (GHS-BUILT, GHS-POP, GHS-LAND version 2023).*

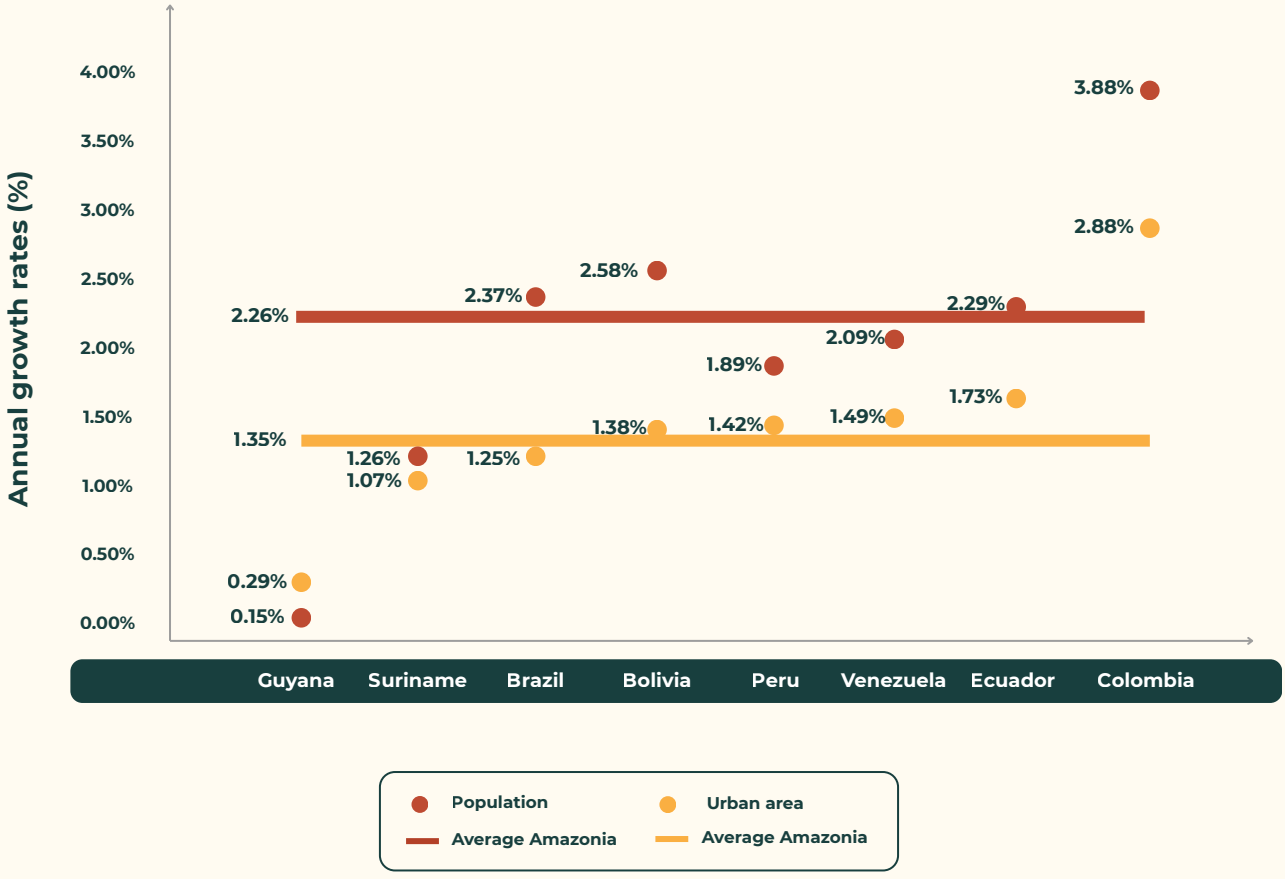
Two key factors explain the rise in Amazonia's urban population. First, many new settlements have reached the thresholds needed to be classified as urban — nearly half of today's urban areas (421 out of 895) did not exist as such in 1975. Second, existing urban areas have grown substantially, with the average population size increasing from about 28,000 in 1975 to over 72,000 by 2020. This growth has resulted in a natural population increase, internal migration and the merging of nearby settlements into larger urban zones.

Among the fastest-growing urban areas in Amazonia is Parauapebas in Brazil, with an annual growth rate exceeding 5%. Puerto Francisco de Orellana in Ecuador, Yapacaní in Bolivia and San José del Guaviare in Colombia also show growth rates above 4%. Additionally, frontier cities have experienced growth well above the regional average of 1.64% between 2000 and 2020. For example, during this period, the Cobija-Brasiléia-Epitaciolândia conurbation on the Brazil-Bolivia border expanded at 4.7% annually, while the Tabatinga-Leticia-Santa Rosa de Yavari area across Brazil, Colombia and Peru grew at 2.9%, highlighting dynamic urbanization along national frontiers.

## Is the urban footprint in Amazonia expanding or contracting?

From 1975 to 2020, the total urbanized area in Amazonia expanded from approximately 2 million hectares to 3.8 million, growing at an average annual rate of 1.35%. While this shows an increasing urban footprint, the faster population growth rate of 2.26% per year during the same period suggests that urban areas in Amazonia are also becoming denser. Across all **Amazonia countries, urban growth has been driven primarily by high-density areas, which expanded at an average annual rate of 2.87% between 1975 and 2020.** In contrast, low-density areas grew by 1.35% and moderate density areas by 0.86%. This consistent pattern across the region suggests a shift toward more compact urban development, which can help reduce environmental pressures and support more efficient infrastructure and provision ofservices (Figure 2.3).

***Figure 2.3:* Expansion of Urban Area and Population Growth, 1975-2020**




*Source: Prepared by the authors based on the Global Human Settlement Layer (GHS-BUILT, GHS-POP, GHS-LAND version 2023).*

Overall, urbanization in Amazonia is well advanced. As of 2020, the region had 895 urban areas with a combined population of 40.7 million, nearly 70% of the region's total population, though only 117 of these areas have more than 50,000 residents.

Urban growth has been driven by both the creation of new settlements and the expansion of existing ones. While most are still small and low-density, there has been a positive shift toward more compact development.

# Urban-Nature Linkages

*Paloma Martín, Pablo Mahnic, Verónica Tejerina, David Cotacachi, Ellen Serrão Acioli, Amancaya Conde (IDB)*

Cities in Amazonia are deeply and structurally intertwined with their peri-urban hinterlands. This interdependence is rooted in centuries of interaction, challenging the simplistic binary between urban spaces and pristine forests. Mounting evidence reveals that the development trajectories of urban and non-urban areas in Amazonia are profoundly interconnected.

Contemporary concepts such as urban forests (Becker 2001) and *extended urbanization* (Monte-Mor 1994) highlight the hybrid nature of Amazonia's urban system, where urban and natural environments merge. Rather than viewing cities as dominant centers extracting wealth from passive rural hinterlands, **Amazonia presents a continuum of large and small settlements linked through reciprocal exchanges and mutual dependence** (Bartoli 2018). This continuum is visible in small urban centers, which often serve as intermediaries between large urban centers and remote settlements. These cities and medium-sized towns connect small communities to regional centers and global markets, often bypassing state capitals (Schor and Oliveira 2011). Forest communities supply products such as *açaí,* fish and bushmeat to their urban relatives, who in turn ease access to healthcare, government services and other essentials (see Chapter 3.2.i) (Costa and Montoia 2020). These interdependencies are further reinforced by cyclical migration flows and the mobility of *multi-sited households* — families that circulate between forest and city, sharing dwellings and livelihoods — which drive the rapid growth of small urban areas across Amazonia (Padoch et al. 2008).

## Economic Linkages: Formal and Informal Systems

Economic integration within the urban-nature continuum occurs in a hybrid and seasonal economy where formal and informal sectors coexist and reinforce each other. Large-scale enterprises — cattle ranching, soy, timber, mining, oil and gas — operate alongside informal activities such as subsistence agriculture, artisanal production, and informal labor networks (see Chapter 3.3.ii). Exported commodities often involve informal practices, from uncontracted labor to undocumented transactions that move products from remote rural frontiers into global supply chains. Formal agribusinesses often rely on informal labor and smallholder suppliers, while illicit activities such as drug trafficking and illegal mining often become intertwined with legal markets (see Chapter 3.1.iii), creating complex economic ecosystems that bridge urban and rural spaces.

In this context, informal networks are vital for survival, particularly in regions where infrastructure and governance are weak (see Chapter 3.1.i). Small-scale producers and traders commonly work outside formal regulatory frameworks, bypassing taxes and official oversight. Typically, small-plot farmers and miners sell their products in urban street markets or through informal intermediaries, providing access to urban consumers and essential services. For instance, in Madre de Dios, Peru, informal gold mining and street vending provide over 1,600 jobs, employing 2.1% of the population (Paredes-Valverde et al. 2024).

The involvement of Indigenous and urban populations in both traditional and informal economic spheres deepens the diversity of these linkages.[3] In the Colombian Amazonia, urban expansion has absorbed *malocas* and Indigenous villages, integrating distinctive practices into the urban settlements in departments such as Caquetá, Putumayo and Guaviare (Domínguez 2001). In peri-urban neighborhoods of Leticia, Indigenous populations combine subsistence agriculture, fishing and informal commerce, adapting ancestral practices to urban economies. These circuits, though outside formal regulation, are governed by traditional norms of barter and reciprocity (Moraes and Schor 2021). Similarly, Indigenous Sateré-Mawé communities in Manaus, Brazil, circulate seeds and crafts between villages and cities, dissolving boundaries through the movement of people, knowledge and goods (Mauro 2016).

Bioeconomy initiatives that connect urban markets with rural producers of *açaí* and Brazil nuts also create sustainable value chains rooted in traditional exchange principles. In the Marajó archipelago in Pará, Brazil, cities such as Ponta de Pedras and Afuá are diversifying their economies and fostering stronger ecological connections.

A notable example of innovation rooted in ancestral knowledge and urban markets is the participatory management of the pirarucu fish — (*Arapaima gigas*) in Medio Juruá, Brazil. By integrating local knowledge of the fish's behavior with scientific methods, this system has transformed a once-predatory practice into a sustainable value chain that connects riverside territories to markets in Carauari, Tefe and Manaus (Gamarra et al. 2022). The availability of essential infrastructure (see Chapter 3.1.ii) refrigeration, river transport and digital connectivity — has been crucial for commercialization, including through public procurement (Paes et al. 2021). Beyond providing income and food security to fishers, this management approach has reduced illegal fishing by up to 77% and effectively integrated local traditions, private markets and public policies.

## Territorial Dynamics: Hybrid Landscapes and Amphibian Cities

The urban–rural continuum is also inscribed in the territory of Amazonia's cities. From floating settlements and

[3] There are 511 Indigenous groups in Amazonia, of which 66 are recognized as living in voluntary isolation or initial contact, inhabiting land covering approximately 2.4 million square kilometers — 28% of Amazonia (RAISG 2020) — making this one of the most culturally and ethnically diverse areas in the world. Additionally, more than 300 Indigenous languages are spoken in the region, enriching its cultural heritage and legacy. Some of the Indigenous languages of Amazonia with the largest numbers of speakers include: Shipibo-Conibo, Asháninka, Aguaruna/Awajún (Peru), Tikuna (Brazil, Colombia and Peru), Nheengatu (Brazil, Colombia and Venezuela), Achuar-Shiwiar (Ecuador and Peru) and Amazonian Kichwa (Ecuador), among others (World Bank 2019).

riverfront neighborhoods to bustling markets and adaptive hinterland zones, urbanism in Amazonia seamlessly integrates the natural and the built landscapes.

The complex urban network — characterized by large and smaller cities — often reflects Indigenous principles of urbanization, with settlements found within five kilometers of each other, creating an inhabited forest and an extended peri-urban system (Ribeiro et al. 2024b). Peri-urban settlements, particularly in riverine zones, blend rural livelihoods based on fishing and agriculture with a reliance on urban services. In these settlements, residents rely on traditional construction methods that are flood-adapted — crucial for coping with seasonal flooding and shifting river courses.

One example of Amazonia's unique hybrid urbanism is its so-called *amphibian cities* — urban centers where land and water are equally central to spatial organization and daily life. In these cities, rivers function not just as natural boundaries but as vital connectors, integrating urban infrastructure with aquatic ecosystems to form an adaptive socio-spatial system. In Añamã, along the Solimões river in the Brazilian Amazonia, much of the town becomes accessible only by boat during the flood season (Castro de Lima and de Souza Araújo 2021). Similarly, in the floating neighborhood of Belén, on the outskirts of Iquitos, Peru, vernacular architecture — crafted from wood and palm leaves — adapts to rising waters (Reátegui 2015). Homes are built on stilts or floating rafts and canoes are used for daily mobility, embodying the region's amphibian architecture (Bachman 2020). In Iquitos, Peru, the Belén Market serves as a vibrant hub where rural producers and urban retailers interact, distributing timber, fish, agricultural goods, wild meat, and crafts throughout the city and beyond (Mayor et al. 2019).

## Indigenous and Afro-Descendant Populations: Bridging Urban and Forest Communities

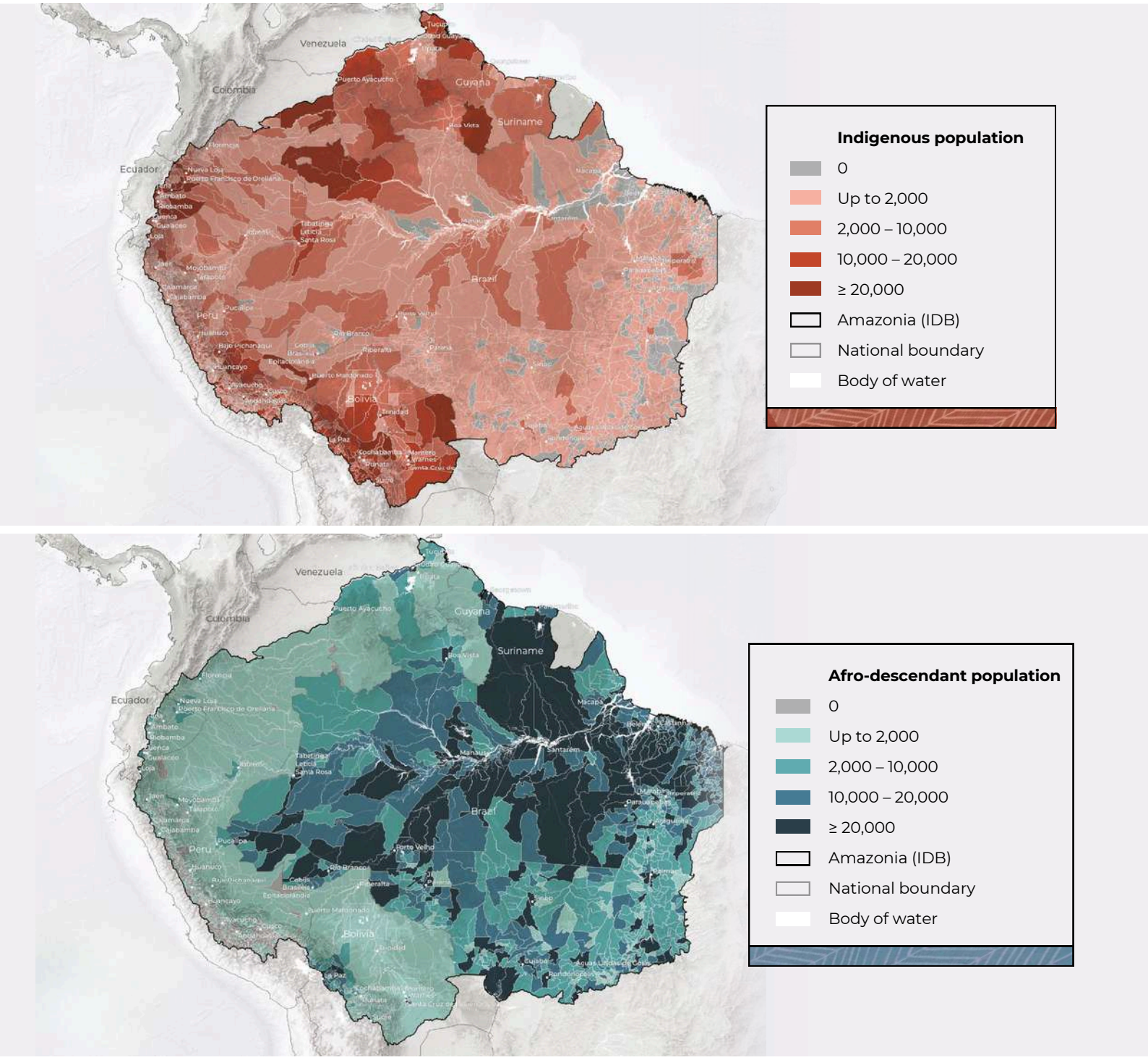
Indigenous and Afro-descendant populations play a pivotal role in shaping the complex relationships between cities and the natural environment.[4] The most recent subnational data indicate that these communities together comprise more than half of Amazonia's 53 million residents — approximately 7 million Indigenous people and 21.5 million people of African descent. Thepercentages of Indigenous people are highest in Bolivia (38%) and Peru (30%), followed by Ecuador (23%) and Colombia (16%). Brazil has the highest percentage of Afro-descendants (70%), followed by Suriname (48%) and Guyana (29%).

Urbanization rates vary significantly. About 44% of Indigenous people in Amazonia live in cities — with national figures ranging from 57% in Peru and 47% in Bolivia to less than 28% elsewhere. In contrast, 72% of Afro-descendants are urban dwellers, with the highest rates in Venezuela (91%), Brazil (73%) and Suriname (72%).

[4] Census definitions of Indigenous and Afro-descendant populations rely on self-identification by respondents. In Bolivia and Brazil, classification is based on color and race; in Colombia, Guyana, Suriname and Venezuela, on ethnicity; in Ecuador, on culture and customs; and in Peru, on customs and ancestry. Peru also categorizes Indigenous populations into four groups — Quechua, Aymara, Indigenous Peoples of Amazonia and Other Indigenous Peoples — while the other three countries include only one Indigenous classification. Surveys covered only individuals aged 12 and older.

It is important to note that much of the data has not been recently updated, and therefore the trends presented here should be interpreted with caution (Maps 2.6(a) and (b)).

***Maps 2.6 (a) and (b): Share of Urban Indigenous Population (a) and Afro-descendant Population (b)***



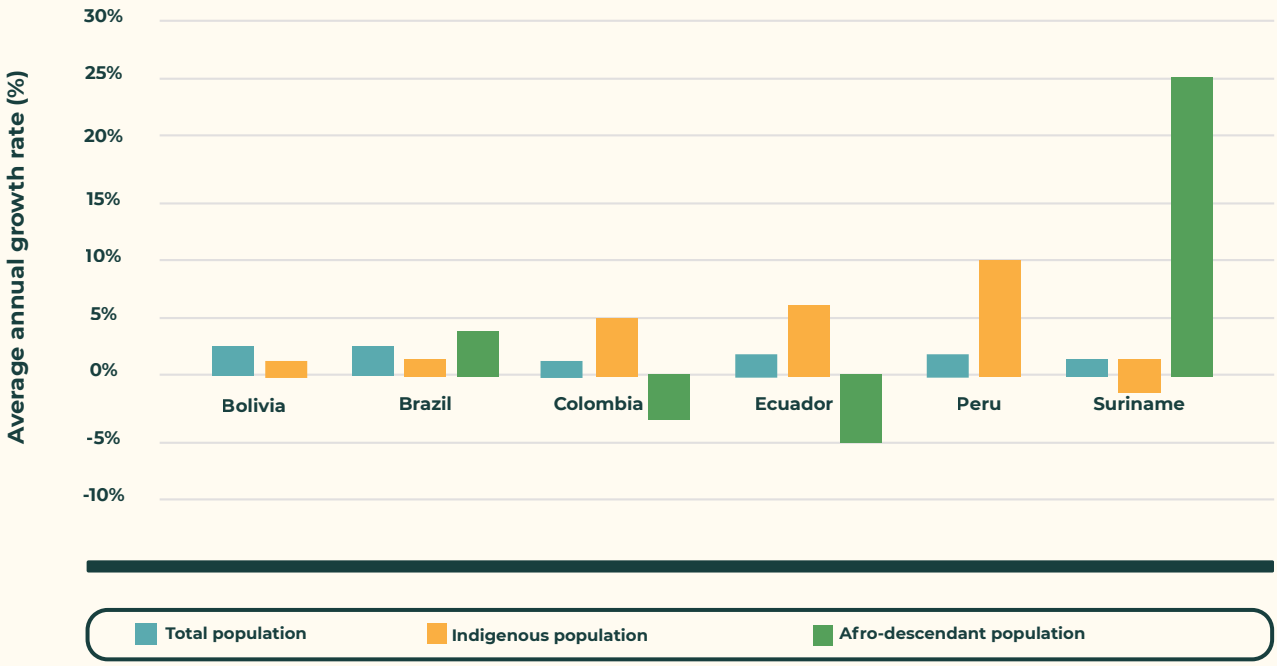

*Source: Prepared by the authors based on the Global Human Settlement Layer (GHS-BUILT, GHS-POP, GHS-LAND version 2023).*
*Note: For more information, see Appendix 1, Box A1: Maps, Data Sources and Geographical References. The censuses considered are Bolivia 2012, Brazil 2010, Colombia 2018, Ecuador 2022, Guyana 2012, Peru 2017, Suriname 2012 and Venezuela 2011.*[5]

[5] Although Bolivia and Brazil conducted censuses in 2022, their data were not included due to the unavailability of microdata at the level of the smaller administrative units necessary for this analysis.

**Indigenous communities are more common in smaller administrative units, while Afro-descendants tend to live in larger ones.** This pattern holds across administrative units, with populous areas within the units having higher percentages of Afro-descendant shares and fewer Indigenous residents. The largest Afro-descendant populations are in Brazil's major cities in Amazonia — Manaus, Belém and São Luís — where Indigenous presence is minimal.

However, most recent data shows that Indigenous populations are increasingly migrating to urban centers. For example, in Colombia, Ecuador and Peru, the share of Indigenous people in urban areas in Amazonia has grown faster than the general urban population. Afro-descendant urban trends vary — showing growth in Brazil and Suriname but declines in Colombia, and Ecuador (Figure 2.4).

***Figure 2.4:* Average Annual Growth Rates of Urban Populations in Amazonia (Total, Indigenous and Afro-descendant), by Country**




*Source: Prepared by the authors based on locally disaggregated data from the last two censuses for each country.*
*Note: The smallest administrative units considered for each country are districts for Bolivia and Peru, municipalities for Brazil, Colombia, and Venezuela, cantons for Ecuador and regions for Suriname. Updated data for Guyana and Venezuela are not available. For Peru and Bolivia, data on the Afro-descendant population are not available for 2007 and 2001, respectively.*[6]

[6] Although Bolivia and Brazil have already conducted censuses for 2022, they were not considered because, at the time of this study, microdata at the level of smaller administrative units were not available. The censuses considered are Bolivia 2001and 2012, Brazil 2000 and 2010, Colombia 2005 and 2018, Ecuador 2010 and 2022, Peru 2007 and 2017 and Suriname 2004 and 2012.

For Indigenous peoples, multiple factors drive migration to cities. Key push factors include the expansion of extractive industries — such as mining, oil, and timber — deforestation and violence (see Chapter 2.1.ii).

These activities disrupt natural ecosystems and undermine Indigenous cultural and territorial rights (Hecht et al. 2021). Simultaneously, urban centers exert a strong pull, particularly for younger generations, offering access to education, healthcare and employment opportunities (see Chapter 3.2.ii). Some Indigenous parents encourage their children to learn the language and behavioral norms of the urban environment, promoting social integration, though sometimes at the expense of their traditional culture.

Often, Indigenous migrants to cities forge new urban identities while still rooted in their heritage (Zarate Botía and López Urrego 2018). They may face marginalization but also carve out their own unique urban identity through cultural fairs, and the use of native languages, imbuing urban life with new meaning (Rivero 2009). A study on Xerente youth shows how technologies can help record oral histories and document languages, disseminate native art and culture through social networks, and promote intercultural educational practices (Santana et al. 2024). Familiarity with the digital world, combined with cultural appreciation, can empower young people to become preservation agents, using new tools to keep their ancestral knowledge alive and promote traditional practices in urban settings. Indigenous involvement in local councils, self-government bodies, and cultural associations exemplifies this engagement.

In summary, the urban-rural spectrum is woven into the social, economic and geographic tapestry of Amazonia's urban system, shaping its enduring rhythm and flow.

## *Box 2.2: Local and Global Influences on Urban Identity*

***André de Moraes (Instituto Sociedade, População e Natureza)***

The complex relationship between urbanization and nature in Amazonia's cities has been deeply shaped by global connections. Many of these cities began as transit points for the flow of people, goods, ideas and cultural influences (see Chapter 2.1.ii). These influences are reflected in the region's urban design, architecture, gastronomy and festivals of the region — resulting from ongoing reinterpretations through interaction with local cultures. **This continuous blending of local and global elements has created a unique yet diverse urban identity in Amazonia.**

The urban design seen in the region reflects this dynamic interplay. Plant species introduced from Asia, Africa and India — such as mango trees, imperial palms and fig trees — were often planted to evoke a European aesthetic but have since become integral to local economies and identities (Cardenas López et al. 2011). For instance, the mango trees of Belém are now city symbols. European architectural styles have also left a lasting imprint on the region. Traditional neoclassical elements have been adapted in theaters, markets and religious missions. For example, the *Raio que o Parta* ("The Lightning That Strikes") movement emerged in the working-class neighborhoods of Belém between the 1940s and 1960s, when bricklayers and residents decorated façades with broken ceramic tiles — left over from local industries. These handmade, lightning-shaped mosaics created a distinctive urban aesthetic and a strong local identity. Developed by people without formal architectural training, this movement stands as a popular expression of modernity (Cardoso 2012).

*Belém, Brazil*
*Photo by Christian Braga*

Gastronomy is another arena where local and global influences meet. The region's traditional diet — rich in fish, tubers like cassava, native fruits and fermented beverages — has evolved over time (Chocano 2009). Western influences, new edible species, and industrialized foods have shaped but not replaced local cuisine (da Costa and Schor 2013). Iconic dishes such as maniçoba, pato no tucupi, and juanes remain central to daily life and celebrations (Chocano 2009), while migration and demographic shifts continue to influence food preferences (Chaves et al. 2024). Initiatives like the Amazon Indigenous Rights and Resources project in Colombia, Peru and Ecuador foster exchanges among Indigenous producers, chefs and markets to promote economic alternatives, cultural identity and conservation (WWF 2024). The Taste Amazonia initiative advances the bioeconomy through gastronomy and resilient food systems (Lesenfants et al. 2024).

**Festivals and events serve as powerful platforms that showcase the region's cities, boost local economies and celebrate cultural richness.** Rooted in resistance to cultural imposition, these gatherings strengthen local identities and artistic expressions. In Peru, the Fiesta de San Juan blends religious and regional traditions, while in Brazil, Belém's Círio de Nazaré procession merges Catholic devotion with *caboclo* customs. In Santarém, the Sairé festival features symbolic pink and tucuxi river dolphins. Notably, in 2015, the Brazilian National Institute of Historical and Artistic Heritage recognized the Parintins Folklore Festival as part of the country's Intangible Cultural Heritage (IPHAN 2019). These vibrant festivals preserve and celebrate cultural heritage and promote the Amazonia's visibility on a global stage.

*Cobija, Bolivia*
*Photo by Christian Braga*

# Remoteness and Connectivity

*Robert Muggah and Mac Margolis (Igarapé Institute)*
*Andrés Blanco, Raphaëlle Ortiz,*
*Reinaldo Fioravanti (IDB)*

A distinctive feature of cities in Amazonia is their remoteness from national markets and broader urban systems. Typically, these cities stay connected to the rest of the country — and the wider world — through a complex, and multi-layered network of rivers, roads, air routes and digital links.[7]

## Water World: The Lifeblood of Amazonia

The rivers and streams of the world's largest hydrographic system — spanning nearly 7 million square kilometers — have long served as Amazonia's original superhighways. These waterways attracted ancient migrants, travelers, and traders from near and far, fostering interactions that led to the rise of large, sometimes colossal towns along their banks. Today, approximately 50,000 kilometers of these rivers are navigable by boats weighing up to 1,000 tons, while 10,000 kilometers can accommodate ships exceeding that weight (Aragón and Clüsener-Godt 2004). **Many urban areas in Amazonia still depend heavily on rivers for the transportation of goods and people.** In Peru, for example, over 90% of cargo and passenger movement in Amazonia flows via river transport. Of the country's 92 port facilities, 32 are located in Amazonia, such as in the departments of Loreto, Ucayali and Madre de Dios (Zucchetti et al. 2020). The city of Iquitos — one of the world's largest urban centers without road access — illustrates the logistical challenges of this system. Transporting one metric ton of goods upstream from Iquitos to Pucallpa requires about 130 hours and 3,400 gallons of fuel during high water; in low water, the journey takes an added 20 hours and 500 gallons. These conditions significantly affect the movement of goods, especially perishables, and require careful planning around inventory, storage and costs (Hausmann et al. 2023). Multiple logistical bottlenecks — such as underinvestment in dredging and limited digitalization of cargo and passenger terminals — further constrain economic activity and keep remote communities underdeveloped (Adaçchi 2022).

River transport in Amazonia is often dominated by small, unregulated vessels, complicating oversight and coordination (Hanusch 2023). These unregulated operators often use polluting fuels (NPS 2024) and contribute to riverbank erosion, which reduces river depth and limits access to urban ports. Seasonal droughts worsen the challenges, as shallower tributaries restrict navigable routes and further hinder regional productivity (Aragón and Clüsener-Godt 2004). Some rivers,

[7] In addition to roads and rivers, air transportation has played a key role in the development of Amazonia's economies. During World War II, the United States built over 50 small landing strips throughout the region to support rubber exports for the war effort. Over time, these landing strips spurred growth in urban areas, including Belém, Iquitos, and Cachuela Esperanza in Bolivia. While air travel is often the fastest form of travel, many airports in the region offer only domestic flights. Additionally, air travel can be cost-prohibitive for low-income populations and small businesses, while it produces higher greenhouse gas emissions than some other modes of transportation (Hanusch 2023).

such as the Meta in Colombia and Venezuela, are navigable only during certain periods depending on water levels (Salazar Cardona and Riaño Umbarila 2015).

**Fluvial shipping in Amazonia is highly vulnerable to climate-related hazards that affect river navigability.** Trade between cities often fluctuates with cyclical El Niño and La Niña events, as well as ongoing warming in the subtropical Atlantic. Back-to-back record droughts in 2023 and 2024 severely disrupted transportation, rendering major rivers unnavigable for weeks and isolating riverine communities (Santos de Lima et al. 2024; Magnani 2024). In 2024, industries in the Manaus Free Zone incurred approximately 1.3 billion reais (about $214 million) in added costs due to the severe dry season, with 87% of companies facing higher operational expenses (Vilera 2024).

## The Asphalt Amazonia: Navigating Connectivity and Conservation

The limitations and unreliability of river transport have intensified demands for faster, safer and more efficient modes of transportation. Over the decades, this need has driven a continental shift toward the combustion engine. By the mid-20th century, South American governments began prioritizing highway expansion as a cornerstone of national integration. Highways spurred the development of secondary and tertiary roads, leading to a rapid expansion of the road network. By 2020, nearly 3.5 million kilometers of roads — (of varying surfaces) — were mapped across the administrative region known as the *Brazilian Legal Amazonia* (Botelho et al. 2022). By 2022, approximately 65% of freight and 90% of passenger transport in Brazil occurred via roads and highways (National Transport Confederation, Brazil 2022).

Despite this expansion, road connectivity remains a significant challenge. Traveling from the Brazilian Amazonia to the Andean region is difficult due to geographic and infrastructure constraints (see Chapter 3.1.ii). About 14.3% of the territory in Amazonia lies more than 45 minutes from major roads, and 7.1 million people live more than 45 minutes away from a primary road, while 4.7 million are similarly distant from a secondary road (Giles Álvarez et al. 2025).

These figures do not account for road quality, which can significantly affect travel times. Navigating national road networks is often costly and hazardous. In Brazil, only 12% of the 1,720,909-kilometer national highway network is surfaced with asphalt. Colombia's 142,000-kilometer network of regional roads has just 6% improved, with only 19% considered to be in good condition. In Peru, while 83% of national highways were paved in 2021, only 15% of the 28,000-kilometer of regional roads had similar treatment. Overall, just 100,000 kilometers of Colombia's total 160,000-kilometer road system are covered with durable surfacing. Furthermore, the Troncal Amazónica highway, which connects the region from west to east, remains in poor condition (Hanusch 2023).[8]

[8] Additionally, roads have been associated with significant harm to the forest ecosystems. There is a strong correlation between paved routes and deforestation, particularly driven by oil and mining activities (Cabrera-Barona et al. 2020). In Amazonia, 95% of the deforestation was within 5.5 km of a road or 1.0 km of a navigable river (Barber et al. 2014).

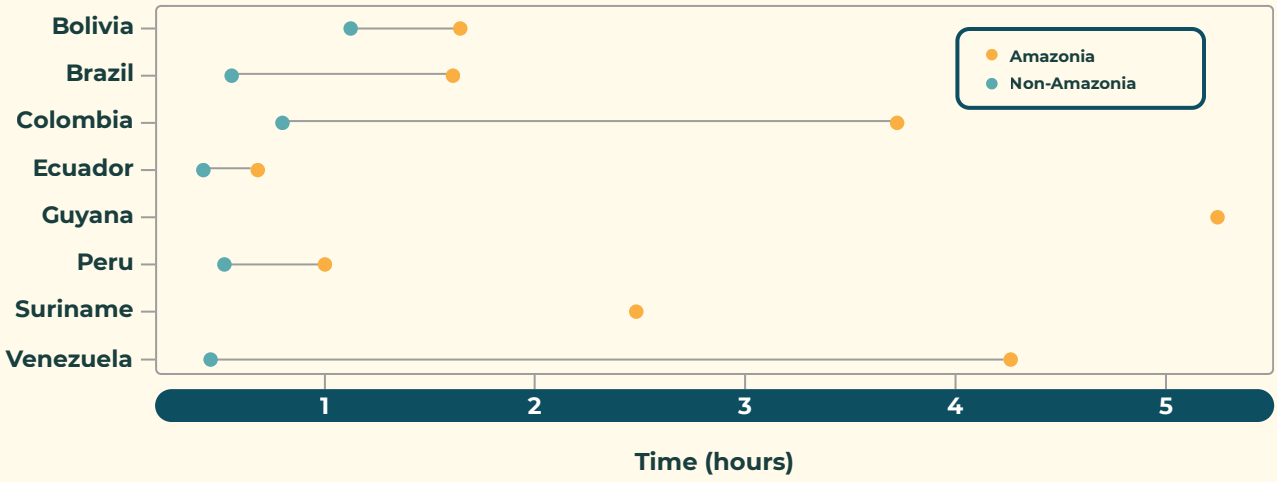
## *Box 2.3: Measuring Remoteness*

***Antonio Vázquez Brust (IDB), Rodolfo Figueroa (Tecnológico de Monterrey)***

Remoteness describes the extent to which a place is physically distant, isolated, or difficult to reach — often due to limited infrastructure, long travel times or challenging geographic barriers. In Amazonia, remoteness typically means poor connectivity to urban centers and scarce transportation networks (Appendix 2B).

**Across all countries, settlements in Amazonia have significantly longer median travel times to the nearest city (with at least 50,000 people) compared to areas outside Amazonia.** This gap is especially wide in Colombia and Venezuela, where average travel times to the nearest city exceed 3.5 hours. Ecuador shows the smallest difference, with areas within and outside Amazonia having median travel times of around 0.5 hours. In the Brazilian Amazonia, the median travel time is about 1.5 hours, compared to less than one hour in Brazilian regions outside Amazonia (Figure 2.5).

***Figure 2.5:* Median Travel Times from a Settlement in Amazonia to the Nearest City**

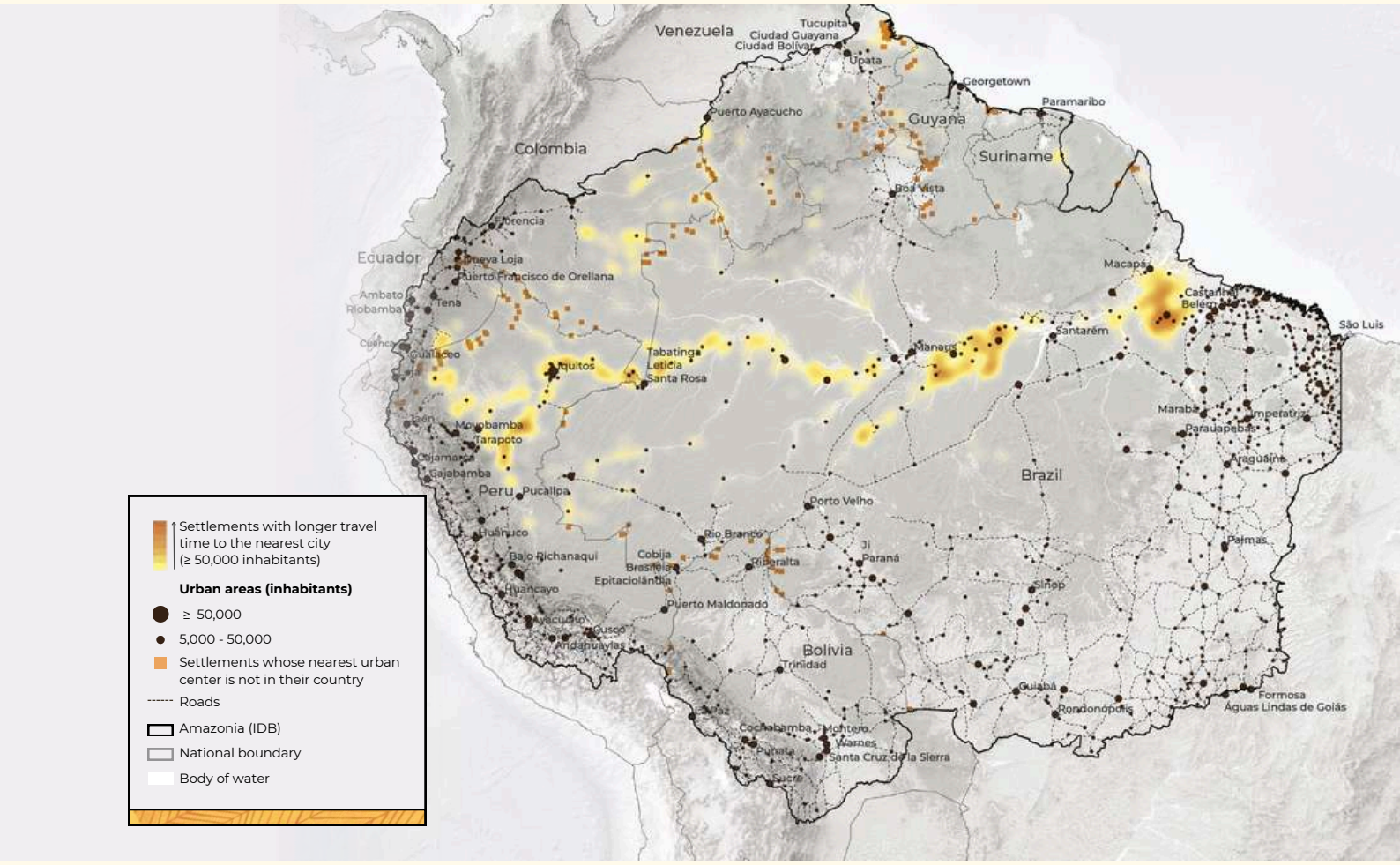



*Source: Prepared by the authors, based on the DEGURBA method (Appendix 2A), the Global Friction Surface dataset, the Global Roads Inventory Project (GRIP) and the Global Roads Open Access Data Set (gROADSv1).*

A notable aspect of remoteness in Amazonia is that internal connectivity across surrounding areas often outweighs national borders. For many settlements, the nearest city is in a neighboring country. Specifically, 189 non-urban settlements and 13 urban settlements fall into this category. This cross-border dynamic is present near national boundaries, particularly in the Andean region of Amazonia.

In sum, there are three main regions in Amazonia with a high concentration of remote settlements: along the main course of the Amazonas river in Brazil; in the central rainforest areas of Colombia, Venezuela, and northern Brazil; and within forest reserves and Indigenous territories in Guyana, Venezuela and Brazil. Many of these settlements face limited connectivity, often relying on river transport. Over half a million residents in 38 urban areas along the Amazonas river live more than five kilometers from the nearest road. (Map 2.7).

***Map 2.7:* Settlements with Long Travel Times and Those Nearest to Urban Areas in a Neighboring Country**




*Source: Prepared by the authors based on DEGURBA method (Appendix 2A), the Global Friction Surface dataset, GRIP, gROADSv1.*
*Note: For more information, see the Appendix 1, Box A1: Maps, Data Sources and Geographical References.*

## Digital Bridges: Connecting Amazonia

Digital connections offer promising solutions to mitigate geographical isolation without the environmental impact of physical infrastructure. Historically, Amazonia's rainforest has posed significant challenges for communications infrastructure (IDEC 2022). Now, high-speed internet and mobile networks are beginning to reach previously isolated towns. Fiber-optic cables and satellite internet services are connecting communities deep in the river basin, illuminating former telecommunications dead zones (Nickas 2024). Instant payment apps on smartphones are providing Amazonia's underbanked populations with secure ways to transfer money with a simple screen tap in what were formerly cash-only markets in Bolivia, Brazil, Colombia and Peru.

Cell-phone ownership is nearly universal, but quality mobile communications are still uneven and highly stratified across the Amazonas river basin. Only 8% of people live in areas with both high building density and high-speed internet — prerequisites for effective digital connectivity. Another 12% live in high-density neighborhoods with inadequate internet speeds. Meanwhile, 38% live in low-density areas with slow web connections, and 42% have no access at all to quality data (Ivarsson and Sekerinska 2025).

There has been rapid progress in the use of digital services, particularly streamlined payment systems. For example, Brazil's instant payment platform, Pix, launched in 2020, has gone nationwide. By 2024, more than 90% of Brazilian adults had used Pix, with over 63 billion transactions totaling 26.5 trillion reais ($4.5 trillion), according to the Central Bank (Aruazo et al. 2024). Interestingly, lower-income. Brazilians are the most frequent users of Pix (Trevisan et al. 2025) . This trend is especially relevant for the Brazilian Amazonia, one of the country's poorest regions, which registered the highest number of transactions per user in 2024. However, while digital services like Pix offer valuable connectivity, the infrastructure that supports them is not always environmentally neutral. Ground-based networks can require forest clearing, while satellite options pose political and regulatory challenges. Ensuring that digital expansion in the region is sustainable is still a challenge.

**Remoteness continues to describe many urban areas in Amazonia, underscoring the need for environmentally sustainable connectivity and strengthened cross-border cooperation.** Such efforts are essential for helping cities overcome historical barriers and transform legacy connections into drivers of collective prosperity rather than sources of persistent vulnerability.

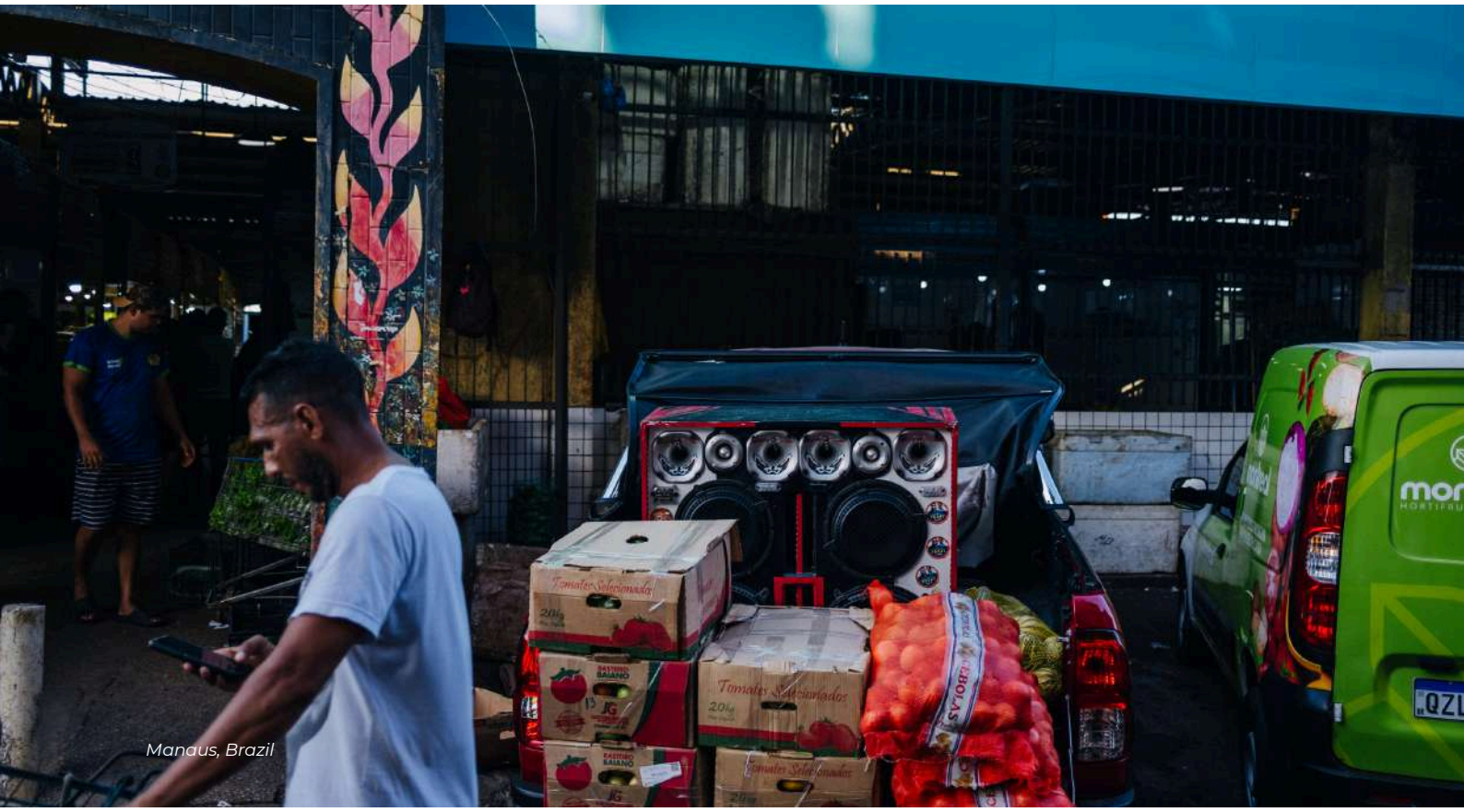
# Photo Essay

## CITIES OF AMAZONIA

by **Christian Braga**

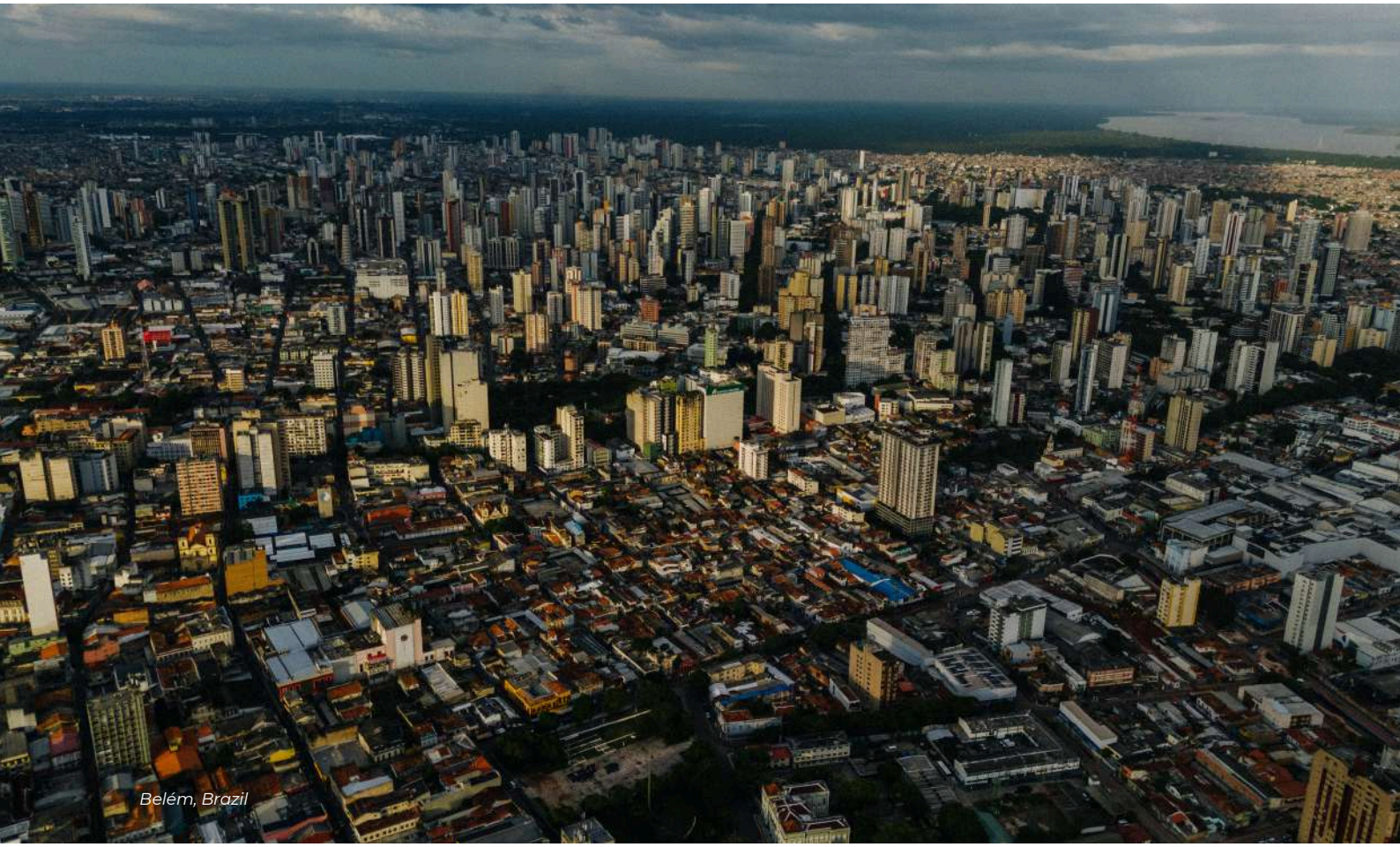
URBAN LIFE
MARKETS
TRANSPORTATION
ARCHITECTURE
PEOPLE

# URBAN LIFE




*Manaus, Brazil*

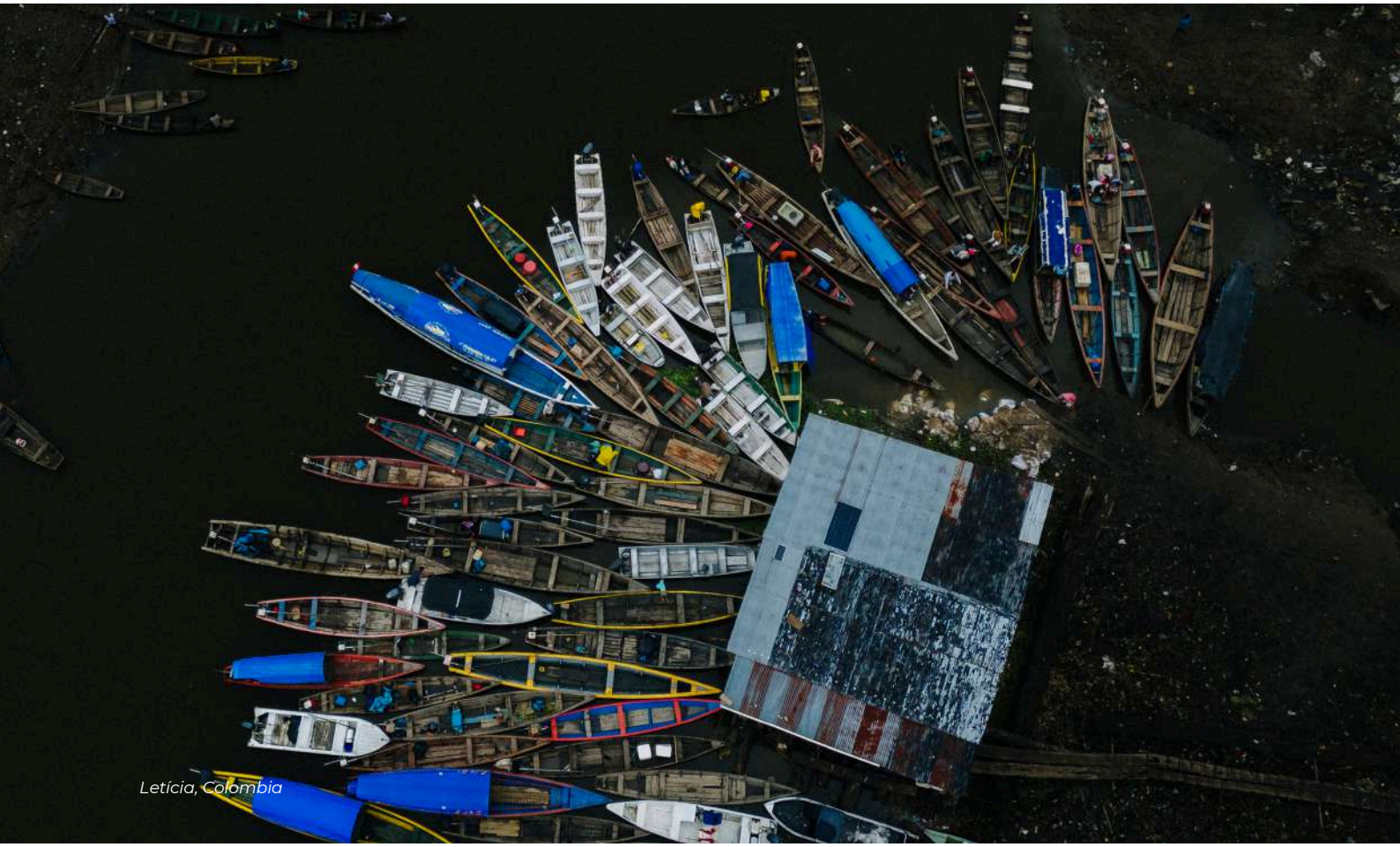

*Santa Rosa, Peru*



*Belém, Brazil*

*Cobija, Bolivia*

*Tabatinga, Brazil*



*Letícia, Colombia*

*Belém, Brazil*


*Santa Rosa, Peru*

# MARKETS

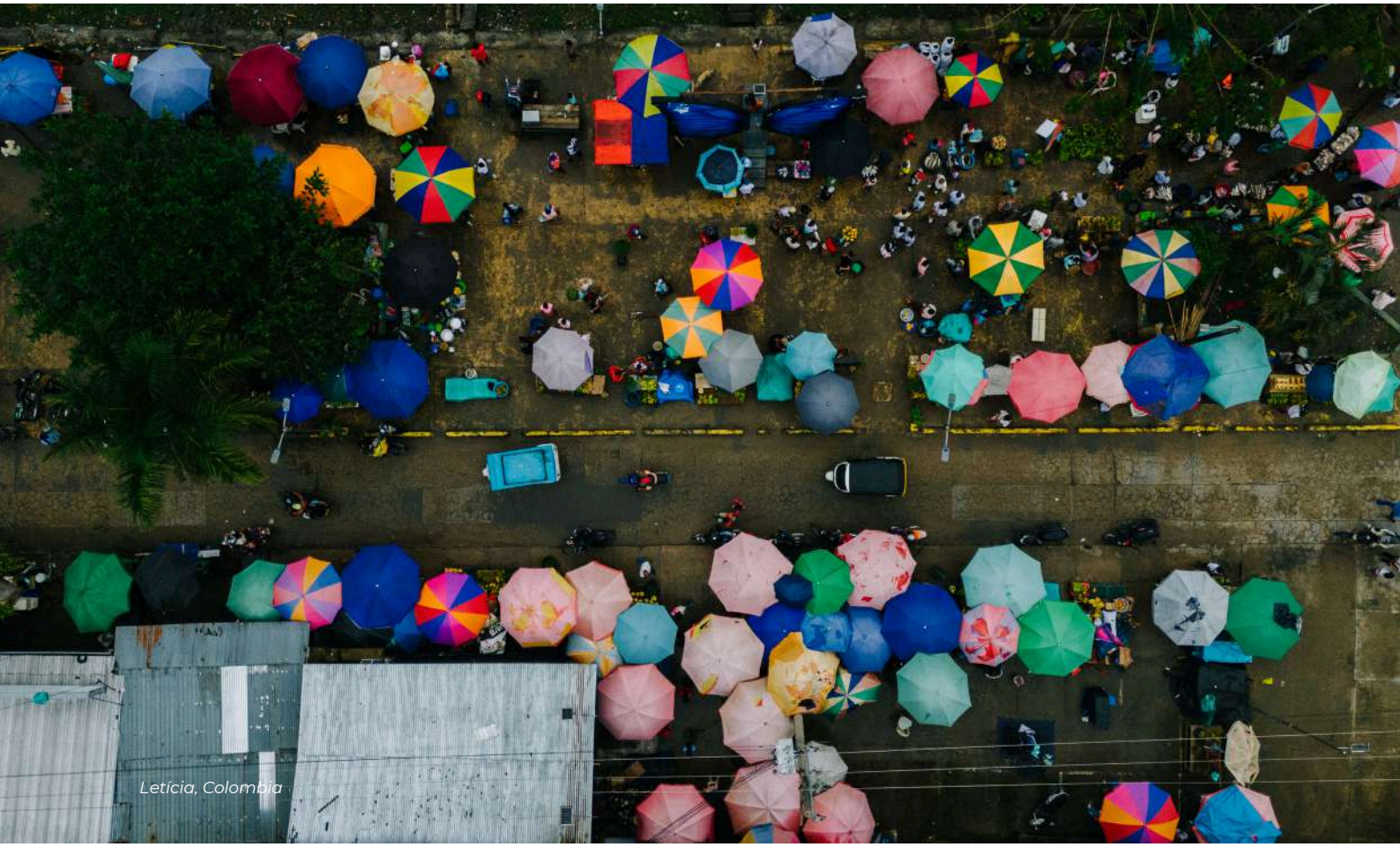

*Riberalta, Bolivia*

*São Gabriel da Cachoeira, Brazil*

*Cobija, Bolivia*

*Tabatinga, Brazil*

*Belém, Brazil*



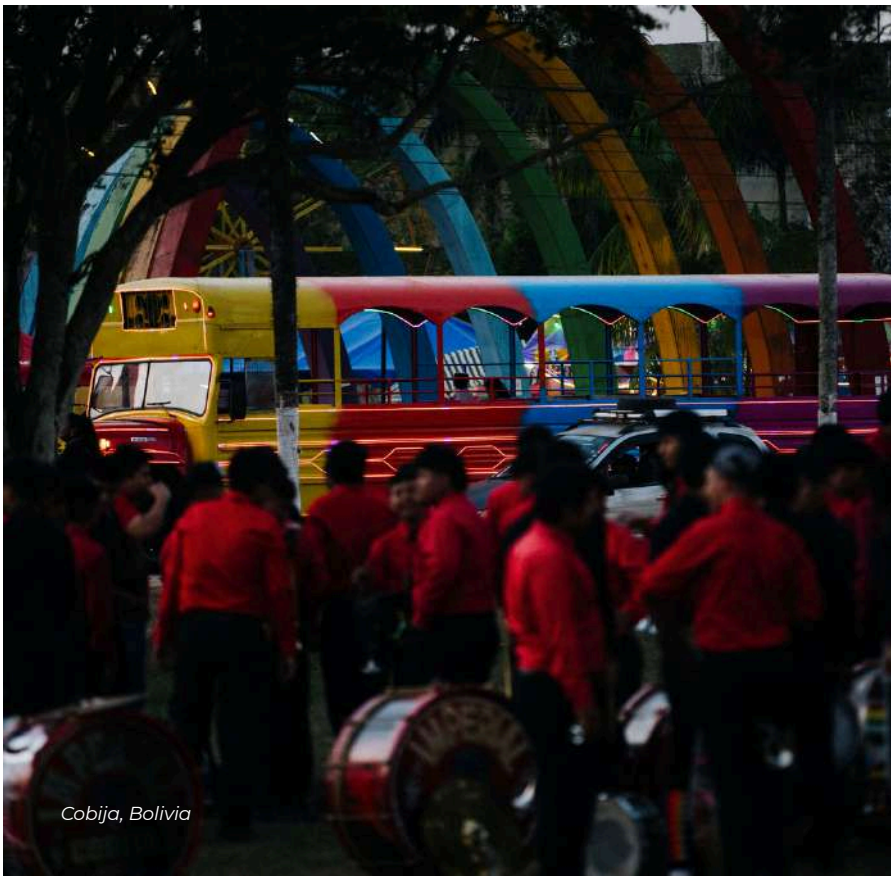
*Letícia, Colombia*

*Cobija, Bolivia*

*Manaus, Brazil*

# TRANSPORTATION

*Belterra, Brazil*



*Cobija, Bolivia*

*Puerto Maldonado, Peru*

*Manaus, Brazil*

*Santa Rosa, Peru*


*Tarapoto, Peru*

# ARCHITECTURE

*Riberalta, Bolivia*

*Belém, Brazil*

*Belterra, Brazil*

*Tarapoto, Peru*

*Riberalta, Bolivia*

*Letícia, Colombia*

*Tabatinga, Brazil*

*San José del Guaviare, Colombia*

*Puerto Maldonado, Peru*

*São Gabriel da Cachoeira, Brazil*


*Tarapoto, Peru*

*Cobija, Bolivia*

*Puerto Maldonado, Peru*


*Riberalta, Bolivia*

*Cobija, Bolivia*

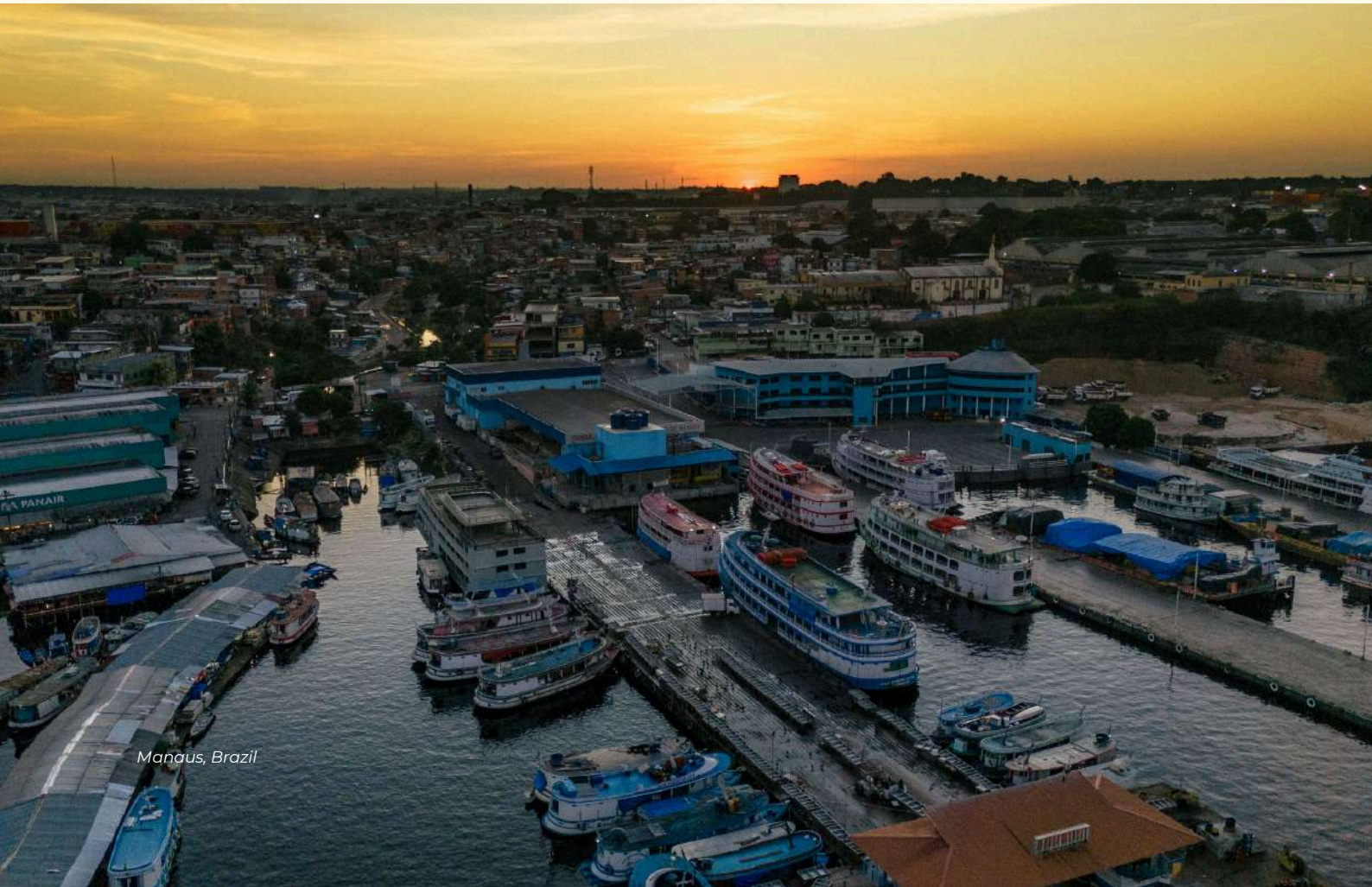
## *Box 2.4: In the Words of the Photographer*

**Christian Braga**

It is fascinating to see how cities adapt to life within Amazonia, navigating both the challenges and opportunities of the world's largest tropical rainforest. I followed a pattern that was repeated in each place, yet was never quite the same: riverbanks, markets and fairs, town squares, museums, cultural events. These spaces, rich with identity, were illuminated by the generous gaze of those who live in these cities and shared their visions with me.

As a photographer, I had an incredible opportunity to gather memories of places filled with beauty, meaning, and affection. This weaving of paths perspectives, and encounters was essential in shaping a visual narrative that resonates more closely with the lived realities of these urban territories. Building a visual archive of cites in Amazonia is fundamental to recognizing and valuing the identities that pulse through them. This journey reveals our plurality and what connects us: the shared experience of living in Amazonia.

Often overlooked in comparison to their nations' major metropolises, these cities are also true incubators of innovation. In the face of the global climate crisis, I believe they can inspire us to explore new paths and solutions for the future, fostering a more balanced relationship between city and nature.



*Manaus, Brazil*

## *Box 2.5: In the Words of the Artist*

**Kaya Agari**

Kurâ-Bakairi painting is not merely lines upon the skin. It is the breath of our ancestors, the whisper of the forest, the movement of the waters. When I draw on the body the lines taught to me by my elders, I feel as though I carry with me entire rivers, the flight of birds and the memory of the *encantados*.

The j*enipapo* fruit dresses me in night, *urucum* dresses me in sun, and clay dresses me in the silence of the earth. Each color holds its power. Each shape carries a story.

For many Indigenous peoples, the fish represents abundance, sustenance and a deep connection to rivers — the source of life. Vivid shapes evoke elements of the natural world: water, leaves, animal skins, seeds, even celestial bodies. Cosmic interdependence exists between humans, nature, and the *encantados*.

These graphic motifs form a visual language — one that preserves history, transmits knowledge and links the one who paints with the one who sees. It is a connection to the spiritual world.

An a*ldeia* is born of the earth, the forest, the river and the animals. The city is an a*ldeia*. The meeting of these two worlds is not only a contrast, but also a dialogue.

*Art by Kaya Agari*

# 3 Assessing Gaps

## 1. FRAGMENTED URBAN SYSTEMS: DEFICITS IN URBAN GOVERNANCE AND SERVICES



## 2. HYBRID URBANIZATION: ADEQUACY AND VULNERABILITY OF URBAN SYSTEMS



## 3. REMOTENESS OF URBAN AREAS: CHALLENGES FOR URBAN PROSPERITY

# FRAGMENTED URBAN SYSTEMS: DEFICITS IN URBAN GOVERNANCE AND SERVICES

## Local Governance and Urban Planning

*Daniela Torres Peláez, Roberto Arana Fierros, Fernanda Balbino (IDB)*

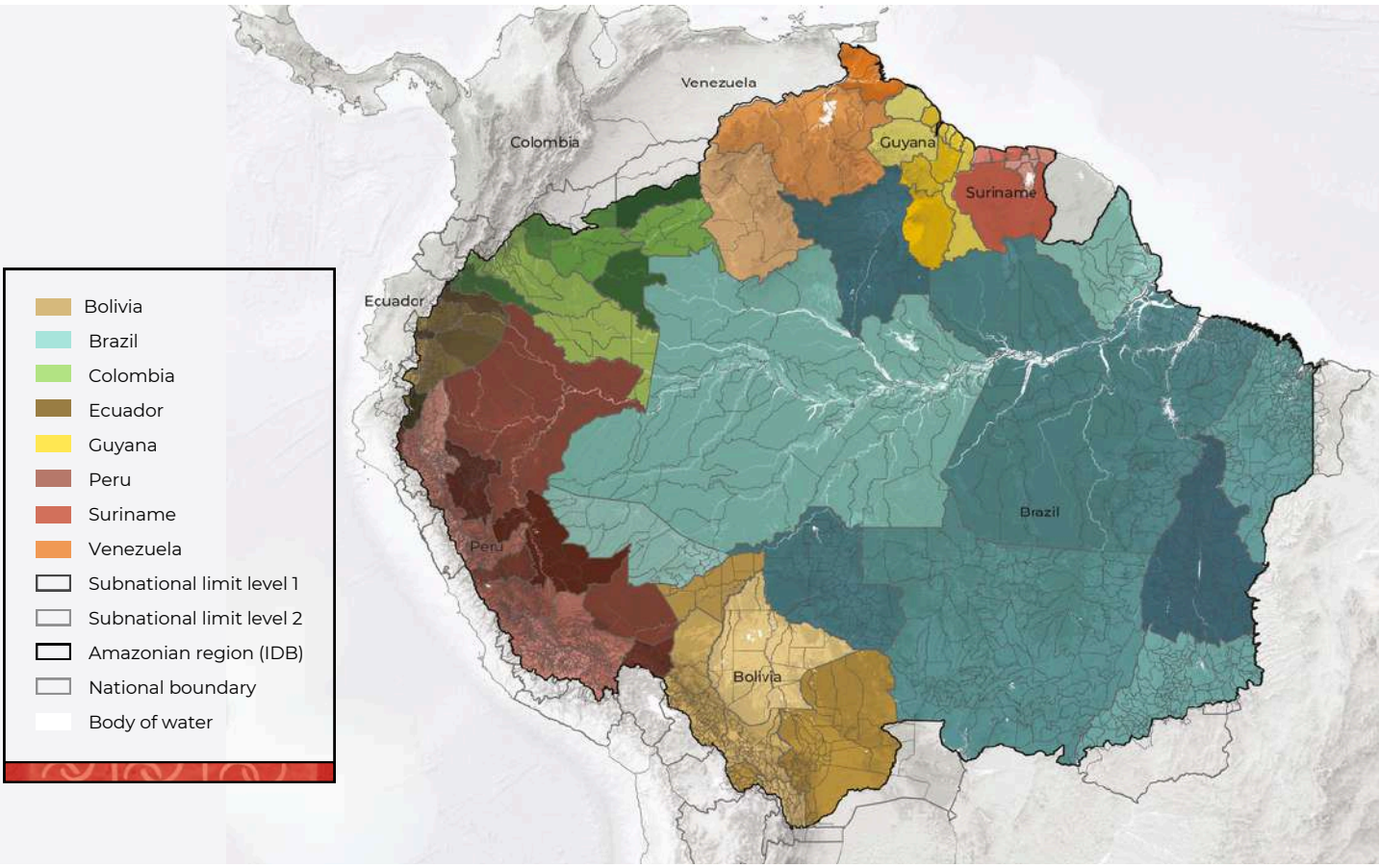
Decentralization reforms in the LAC region have expanded the mandates of subnational governments, particularly in urban and environmental governance. Bolivia, Brazil, Colombia, Ecuador and Peru significantly devolved authority in these areas (Arcia et al. 2023). However, this devolution has often outpaced institutional and fiscal capacity, leaving local governments with broad responsibilities but limited resources and support from higher levels of government (Malhado et al. 2017).

**A persistent gap exists between the legal responsibilities assigned to subnational governments and their actual capacity to deliver, as reflected in widespread deficits in provision of basic services.**[9] This challenge is particularly acute in urban areas of Amazonia, where local governments face mounting pressures from high levels of unmet population needs, inadequate infrastructure and escalating environmental risks (see Chapter 3.2.iii). Throughout the region, local governments are heavily dependent on central government transfers, a reliance that can undermine accountability and restrict fiscal autonomy. Moreover, intergovernmental arrangements are often poorly defined, with ambiguous expenditure responsibilities that further complicate effective governance.

Many subnational governments in Amazonia lack the capacity to generate sufficient own-source revenues, making them reliant on central government transfers for much of their funding. This dependence is especially high in Bolivia and Peru, where transfers accounted for 77.1% and 98.8% of departmental revenues in 2019, respectively — significantly constraining their financial autonomy (IDB 2022). Similarly, in Colombia and Ecuador, local governments depend on central transfers (Map 3.1).

[9] Bolivia, Colombia, Ecuador and Peru are unitary states with a high level of decentralization, while Guyana, Suriname and Venezuela show significantly lower levels. Brazil is the only federal country in the region. Government fragmentation — which affects the cost and complexity of implementing territorial policies — also varies widely. Fragmentation is low in Bolivia, Brazil, Ecuador, Suriname and Guyana; medium in Colombia; and high in Guyana and Peru (Radics and Eguino 2018).

***Map 3.1:* Subnational Governments in Amazonia**




*Source: Prepared by Gabriel Kozlowski, based on Database of Global Administrative Areas (2022).*
*Note: For more information, see Appendix 1, Box A1: Maps, Data Sources and Geographical References. The map shows the highest administrative level (subnational level 1) in different colors for each country ("department" for Bolivia, Peru and Colombia; "state" for Brazil and Venezuela; "province" for Ecuador; and "regions" for Suriname and Guyana) and the minimum administrative levels for each of them (subnational level 2), which includes 210 districts in Bolivia, 900 municipalities in Brazil, 86 municipalities and non-municipal areas in Colombia, 75 cantons in Ecuador, 10 regions in Guyana and 955 districts in Peru.*

## *Box 3.1: Country Snapshots of Fiscal Frameworks*

**BOLIVIA.** Bolivia has advanced decentralization, giving municipalities and departments key roles in education, health and infrastructure (IDB 2022). However, subnational revenues are volatile and heavily dependent on national transfers (over 77%), limiting local fiscal autonomy. Debt levels are moderate but concentrated in larger cities, highlighting regional disparities.

**BRAZIL.** Brazil's federal system grants states and municipalities fiscal autonomy, but Amazonia's cities still depend on national transfers (91.3% of income) and face barriers to credit and resources. Regional fiscal disparities persist, though there are recent improvements in state-level fiscal management.

**COLOMBIA.** Municipalities can collect property and industry taxes but underperform, especially in Amazonia, where local governments struggle with resource allocation and infrastructure. Departments rely heavily on national transfers and prioritize current spending, with fiscal surpluses unevenly distributed (Ardanaz et.al 2022)

**ECUADOR.** Local governments depend on national transfers for about 72% of revenue, with even higher dependency in Amazonia. Special funds exist for the region, but low execution rates and limited planning capacity hinder impact. Credit use is rising, but slow project delivery strains fiscal health.

**PERU**. Administrative fragmentation limits revenue generation in Amazonia municipalities, which rely more on national transfers and spend less on capital investment. Subnational borrowing is concentrated in a few departments, reflecting uneven access to finance.

**SURINAME**. Despite decentralization laws, districts lack fiscal autonomy and rely almost entirely on national transfers, deepening regional disparities. Weak local fiscal management and outdated systems further limit effective decentralization (Ardanaz et.al 2022).

**GUYANA.** Subnational regions, especially in Amazonia, are highly dependent on central transfers and struggle with revenue generation, resource distribution and fiscal transparency. There is a need for stronger regulatory frameworks (Ardanaz et.al 2022).

**VENEZUELA**. Despite a federal model, power and finances are centralized. States and municipalities have little control, and transfers have declined amid instability, worsening regional inequalities and limiting development in parts of Amazonia (Ardanaz et.al 2022).

This high level of dependence limits the financial autonomy of subnational governments and exposes them to economic fluctuations, particularly when their own-source revenues are tied to natural resources. As a result, regional inequalities are exacerbated, with the territories most in need of public investment often being the least able to finance it. Subnational debt also reflects the structural gap between legal provisions and actual financial independence. While many subnational governments have the legal authority to incur debt, and some even have access to external credit without sovereign guarantees, their borrowing capacity is often constrained in practice by low fiscal autonomy and limited institutional capacity. In this context, debt financing tends to be concentrated in the largest and most affluent urban centers, leaving smaller urban areas with severely limited resources to address local development needs (Table 3.1).

***Table 3.1:* Institutional Frameworks of Subnational Governments in Amazonia**

| | AMAZONIA/TOTAL FOR THE COUNTRY | | | FINANCIAL AUTONOMY | | |
|---|---|---|---|---|---|---|
| COUNTRY | GOVERNMENTS | | POPULATION (IN MILLIONS) | AREA (IN KM2) | NATIONAL TRANSFERS AS A % OF SUBNATIONAL REVENUE | ACCESS TO EXTERNAL CREDIT WITHOUT A SOVEREIGN GUARANTEE (AUTHORIZED BY) |
| | INTERMEDIATE | LOCAL | | | | |
| Bolivia | **8**/9 Departments | **210**/343 Municipalities | **70% (7M)** | 711,729 (65%) | >77.1% | Yes (Plurinational Legislative Assembly) |
| Brazil | **11**/27 States | **900**/5,570 Municipalities | **15% (28.7 M)** | 5,194,159 (61%) | 91.3% | Yes (Federal Senate) |
| Colombia | **11**/33 Departments | **86**/1,101 Municipalities | **4% (1.9 M)** | 482,666 (42%) | 88.9% | Yes (Ministry of Finance and Public Credit) |
| Ecuador | **13**/24 Provinces | **75**/222 Cantons | **21% (3,5 M)** | 131,414 (51%) | 71.8% | Yes (Debt and Financing Committee) |
| Peru | **20**/26 Departments | **995**/1,874 Districts | **30% (8.7 M)** | 962,663 (75%) | 70.1% | No |
| Guyana | **10**/10 Regions | **75**/75 Councils | **100% (0.7 M)** | 210,740 (100%) | N/A | Yes (Ministry of Local Government and Regional Development) |
| Suriname | NA | **10**/10 Districts | **100% (0.5 M)** | 145,784 (100%) | N/A | N/A |
| Venezuela | **3**/23 States | **22**/335 Municipalities | **6% (1.73 M)** | 468,880 (51%) | N/A | No |

*Source: Prepared by the authors based on Radics et al. 2022*[10]

## Urban Planning Capacities

All Amazonia countries except Suriname and Guyana[11] have established legal frameworks for land-use planning.[12] In Bolivia, Brazil, Colombia, Ecuador and Peru, local governments have been delegated authority over urban and environmental matters. These frameworks operate across national, intermediate and local levels, providing local governments with a robust mandate to manage urban growth through long-term planning, land-use regulation, density controls and building standards. This mandate is especially critical in Amazonia, where sprawling urban areas can increase commute times and disrupt vital ecosystems (IPCC 2018).

[10] In Colombia, the number of local governments also includes areas not part of municipal jurisdictions, while in Peru it includes provincial municipalities. Additionally, some subnational levels are not reflected in the table: Bolivia has provinces between departments and municipalities; Ecuador includes parishes below cantons; Peru has provinces between departments and districts; Guyana includes village councils below municipalities; Venezuela has parishes below municipalities; and Suriname has an additional administrative level known as resorts. The values that appear in bold correspond specifically to the whole of Amazonia, while the value in regular text stands for the data at the national level.

[11] Suriname adopted a Spatial Planning Act in 1973 and the Urban Development Act in 1972, and Guyana the Town and Country Planning Act in 1946. However, these frameworks are outdated and have not been substantially modernized to address current urban planning challenges.

[12] All Amazonia countries have national frameworks to guide subnational urban planning. These include the Plan for National Economic and Social Development in Bolivia, the City Statute in Brazil, the National Development Plan in both Colombia and Ecuador, the National Land Use Plan in Guyana, the National Policy for Territorial Order in Peru, the Regional Development Program in Suriname and the Organic Law for Territorial Order in Venezuela (Arcia et al. 2023).

However, local governments have often fallen short of these responsibilities. Local governments face difficulties in fulfilling their mandates due to overlapping land-use policies and limited use of planning tools. This contributes to unmanaged urban growth in environmentally sensitive areas and weakens their ability to plan strategically, develop projects, and secure resources for sustainable development. In Brazil, for example, the City Statute (2001) requires municipalities with over 20,000 residents to prepare Master Plans (Planos Diretores), yet only about 51% of the 772 municipalities in the Brazilian Legal Amazonia have done so (Fajardo et al. 2023). Similar barriers exist in other Amazonia countries. In Peru, the institutionalization and application of territorial planning tools is quite limited. A 2019 review of Peruvian cities in Amazonia found that while nearly all (97%) had a Concerted Development Plan, only 68% had an Urban Development Plan, and fewer than half had a Land Use or Territorial Plan (Zucchetti et al. 2020).

The underuse of planning tools limits cities' ability to develop long-term visions, prepare projects and mobilize financial resources for sustainable territorial development (Arcia et al. 2023). In rapidly urbanizing parts of Amazonia, unplanned urban growth has led to fragmented urban landscapes, low-density settlements and high informality. For example, eight of Brazil's 20 largest favelas are in the northern region, six of them in Manaus (IBGE 2024). These patterns, coupled with limited digital and physical connectivity, create major governance challenges. The fragmentation of the urban system further complicates infrastructure planning, public service delivery and land-use enforcement (see Chapter 3.1.ii).

**Despite encompassing vast territories of high socio-environmental and strategic importance, intermediate in Amazonia and local governments still lack fully developed fiscal capacity and credit instruments to drive their sustainable and autonomous development.** Strengthening their ability to plan, coordinate and deliver services is essential for the region's long-term development.

*Tarapoto, Peru*
*Photo by Christian Braga*

# Basic Infrastructure Deficits

*Andrés Blanco, Raphaelle Ortiz, Javier Cuervo (IDB)*

In many urban areas of Amazonia, access to essential services has fallen behind rapid urbanization (Costa and Brondizio 2009). Nearly half of Amazonia's people face difficulties accessing essential services, deepening their social and economic marginalization (Giles Álvarez et al. 2025). Urban areas experience significant deficits in critical local services — such as water, sanitation and energy — which are expected to worsen as urban growth accelerates throughout the region.

## Water and Sanitation

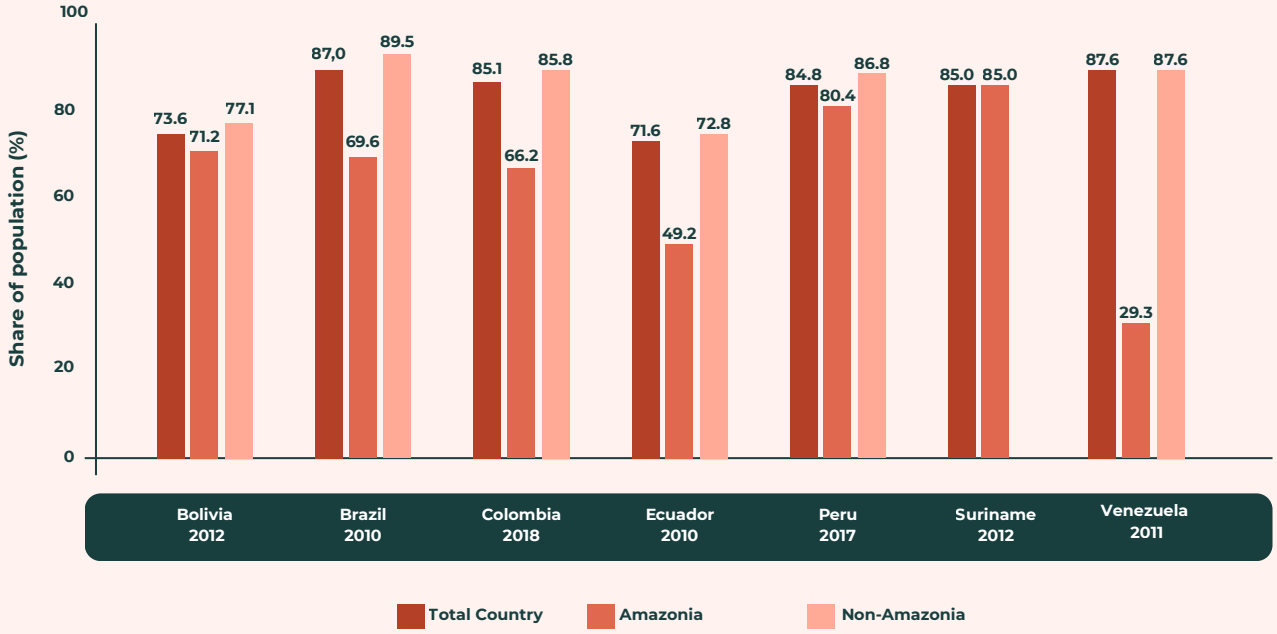
Amazonia holds more than one-fifth of the world's freshwater resources, yet fewer than one in four residents has access to water services (Aravena et al. 2024). Even in areas where household access to potable water exceeds 80%, service is often unreliable, with many households receiving water only three days a week or less than 24 hours per day (Zucchetti et al. 2020).

Between 2010 and 2018, Amazonia territories consistently lagged behind national averages in household access to potable water — ranging from 29.3% to 80.4%, compared with 72.8% to 89.5% in other regions (Figure 3.1). Over the same period, access to improved sanitation was also lower in Amazonia, with rates between 21.4% and 83.7%, versus 31.4% to 91.4% elsewhere (Figure 3.2). In urban areas, these service gaps were furthered by rapid urban expansion, which left many settlements without adequate drinking water or sewage infrastructure (Silva do Carmo et al. 2023).

A 2016 study of 50 municipalities of the Amazonas delta estuary found that sewage and garbage collection services are typically available only in larger and older cities, such as Belém and Macapá in Brazil, while most garbage waste is disposed of in open pits, street corners or drainage channels (Brondizio 2016). Similarly, a study of 22 cities in the Peruvian Amazonia revealed that only three had landfills and only eight had wastewater treatment plants (WWF 2020; Zucchetti et al. 2020). These findings highlight the significant infrastructure gaps needed to treat water and sewage and improve waste management in Amazonia's cities.

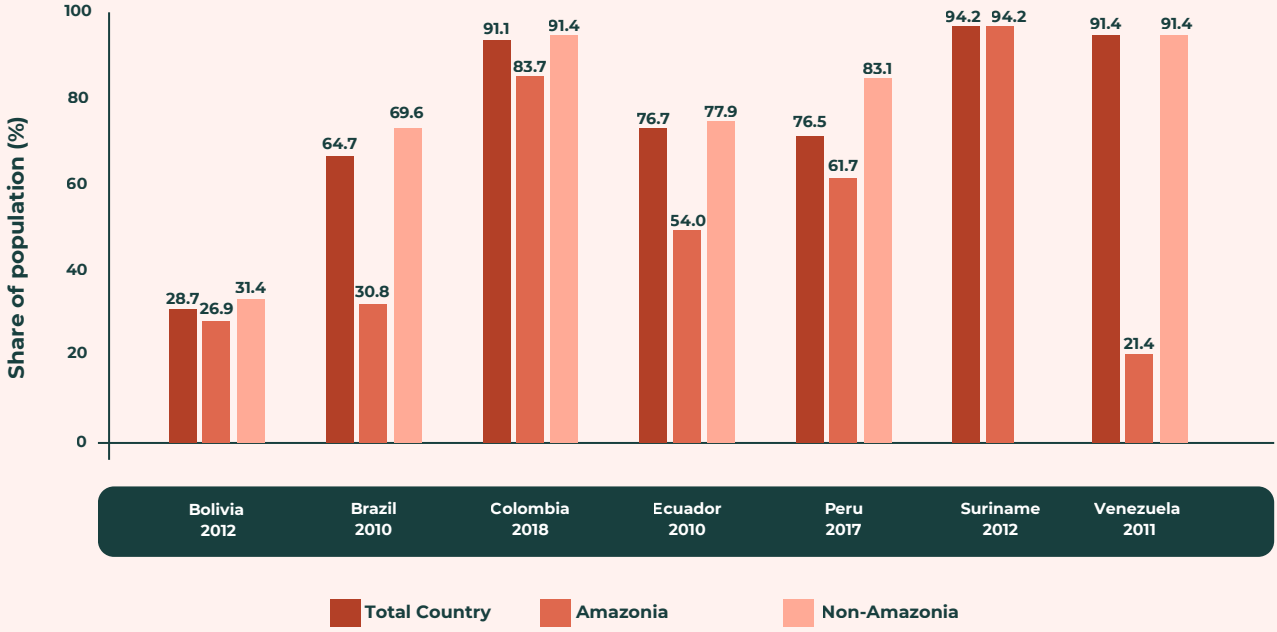
*San Jose Del Guaviare, Colombia*
*Photo by Christian Braga*

***Figure 3.1:* Household Access to Safe Drinking Water in Amazonia vs. Non-Amazonia, Average by Country**




*Source: ECLAC/ACTO 2024.*

***Figure 3.2:* Household Access to Improved Sanitation in Amazonia vs. Non-Amazonia, Average by Country**




*Source: ECLAC/ACTO 2024.*

Limited access to potable water and sanitation poses serious risks to both public health (see Chapter 3.2.i) and the environment in urban areas (Costa and Brondizio 2009). A scientific study of peri-urban households in the Peruvian Amazonia found that inadequate sanitation facilities led to elevated levels of fecal contamination, particularly affecting infants (Exum et al. 2016). As children become ill, parents, especially mothers, must often stay at home and care for them, reducing their ability to take part in the workforce. In addition, in the absence of reliable potable water, communities depend on water trucks or collect water from rivers, increasing the risk of gastrointestinal illnesses and negatively affecting school attendance and productivity. **Poor waste disposal further degrades natural spaces, worsens urban flooding and threatens local wildlife.**

## *Box 3.2: Access to Potable Water, Sanitation and Garbage Collection in Urban Areas*

***Paloma Martín, Pablo Mahnic (IDB)***

The latestavailalbe census data at the subnational level[13] reveals substantial disparities in access to basic urban services between Amazonia and non-Amazonia regions across water supply, sanitation and solid waste management.

**Potable water.** According to the census data, an average of 18.6% of urban households in Amazonia lack access to potable water — defined as living in a home with piped water — compared with 8.6% in non-Amazonia areas. However, regional disparities are clear. In Brazil, the Amazonia rate exceeds the non-Amazonia rate by 10 percentage points, while in Colombia, the difference is 4.5 percentage points. Conversely, in Bolivia and Ecuador, the pattern is reversed, with urban households in Amazonia having better access than those in the rest of the country by 5 and 4 percentage points. Venezuela and Peru also show higher rates of households without piped water in Amazonia; however, in both cases, the differences do not exceed 2 percentage points.

**Sanitation.** According to the latest census data, only 50% of urban households in Amazonia have access to sewerage services — defined as a connection to a piped sewer system or other safely managed sanitation infrastructure — compared with 73% in non-Amazonia areas. The urban sanitation deficit in Amazonia is therefore nearly double that of non-Amazonia regions. Brazil reports the highest urban deficit in the

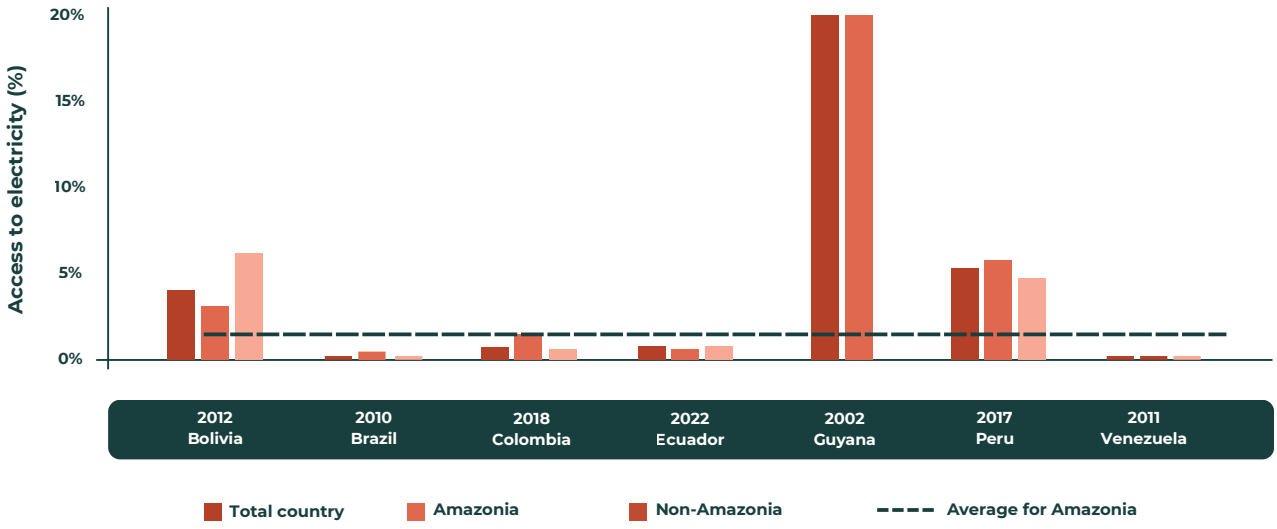
[13] Bolivia 2012, Brazil 2010, Colombia 2005, Ecuador 2010, Peru 2017 and Venezuela 2011.

region, with 70% of households lacking access, 30.5 percentage points above the national average. In Bolivia, the gap is 17 percentage points, followed by Venezuela with a 15-percentage point difference and Peru with an 8 percentage point difference. Except for Ecuador, all countries show higher rates of urban households without sewerage in Amazonia than in their respective non-Amazonia areas.

**Solid waste management**. According to the latest census data, 26.6% of urban households in Amazonia lack access to garbage collection services or public waste containers, compared with just 12% in non-Amazonia areas. The most significant disparities between Amazonia and non-Amazonia urban regions are seen in Brazil and Venezuela, where the share of urban households without access is 4.4 and 8.5 percentage points higher, respectively, in the Amazonia region.

## Energy Provision

***Figure 3.3:* Urban Household Access to Electricity in Amazonia vs. Non-Amazonia, Average by Country**




*Source: Prepared by the authors based on the latest census data and the Amazonian region defined by the IDB.*
*Note: Suriname lacks subnational census data, while microdata from the most recent censuses in Bolivia and Brazil had not yet been released at the time of this publication. Guyana is entirely encompassed within Amazonia.*

In contrast to water and sanitation, energy access in Amazonia has seen notable improvements (Aravena et al. 2024). According to the latest census data, on average, 98% of urban households in Amazonia have electricity, compared with 99% in non-Amazonia areas. However, regional disparities persist — driven by Guyana, where 20% of urban homes lack electricity, and Peru, where the rate of urban homes without electricity is 1.7 percentage points higher in Amazonia than elsewhere. Conversely, Bolivia and Ecuador report slightly better electricity access in their Amazonia urban areas compared with non-Amazonia regions (Figure 3.3).

Despite high coverage rates, many urban populations still face intermittent and costly energy services. Utility providers struggle with high losses, poor management and weak commercial practices, resulting in inconsistent service delivery (Hanusch 2023).[14]

The rapid and often unplanned urban growth in Amazonia over recent decades has exposed significant infrastructure deficits, particularly in water, sanitation and energy. Despite being in one of the world's most resource-rich regions, many urban residents lack access to essential services. Deficiencies in water and sanitation infrastructure are particularly concerning, as they directly affect public health, environmental quality and social equity, particularly for the most vulnerable populations and neighborhoods. These challenges are intensified by the growing population, which continues to strain already overburdened systems.

[14] In the Brazilian Legal Amazonia, which includes urban and non-urban areas, about one million residents rely on local diesel or gasoline generators, often receiving electricity for only a few hours per day (Schutze et al. 2022). This reliance on generators not only leads to unreliable energy access but also contributes to air pollution and high operational costs.

# Security Challenges in Urban Amazonia

*Gonzalo Croci, Federico Veneri, Fernando Cafferata, Rodrigo Serrano-Berthet, Eduardo Vergara, Nathalie Alvarado (IDB)*

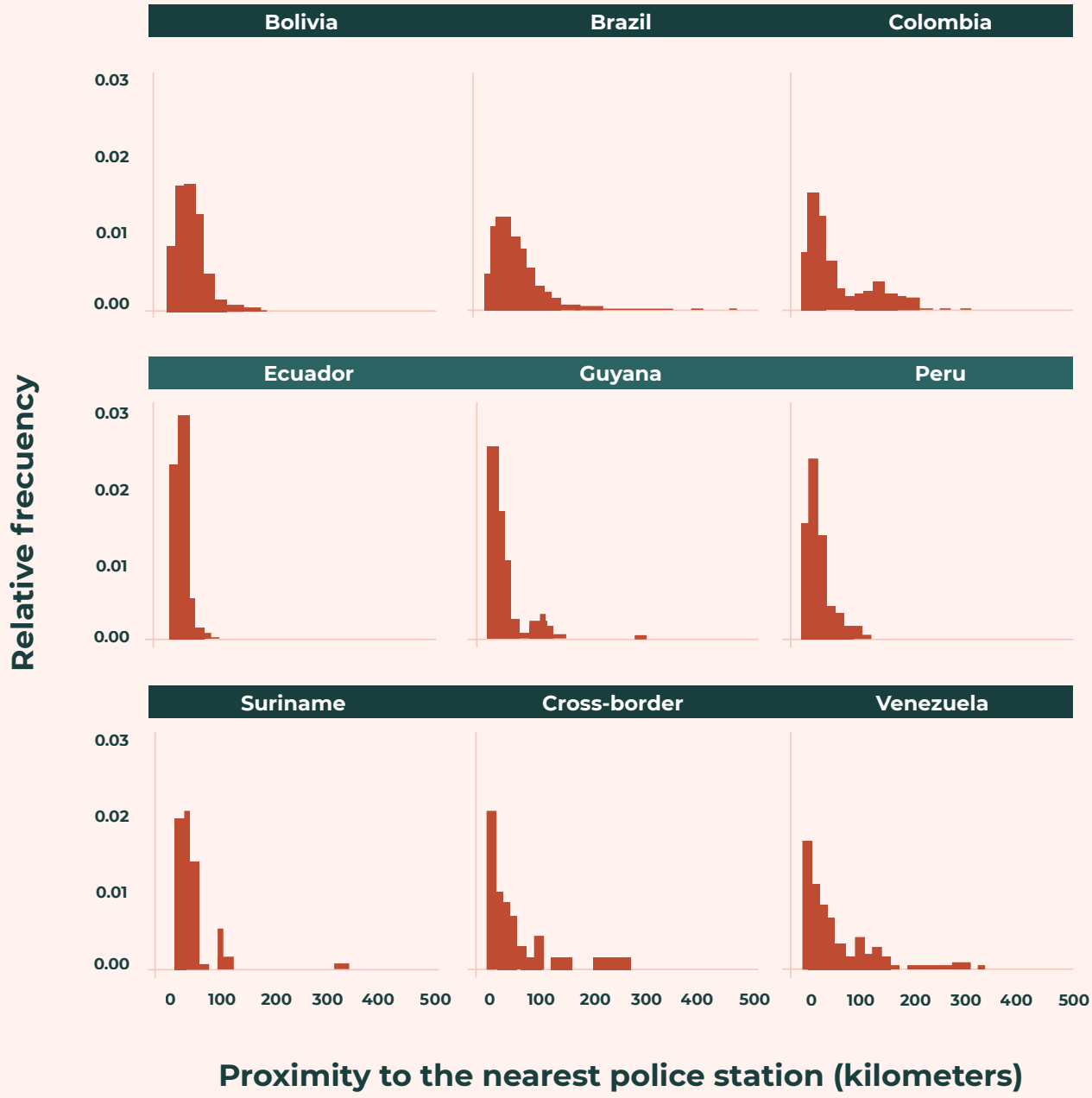
Urban areas in Amazonia are increasingly vulnerable to complex criminal dynamics that exploit the limited territorial presence of the state. **In many areas, criminal networks have set up significant territorial and social control, undermining opportunities for legitimate and sustainable livelihoods within local communities (Forum Brasileirode Segurança Pública 2024).**

Police station density is a key indicator of state presence and citizen security. In Amazonia, the number of stations per 100,000 inhabitants reveals a pattern of institutional isolation. Densities vary widely: Guyana leads with 12.4 stations per 100,000 (likely reflecting the urbanized spread of its territory), while Ecuador, Venezuela, Peru and Suriname range from 4.6 to 5.9. In contrast, Brazil and Colombia — despite having more settlements — have the lowest densities, at 0.82 and 1.73, showing a weaker institutional presence.

A spatial analysis further reveals significant gaps in territorial coverage. While many urban areas have police stations nearby, some locations — especially in border regions, Brazil and Venezuela — are situated over 100 kilometers from the nearest station. These patterns underscore persistent institutional weaknesses and limited public security infrastructure throughout much of Amazonia (Figure 3.4).

*Photo by Christian Braga*
*Tabatinga, Brazil*
*Photo by Christian Braga*

***Figure 3.4:* Distance from Settlements in Amazonia to the Closest Police Station**




*Source: Prepared by the authors based on data collected by IDB Amazonia360+ and the DEGURBA method (GHS-BUILT, GHS-POP, GHS-LAND version 2023).*
*Note: An area is considered a cross-border area if its area of influence includes two or more countries.*

### *Box 3.3: The Social and Environmental Impact of Illegal Mining*

Environmental crimes, including the illegal extraction, trafficking and exploitation of minerals, timber, and wildlife, have fueled vast illicit markets, generating an estimated $110 to $281 billion annually. These activities are not only highly profitable but also deeply entwined with organized crime. Illegal mining alone generates up to $48 billion per year for criminal networks and is responsible for financing approximately 38% of non-state armed conflicts — surpassing even drug trafficking as a source of illicit funding (Nellemann et al. 2018).

**Although these activities typically occur in remote areas, urban centers play a key role in their broader operational networks. For example, urban areas serve as coordination hubs, financial platforms and transit points that support illegal mining economies across Amazonia.** Criminal networks often go beyond extraction, embedding themselves in cities and branching into other forms of organized crime.

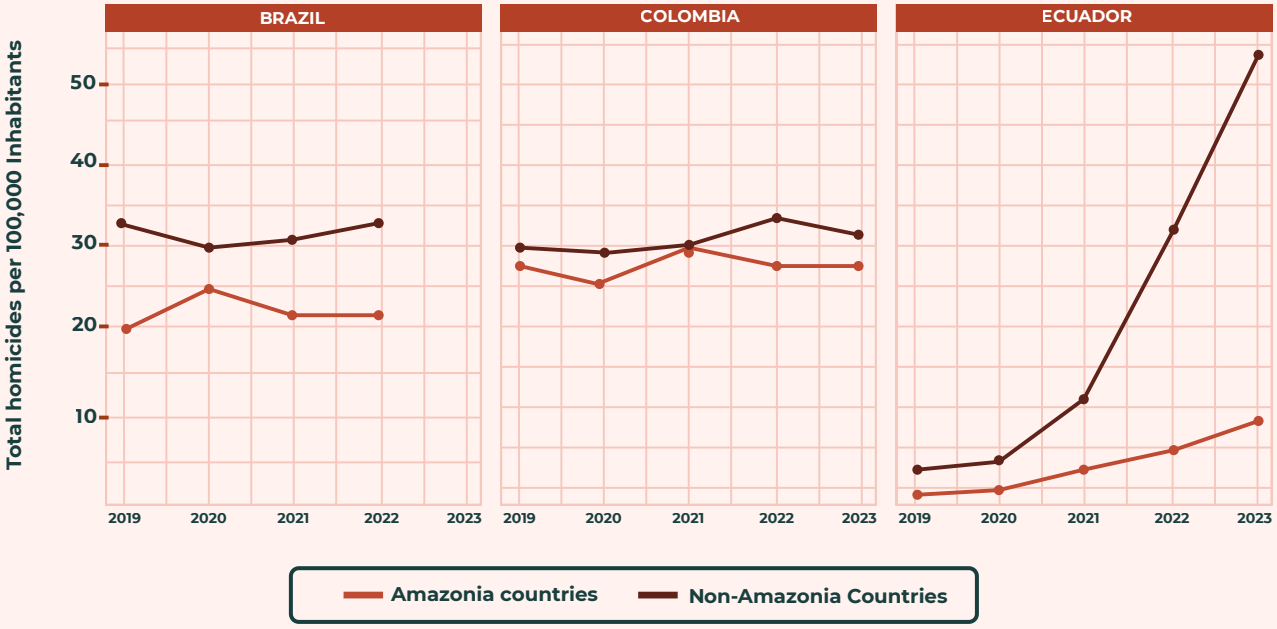
Across Amazonia, there are more than 4,100 active illegal mining sites (WWF 2023). These operations inflict environmental damage, serving as a major source of global mercury pollution and accounting for 37% of worldwide mercury contamination (UNEP 2023). The environmental impact is staggering; for every gram of gold extracted through amalgamation, approximately 4.63 tons of mercury are released, and just one gram can contaminate an entire 8-hectare lake (Webb 2025). In Ecuador, a 2020 study found that 90% of water samples from mining areas had dangerous levels of toxic metals (Heath 2024). Beyond environmental destruction, illegal mining is closely linked to serious human rights violations causing lasting harm to local communities (Tarazona 2023).

## One Region, Multiple Realities

Recent trends in homicide rates reveal significant disparities in criminal dynamics both among and within countries. Many municipalities in Amazonia experience violence levels higher than the national averages of their respective countries. For example, in 2021, the average homicide rate for municipalities within the Brazilian Amazonia was 29.6 per 100,000 residents, compared with Brazil's national average of 21.3 per 100,000 (UNODC 2023). There are also disparities within this area. While Manaus benefits from visible state infrastructure, military presence and logistical capabilities, smaller urban areas like Cumaru do Norte — with a homicide rate of 141.3 in 2023 — lack effective police presence and adequate access to justice. (Forum Brasileiro de Segurança Pública 2024).

Subnational data from 2019 to 2023 highlight persistently elevated levels of criminal activity in municipalities of the Colombian Amazonia. In contrast, Ecuador has experienced a sharper and more rapid escalation of violence in non-Amazonia cantons, underscoring a shift in the geographic concentration of homicides (see Figure 3.5).

***Figure 3.5:* Trends in Homicide Rates in Amazonia vs. Non-Amazonia Municipalities/Cantons in Brazil, Colombia, and Ecuador, 2019-2023**




*Source: Prepared by the authors based on data provided by the Ministry of the Interior (Ecuador), Ministry of Defense (Colombia), Ministry of Health (Brazil), and population projections for level 2 administrative units from various national statistical institutes.*
*Note: Municipalities in Amazonia are defined as level 2 administrative geographic units with at least 50% of their area within the Amazonia territory as defined by the IDB. The homicide rate is calculated as the total number of homicides committed in Amazonia and non-Amazonia territories per 100,000 inhabitants in each region.*

**Urban areas in border regions in Amazonia are particularly vulnerable to complex criminal dynamics, shaped by the growing influence of transnational criminal organizations.** In Ecuador, northern Amazonia cantons are affected by fuel trafficking, illegal mining, smuggling and armed violence (OECO 2023). Recently, La Joya de los Sachas and Shushufindi reported homicide rates of 126 and 77 per 100,000 inhabitants, respectively, with most crimes involving firearms and linked to organized violence (Rivera et al. 2025).

## Key Determinants of Territorial Security Disparities

A combination of factors explains the stark differences in levels and types of violence between and within urban areas in Amazonia.

One of the most salient factors is institutional presence. In many cases, these territories are not significantly included in national development plans or security and justice strategies, which helps to perpetuate a vicious cycle of social exclusion, vulnerability and violence (UNODC 2023b). At the local level, the ratio of prosecutors, judges, defenders and police per inhabitant in Amazonia is significantly below the national average, limiting the ability to respond to crime and violence. State presence is further weakened by high turnover among law enforcement personnel, who often stay briefly in Amazonia due to high living costs and isolation (Funari 2024). In many cases, local governments have limited resources or ambiguous powers to act against organized crime. This

institutional heterogeneity contributes to creating authority vacuums in various territories where the state response is scarce or merely reactive.

Another significant factor influencing criminal dynamics in Amazonia is geography. Many urban areas are remote, surrounded by rivers, dense forests or porous borders, making it challenging to provide local services and support a sustained state presence (see Chapter 2.2.ii). State territorial control is particularly affected by the presence, or absence, of functional roads. This configuration shapes both levels of violence and patterns of criminal governance at the local level. For instance, in Brazil and Colombia, criminal markets are primarily organized around drug trafficking, while in Peru and Ecuador, illegal mining plays a central role (Global Organized Crime Index 2023).

Finally, the interconnectedness of various criminal dynamics in Amazonia allows illegal groups to run international networks that adapt quickly to state interventions. These networks are using Amazonia's vast and transnational territory as a hub for a variety of illicit activities that share logistics, personnel and protection networks (UNODC 2023b). One single river corridor can serve to transport illegal drugs, gold, timber and people, while shared financial networks are used to launder proceeds from activities such as illegal mining, arms trafficking and extortion. Likewise, remote towns function as crucial entrepôts for illegally extracted products before they reach larger cities and continue on to national and international consumer markets via plane, boat or road (Pereira et al. 2025).

These criminal structures affect both large and small urban centers. The growing presence of organized crime has led to increased violent crimes, drug consumption, and sexual abuse and exploitation, particularly among youth (Funari 2024). Rising competition among criminal groups has heightened insecurity throughout communities, affecting not only major cities but also small and medium-sized towns. Of the 50 most violent cities in the Brazilian Amazonia, only one — Macapá — is a state capital, underscoring the urgency of the issue in remote municipalities. Border cities are exposed to the high circulation of goods and people with low state oversight (Fórum Brasileiro de Segurança Pública 2024).

### *Box 3.4: Crime as a Driver of Rural-Urban Migration in Brazil*

***Antônio Sampaio, Gabriel Funari (Global Initiative Against Transnational Organized Crime)***

Escalating rural crime is a major factor fueling migration to urban areas in Amazonia. Impoverished small farmers are often violently evicted from their land by armed men — known locally as *pistoleiros* — who act on behalf of larger criminal organizations seeking to clear land for illegal logging and cattle ranching (Pontes 2019).

These criminal activities are often helped by the rapid construction of thousands of kilometers of unofficial side roads, or *ramais*, built without government oversight, contributing to extensive deforestation (ClimaInfo 2024). In 2023 alone, over 5,000 kilometers of informal roads were opened along the BR-319 highway corridor connecting Canutama, Humaitá, Manicoré and Tapauá in southern Amazonas state (Moura 2023). As a result, most displaced farmers have sought refuge in nearby cities, which, despite limited police presence, are still perceived as safer than their vulnerable rural properties.

## Security, Territorial Dynamics and Governance in Amazonia

Amazonia is characterized by a complex interplay of local realities, where diverse illicit markets, criminal networks and uneven state capacities converge. These dynamics manifest not only in the varying intensity and forms of violence, but also in the ways organized crime embeds itself within the social and territorial fabric of the region's cities. Effectively addressing these challenges requires comprehensive, context-specific strategies that recognize the unique circumstances of each urban area and prioritize the strengthening of local institutional capacities. As hubs of population and governance, cities play a pivotal role in enhancing security and promoting robust institutional development across the region.

# HYBRID URBANIZATION: ADEQUACY AND VULNERABILITY OF URBAN SYSTEMS

## Availability of Health Systems

*Sofía Castro Vargas, Laura Goyeneche, Sebastian Bauhoff (IDB)*

This article examines the availability and utilization of healthcare infrastructure in urban Amazonia to better understand access and adequacy of healthcare services.[15] Urban centers in the region face unique challenges, including overburdened facilities and limited-service capacity. Cities often function as referral hubs for surrounding rural and Indigenous areas (see Chapter 2.2.i), where healthcare is typically limited to primary units staffed by auxiliary nurses or community health personnel rather than physicians (Sousa et al. 2022). Remoteness, high travel costs and a lack of emergency transport (see Chapter 2.2.i) often force residents of non-urban or Indigenous communities to delay seeking care until conditions become critical, increasing the likelihood of hospitalization (Syed et al. 2013).

Due to limited primary care availability in many settlements, urban hospitals in Amazonia often serve as the first point of contact for patients (Ziller et al. 2024). Obstetric care is particularly vulnerable to these systemic gaps, with frequent challenges including limited access, weak emergency referral networks, shortages of skilled personnel and inadequate neonatal facilities. Additionally, some Indigenous communities prefer home births and seek medical care only in severe cases, contributing to higher rates of maternal and neonatal complications and mortality (Madeira Domingues et al. 2024).

**Traditional cultural practices remain a defining feature of urban healthcare in Amazonia** (Berlowitz et al. 2025), but the region's epidemiological profile increasingly mirrors national trends — likely due to lifestyle changes associated with urbanization. Over the past three decades, non-communicable diseases have surpassed infectious and maternal conditions as the leading contributors to disease burden. By 2019, cardiovascular diseases had become the top cause of disability-adjusted life years,[16] largely driven by poor diets and rising obesity rates (IHME 2021). **Projections for 2050**

[15] This analysis does not account for other factors relevant to health services, such as the quality of medical personnel, availability of medical supplies, access to health technology or other critical components of healthcare delivery. The datasets used for this study include healthcare facility locations, population projections and hospital discharge data for 2021–2022 across Bolivia, Brazil, Colombia, Ecuador, Guyana and Peru. Sources include the crowdsourced platform healthsites.io (Global Healthsites Mapping Project 2025), national statistics institutes for population projections and national administrative data on public hospital discharges. The datasets represent between 28% and 70% of total hospitalizationsnationally: Brazil's DATASUS accounts for 65% of total hospitalizations, Colombia's RIPS covers 28%, Ecuador's census data covers 69%, and Peru's SIS covers 50%. While data for these four countries are comprehensive, Bolivia's dataset includes only first-level facilities and Guyana's is limited to essential obstetric and neonatal care. (For more details on data and method see Appendix 2C).

[16] DALYs are the sum of the years of life lost due to premature mortality (YLLs) and the years lived with a disability (YLDs) due to prevalent cases of the disease or health condition in a population.

**indicate that the burden of chronic diseases will continue to rise** (Araujo et al. 2017). Even as these trends align, significant structural and access-related disparities persist between Amazonia and non-Amazonia populations.

Urban health systems in Amazonia are also under increasing pressure from climate-sensitive diseases (see Chapter 3.2.iii). More frequent and severe heatwaves, floods and shifts in rainfall patterns are linked to rising cases of malaria, dengue and diarrheal diseases (Semenza et al. 2022). Urban centers in Amazonia face heightened environmental health risks, especially in overcrowded areas with poor drainage, inadequate sanitation and frequent exposure to air and water pollution (Parry et al. 2018). Environmental degradation from deforestation and illegal mining worsens these risks (see Chapter 3.1.iii), increasing the incidence of malaria and respiratory illnesses (Moutinho 2022).

Prolonged heat exposure is associated with higher mortality from chronic conditions such as cardiovascular disease, stroke, heart failure, chronic obstructive pulmonary disease and chronic kidney disease (Sarmiento 2023). Wildfires and rainfall extremes further contribute to spikes in respiratory and diarrheal disease (Couto et al. 2024). In the Brazilian Amazonia, the exposure to forest fire smoke has been linked to spikes in respiratory and cardiovascular hospitalizations, particularly among children and the elderly (Ribeiro et al. 2024a). Similarly, fluctuations in river levels in Rio Branco are associated with increased cases of diarrhea, particularly affecting infants (Duarte et al. 2019).

## Healthcare Infrastructure in Urban Areas in Amazonia

The density of health facilities in Amazonia is slightly lower than national levels, with differences ranging from two to six facilities per 100,000 people. Within the region, urban areas tend to host more specialized centers, while basic care units primarily serve non-urban areas. Hospitalization rates are consistently higher in Amazonia than nationwide, driven by both communicable and non-communicable diseases, as well as maternal and nutritional conditions. Avoidable hospitalizations for ambulatory care-sensitive conditions account for a similar share of total hospitalizations in Amazonia and nationally.

Healthcare facility availability in Amazonia is lower than in non-Amazonia regions across most countries except Ecuador and Peru. For example, in Brazil, the Amazonia region has 2.7 facilities per 100,000 residents, compared with 3.9 elsewhere. Urban areas in Amazonia typically have a higher density of healthcare facilities than non-urban areas, reflecting national patterns (Table 3.2). However, in Colombia, Peru and Venezuela, non-urban areas in Amazonia have more facilities per capita than urban areas, likely due to targeted rural health centers. These differences highlight significant subnational disparities in healthcare infrastructure.

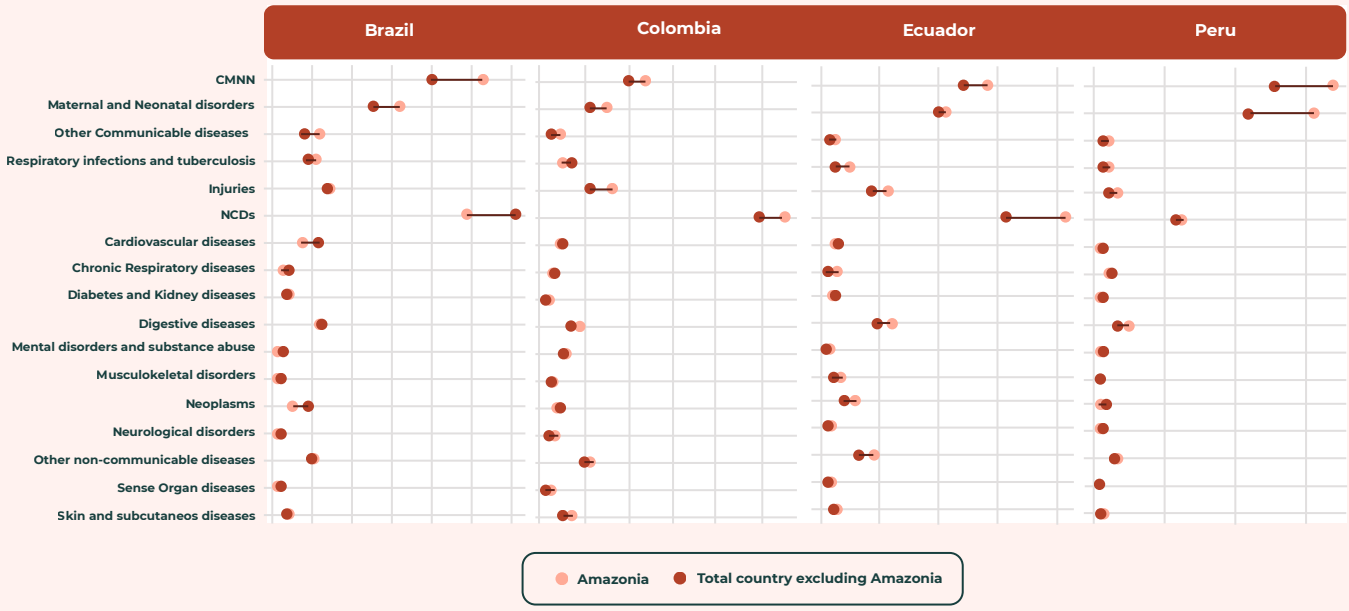
***Table 3.2:* Hospitals and Clinics per 100,000 Residents in Amazonia**

| | Non-Amazonia | Amazonia | Non-Amazonia minus Amazonia | Urban Amazonia | Non-urban Amazonia | Urban minus non-urban Amazonia |
|---|---|---|---|---|---|---|
| Bolivia | 8.9 | 7.5 | 1.4 | 9.4 | 8.4 | 1.0 |
| Brazil | 3.9 | 2.7 | 1.1 | 4.1 | 2.7 | 1.5 |
| Colombia | 3.0 | 2.2 | 0.8 | 2.7 | 6.1 | -3.4 |
| Ecuador | 4.2 | 9.9 | -5.7 | 26.5 | 5.5 | 21.0 |
| Guyana | - | 7.5 | - | 8.7 | 1.9 | 6.8 |
| Peru | 4.0 | 8.2 | -4.3 | 10.9 | 18.2 | -7.3 |
| Suriname | | 6.5 | - | 7.8 | 1.3 | 6.5 |
| Venezuela | 2.5 | 2.1 | 0.4 | 2.5 | 3.6 | -1.1 |

*Source: Prepared by authors using health infrastructure data from healthsites.io and official population projection data from the national statistics institute of each country.*
*Note: Values may be affected by the inclusion of only public hospitals, incomplete or inaccurate facility data (healthsites.io), and potential misclassification or coordinate errors.*

Overall, Amazoniahas higher per capita hospitalization rates (age and sex- sex-standardized healthcare utilization per 10,000 people) compared with other regions (Figure 3.6). However, avoidable hospitalizations in Amazonia are driven by chronic non-communicable diseases (NCDs), infectious diseases and maternal conditions, with each contributing to varying degrees. Chronic NCDs account for 31% to 43% of admissions for ambulatory care-sensitive conditions, infectious diseases for 4% to 10%, and maternal, under-five, and nutritional diseases for 5% to 25%. Notably, maternal and related conditions — particularly those associated with prenatal care and childbirth — are more prevalent in the Amazonia than in the non-Amazonia areas of Brazil, Ecuador and Peru.

***Figure 3.6:* Total Hospitalizations per 10,000 Residents**




*Source: Prepared by the authors based on hospital discharge data and national population statistics.*
*Note: CMNN stands for communicable, maternal, neonatal and nutritional; NCDs are non-communicable diseases.*

## Urban Health care Gaps

The data shows that maternal and neonatal disorders account for the highest in-hospital mortality rates and lengths-of-hospitalization rates in urban Amazonia. While non-communicable diseases are less prevalent in Amazonia than in other regions, they still are a significant cause of mortality, particularly from cardiovascular and digestive diseases. Ambulatory care-sensitive conditions (ACSCs) — a term used to designatecertain types of manageableillnesses — make up a similar proportion of hospitalizations both inside and outside Amazonia, but their incidence is notably higher in the region.

**Understanding the barriers to healthcare access in urban areas in Amazonia is key for designing more responsive and inclusive strategies.** The presence of healthcare facilities in urban areas of Amazonia is not enough to guarantee adequate care. These urban facilities, which have higher hospitalization rates than national averages, also serve as referral points for remote populations, who often face long travel distances, difficult journeys and inadequate local services. This dynamic contributes to avoidable hospitalization and highlights persistent gaps in the healthcare system of urban and non-urban areas of Amazonia.

*Riberalta, Bolivia*
*Photo by Christian Braga*

# Access to Public Education

*Cecilia Giambruno Michelini, Claudio Ortega, Nicolás Castro (IDB)*

This article examines the territorial dimension of school accessibility in urban and peri-urban areas of Amazonia, focusing on Brazil, Bolivia, Colombia, Ecuador, and Peru.[17] While primary-education attendance and completion rates in these regions exceed 90%, educational trajectories weaken considerably at the secondary level. The net attendance rate drops to 73%, and only 54% of young people aged 18 to 20 complete secondary education in Amazonia (Cossi et al. 2024). Improving these outcomes requires addressing a complex set of interrelated factors, including curriculum relevance, available student capacity in educational centers, teacher absenteeism, household-level challenges and broader contextual variables. Among these, physical accessibility to schools stands out as a critical determinant of students' ability to complete their education in the context of Amazonia.

International research consistently demonstrates that reducing the distance to school has a direct and significant impact on attendance and retention. A systematic review of evidence from developing countries highlights that shorter travel distances to school can improve enrollment, attendance and learning outcomes (Evans et al. 2019). For instance, a randomized experiment in Afghanistan found that building new schools increased enrollment by 42% and significantly reduced the gender gap in attendance and performance (Burde and Linden 2013). Similarly, a study in Indonesia showed that constructing new schools led to higher years of education and increased future wages, with annual returns rising by up to 10.6% (Duflo 2001).

## Education Accessibility Challenges in Amazonia

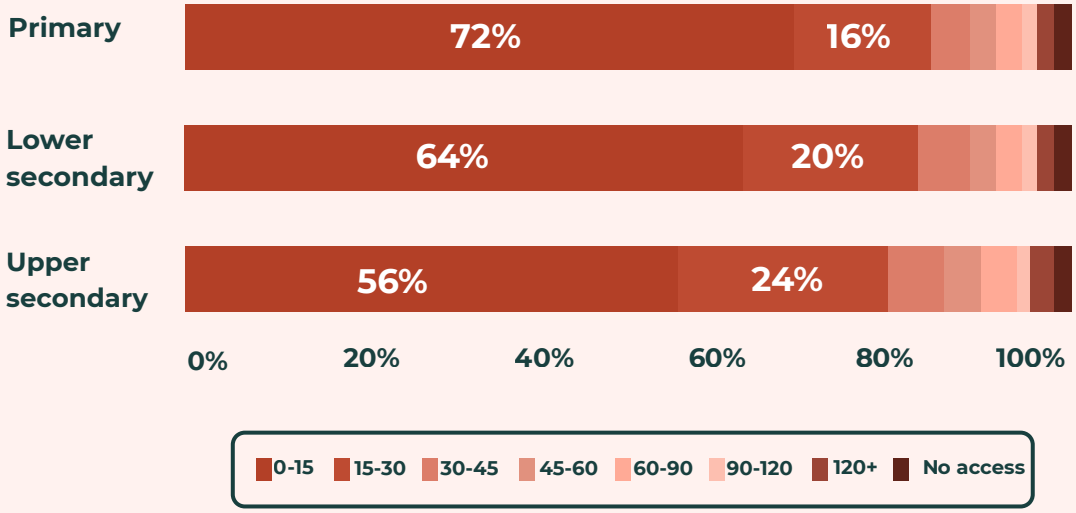
In most settlements in Amazonia, walking is the primary mode of travel to school, making travel time a key measure of accessibility. Accessibility is categorized by estimated walking time: optimal (up to 15 minutes), adequate (15–30 minutes) and critical (over 30 minutes). A fourth category, limited, applies to areas lacking road infrastructure, where access is even more challenging (see Chapter 2.2.ii).

**As students advance through the education system, walking times increase sharply. About 72% of primary school-age children live within 15 minutes of a school, but this share drops to 64% for lower secondary students and 56% for upper**

[17] The dataset for this study includes the location and level of each educational center, sourced from the Amazonia Educational Establishments Layer developed by IDB's Information Center for the Improvement of Learning. School-age population data, segmented into age groups—5 to 9 years (primary), 10 to 14 years (lower secondary), and 15 to 19 years (upper secondary)—was obtained from WorldPop. Walking routes were modeled using the UrbanPy Platform, which incorporates the road network and terrain conditions, including both formal and informal roads. (For more details on data and methods see Appendix 2D).

**secondary school.** The proportion of students facing limited accessibility rises from 12% at the primary level to 15% in lower secondary and 20% in upper secondary. Notably, 3% of upper secondary students must walk more than two hours to reach school, and 1% have no direct road access, relying instead on boat transportation. These percentages reveal significant barriers in the universal access to education — especially when combined with other vulnerabilities at the household or community level — contributing to higher dropout rates and deepening social inequality (Figure 3.7).

***Figure 3.7:* Percentage of the School-Age Population by Walking Time to the Nearest Public School, by Education Level, Average for Amazonia**




*Source: Prepared by the authors..*
*Note: Simple average based on the Amazonia territories of five countries (Brazil, Ecuador, Peru, Colombia and Bolivia). Includes urban and peri-urban settlements, excluding dispersed areas.*

## *Box 3.5: School Access by River in Amazonia*

Understanding the impact of Amazonia's unique urbanization patterns (see chapter 2.2.i) on school access is essential to ensuring education for all children and youth. Many students rely on river transport, with 71,695 identified as traveling by boat; 75% of these students live in areas potentially reachable via regular river routes, while the rest live in extreme isolation with severely limited or irregular access to schools. More than 12,000 students face river journeys longer than 30 minutes, assuming direct routes.

While 83% of primary and 78% of lower secondary students have optimal access, only 60% of upper secondary students do, and 13% must travel over two hours. These figures are based on ideal conditions and do not account for seasonal disruptions in navigability, such as droughts or floods, which can further restrict access. These challenges underscore significant equity concerns and highlight the need for tailored territory-specific strategies to ensure uninterrupted education for all students in Amazonia.

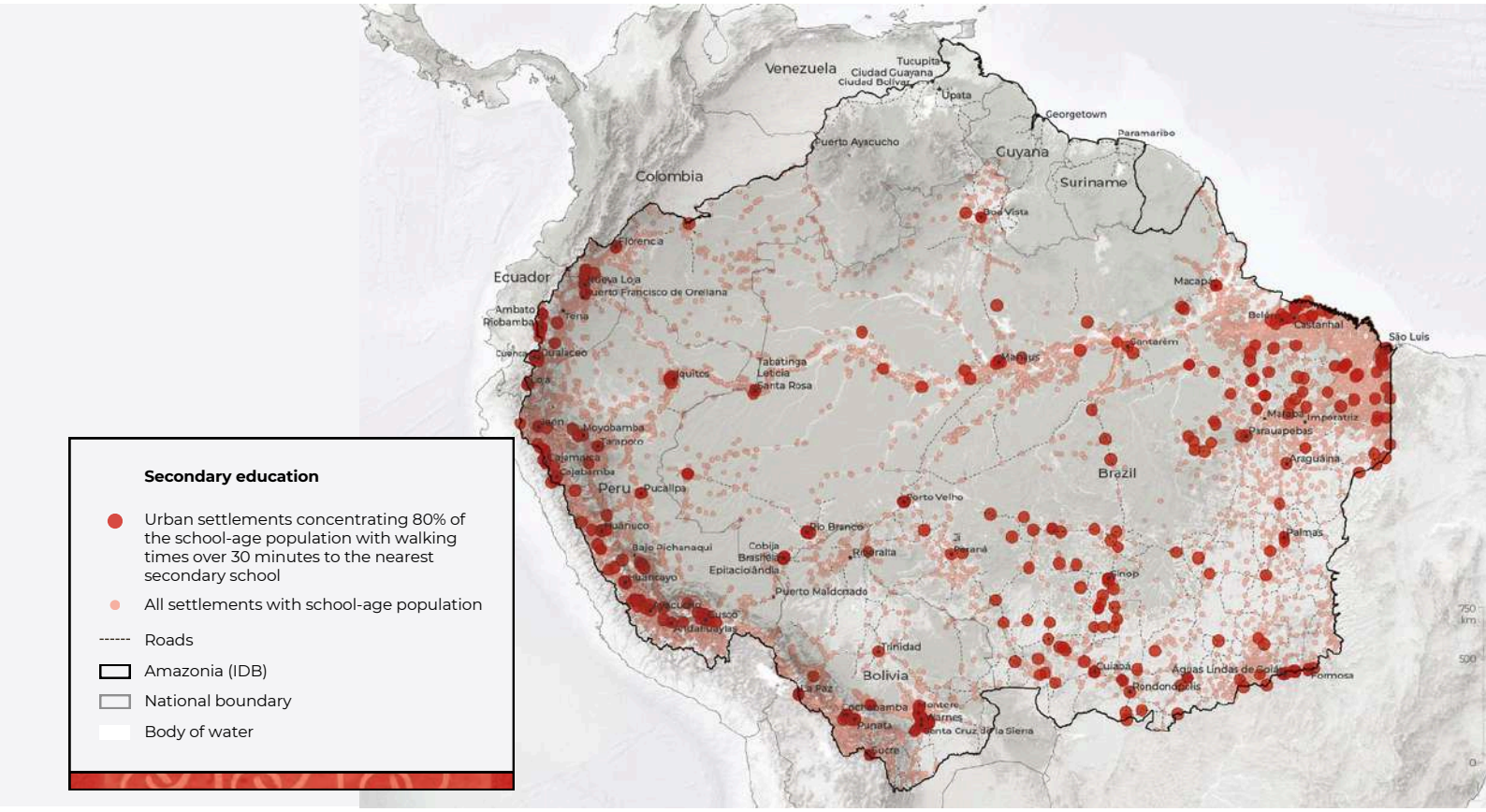
At the country level, the same trend appears: accessibility to educational centers declines as students advance to higher educational levels. However, the point at which access drops varies by country, reflecting differences in educational system organization, local geography and infrastructure, and the territorial distribution of schools. In the Bolivian Amazonia, 24% of primary students face limited access — over 30 minutes to school — which is double the regional average of 12%. This figure rises to 26% in lower secondary. In Colombia and Ecuador, the proportion of students with limited access doubles from primary to lower secondary, reaching 18% and 14%, respectively. At the upper secondary level, more than one in four students in Bolivia (26%) and more than one in five in Ecuador (22%) and Colombia (21%) live more than 30 minutes from the nearest school, highlighting increasing barriers as students advance.

In contrast, Brazil and Peru show high levels of accessibility in Amazonia, with 83% and 80% of primary students enjoying optimal access, and Peru achieving 69% optimal access at the upper secondary level — well above the regional average.

In Brazil and Ecuador, access to education declines most sharply at the upper secondary level, while in Bolivia, Colombia, and Peru, the most significant drop occurs earlier, between primary and lower secondary education. Notably, 80% of the population with limited access to schools is concentrated in dispersed settlements, primarily situated in peripheral Andean regions, with substantial expansion along the Amazonas rivers and into northeastern Brazil. The number of these settlements increases with each educational level: 217 at the primary level, 367 at lower secondary and 737 at upper secondary (Map 3.2).

*Puerto Maldonado, Peru.*
*Photo by Christian Braga.*

***Map 3.2:* Settlements Where Over 80% of Students Live More Than 30 Minutes from the Nearest Upper Secondary School**




*Source: Prepared by the authors based on DEGURBA method.*
*Note: For more information, see Appendix 1, Box A1: Maps, Data Sources and Geographical References. Amazonia territories of five countries (Brazil, Ecuador, Peru, Colombia and Bolivia). Includes all settlements, excluding dispersed areas.*

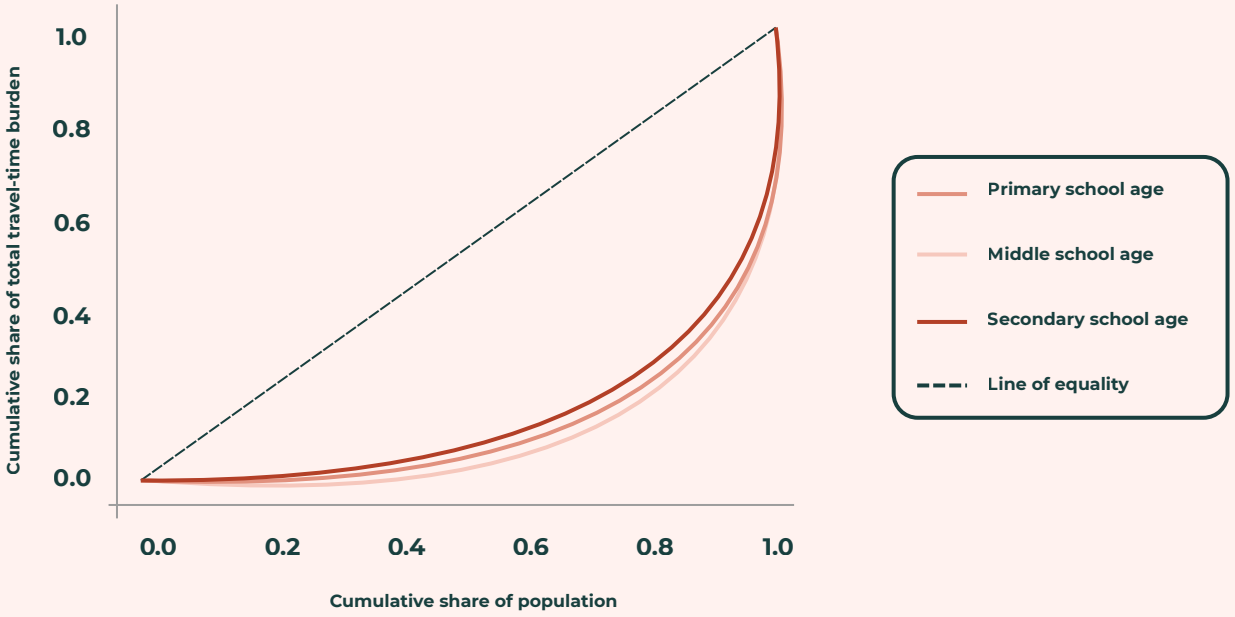
## *Box 3.6: Lorenz Curve of Educational Accessibility in Amazonia*

A Lorenz curve[18] of estimated walking times to the nearest school for school-age children in urban areas of Amazonia in Brazil, Bolivia, Colombia, Ecuador and Peru reveals significant inequality in students' travel times across all education levels (Figure 3.8). Notably, a small share of students accounts for most of the total walking time — for example, the 20% with the longest commutes represent about 75% of total walking time in upper secondary school, and 79% in primary school. This highlights how average travel times can obscure the significant challenges faced by the most vulnerable students, whose lengthy journeys likely impede school attendance and completion.

The Lorenz curve also illustrates that disparities in physical access persist even within urban areas. While walking time serves as a proxy for physical accessibility, it does not capture actual effective access. For instance, factors such as extreme weather events—heavy rains, floods, heat—that can prolong travel or disrupt roadways are not reflected in these estimates. Consequently, the figures are likely to overstate the true level of educational access for school-age children and youth in these urban settings.

[18] The Lorenz curve graphs the cumulative share of a population against the cumulative share of a resource, showing inequality. A straight 45-degree line means perfect equality; the more the curve bends away, the greater the inequality.

***Figure 3.8:* Lorenz Curve of Educational Accessibility in Amazonia**




*Source: Prepared by the authors.*
*Note: Amazonia territories of five countries (Brazil, Ecuador, Peru, Colombia and Bolivia). Includes urban and peri-urban settlements, excluding dispersed areas.*

## Educational Accessibility in Amazonia

Ensuring the right to education in Amazonia fundamentally depends on the physical accessibility of schools. Educational accessibility in Amazonia declines through school levels. While most primary school children live within 15 minutes of a school, this proportion drops sharply at the lower secondary level and even further at the upper secondary level. At the same time, the share of students facing journeys longer than 30 minutes increases with each educational stage. These structural barriers are significant even without considering how disruptions by climate hazards (see Chapter 3.2.iii) or other transportation barriers may affect school commutes. In urban areas in Amazonia, travel modes and times become most acute precisely when students are at greatest risk of discontinuing their education.

# Climate Hazards

*Mariel Juárez Olvera, Luis Mora (IDB)*

Urban areas in Amazonia are deeply intertwined with their surrounding rivers and forests, making them especially vulnerable to climate-related hazards. These include extreme heat, prolonged droughts, fluvial and pluvial flooding, and increasing seasonal variability.[19]

**Extreme heat and heatwaves pose serious risks to urban systems and disproportionately impact vulnerable populations** (Libertun deDuren and González 2025). In some densely built neighborhoods, the removal of vegetation has raised local temperatures by more than 4 °C (SPA 2021). Climate projections show that mean-annual temperatures in Amazonia could rise by 2°C to 4°C by mid-century under high-emission scenarios (Flores et al. 2024; Appendix 3). Large cities are exposed to extreme heat due to extensive paved surfaces and the urban heat island (UHI) effect. For example, during the October 2023 heatwave in Manaus, temperatures reached 39°C — about 6°C above the historical average — resulting in a surge in heat-stroke hospitalizations and increasing energy demands as the UHI effect intensified (Grossman 2024).

Prolonged droughts are also an escalating threat, especially in the southern Amazonas basin, where the dry season has lengthened by six to eight days per decade (Ritchie et al. 2022). These droughts lower river levels, disrupt water supplies, navigation and hydropower production, and increase wildfire risk. In 2023, the Negro river in Manaus dropped to its lowest recorded level, isolating riverside communities, cutting off transport routes, and forcing the temporary closure of key ports (Espinoza et al. 2024). In Bolivia, the Llanos de Moxos region faces similar challenges, with impacts worsened by infrastructure gaps (see Chapter 3.1.ii) (Pabón-Caicedo et al. 2018). Smaller riverside towns and *riverine communities* are particularly affected, as they rely on river systems for livelihoods and connectivity (see Chapter 2.2.ii).

**At the same time, Amazonia is increasingly vulnerable to both pluvial and fluvial floods.** These are becoming more frequent and severe due to intensified rainfall and river surges during the wet season, particularly in urban areas on alluvial plains. These events often overwhelm drainage systems, damage homes, spread waterborne diseases, and disrupt mobility and logistics. In Brazil, cities such as Belém, Manaus, Porto Velho, Rio Branco, and Santarém often experience flooding due to their proximity to major rivers and insufficient drainage infrastructure (dos Santos 2022).

[19] Heatwaves are prolonged periods of consecutive days with persistently elevated maximum and minimum temperatures that exceed critical thresholds (IPCC 2022). Droughts are an abnormally persistent precipitation deficit relative to average conditions, while hydrological drought refers to river discharges and storage levels below normal (WMO 2016). Floods are temporary overflows of water onto normally dry land, either from river rises or from intense rainfall (WMO 2011). Seasonal variability refers to fluctuations in the temporal and spatial distribution of precipitation and temperature within the annual cycle, while hydrological uncertainty describes the difficulty in predicting river flows and water availability under such conditions (IPCC 2021).

In 2021, the Negro river in Manaus rose above 30 meters, flooding the historic center and affecting more than 24,000 homes (Espinoza et al. 2024). Porto Velho has faced back-to-back climate extremes — severe drought in 2014 followed by major flooding in 2015 along the Madeira river, which led to water shortages and infrastructure damage (Sierra-Pérez 2022).

In Peru, Iquitos and settlements along the Ucayali and Marañón rivers experience recurring floods and erratic rainfall that strain infrastructure and service delivery (Espinoza Villar et al. 2009). In Bolivia, Cobija and the Llanos de Moxos face seasonal flooding, with vulnerabilities compounded by limited infrastructure and early warning systems (Pabón-Caicedo et al. 2018). In Colombia, Leticia is exposed to moderate flood and landslide risks, particularly in low-lying and hillside peri-urban zones where geographic isolation further limits emergency response and access to services. Similarly, in Ecuador, Puyo and Tena face flood and landslide hazards linked to rapid urban growth and inadequate planning (Cargua et al. 2023).

*Leticia, Colombia*
*Photo by Christian Braga*

## *Box 3.7: Environmental Degradation in Urban Areas*

***Francisco Román-Dañobeytia (Fundación Amanatari)***

**The hybrid nature of urbanization in Amazonia — where urban, peri-urban, rural and forested areas are deeply interwoven — intensifies the environmental impacts of urban expansion and increases cities' vulnerability to climate hazards by embedding human activities and built environments within ecologically sensitive landscapes.**

Rapid population growth, coupled with inadequate treatment of wastewater, solid waste and industrial effluents, has led to rising pollution in rivers and soils. This pollution degrades aquatic ecosystems, threatens drinking water quality, and damages wetlands (Silva and Bandeira 2025). In the micro-basins of Santarém, high concentrations of contaminants are consistently detected during the rainy season, primarily due to runoff from agriculture, mining and industrial activities (Batista et al. 2024). Tanneries and the wood industry are key urban sources of chromium pollution, posing significant health risks for communities that rely heavily on fish as a dietary staple (Sousa et al. 2017).

Most urban areas in the region lack adequate sanitary landfills, depending instead on open dumps, forested areas, or riverbanks for waste disposal and open burning — especially of plastics and organic matter. Micro- and nano-plastics have been found in fish gills in Brazilian Amazonas rivers, indicating both local and transboundary contamination through water systems (Campos Ribeiro 1995). Urban expansion into interfluvial wetlands — such as in Pucallpa in Peru, Rio Branco in Brazil and Florencia in Colombia — further increases pollution exposure by degrading natural buffers that would otherwise filter contaminants (Mantilla 2022). In addition, unregulated or inadequately planned urban growth undermines biodiversity both within and around city boundaries.

In the Peruvian Amazonia, only 10 out of the 22 urban areas offer more than one square meter of green space per inhabitant (Zucchetti et al. 2020). Infrastructure-driven fragmentation increased *ecological isolation* by 38% in peri-urban areas of Leticia and Tarapoto between 2001 and 2018 (Clerici et al. 2020). Additionally, native flora is increasingly being replaced by non-native species; for example, in Leticia, Colombia, 83% of urban plant species now originate from outside Amazonia (Cárdenas et al. 2004).

## Impacts on Key Infrastructure

Climate hazards increasingly impact urban infrastructure systems across multiple sectors. The most affected include transportation networks, energy systems, water supply and sanitation, housing, information and communication technology, natural and ecological infrastructure, and social infrastructure, such as health facilities (see Chapter 3.2.i) (Table 3.3).

In general, urban infrastructures are highly interdependent, meaning disruptions in one system — such as electricity — can quickly cascade into failures in water supply, healthcare, telecommunications and emergency response. A single disruption can rapidly escalate, amplifying risks for urban populations, especially in areas with little redundancy. In the case of Amazonia, given its limited and uneven infrastructure, this interconnectedness heightens the risk of systemic breakdowns. The combination of outdated infrastructure, lack of maintenance and informal urban expansion further increases vulnerability to extreme hydrometeorological events (IPCC 2022).

***Table 3.3:* Impacts of Climate Hazards on Critical Infrastructure**

| Sector | Key Infrastructure at Risk | Climate Hazards | Vulnerability Factors | Resilience Priorities |
|---|---|---|---|---|
| Transportation | Roads, bridges, river ports, hillside corridors | Extreme rainfall, floods, landslides, erosion | Few alternative routes, slope instability, poor connectivity to emergency logistics | Reinforce and reroute corridors, stabilize slopes, conduct emergency detour planning |
| Energy | Hydropower plants, substations, transmission lines, river-based fuel transport | Dry-season droughts, floods, 40+°C heatwaves, navigation disruption | Heavy reliance on river flow, lack of energy diversification, heat-driven demand surges | Diversify energy mix, upgrade grid infrastructure, protect supply routes |
| Water and Sanitation | Water intake systems, sanitation plants, drainage channels | Floods, droughts, increased seasonality, blocked drainage | Unregulated growth, weak drainage, informal settlements with no access to safe water. | Expand service coverage, build green infrastructure for runoff, integrate solid waste management |
| Housing | Informal housing, stilt and floating houses, low-lying settlements | Floods, heatwaves, landslides, windstorms (linked to urban heat islands). | Poverty, insecure land tenure, weak construction norms, exclusion from governance | Secure land rights, upgrade to climate-resilient housing, set up early warning systems |
| Information and Communication Technology | Telecom towers, internet cables, server rooms, cellular networks | Floods, storms, power outages, lightning (critical failure during compound events) | Low redundancy, vulnerable siting, reliance on unstable power and network grids | Establish backup power, hazard-resistant design, continuity plans for storm/heat failures |
| Green Infrastruture | Wetlands, riparian buffers, mangroves, floodplain forests (*várzeas*, igapó) | Floods, droughts, deforestation, urban expansion | Zoning violations, habitat fragmentation, limited ecological monitoring | Restore hydrological buffers, enforce land use, integrate ecosystem services |
| Health | Clinics, hospitals, cooling systems, water supply and sanitation in facilities | Floods, heatwaves, power/water outages, storm damage | Low elevation seating, heat-sensitive services, lack of backup systems. | Build elevated, resilient construction; integrate with utilities; improve emergency prep |
| Source | - | IPCC 2022; Espinoza et al., 2024; Ritchie et al. 2022; USAID 2018 | IPCC, 2022a; Mansur & Brondízio 2017; OTCA 2023 | SPA 2021; World Bank 2021; Lin et al. 2015 |

*Source: Prepared by the authors.*

## *Box 3.8 Unlocking Climate Finance Funds for Urban Areas in Amazonia*

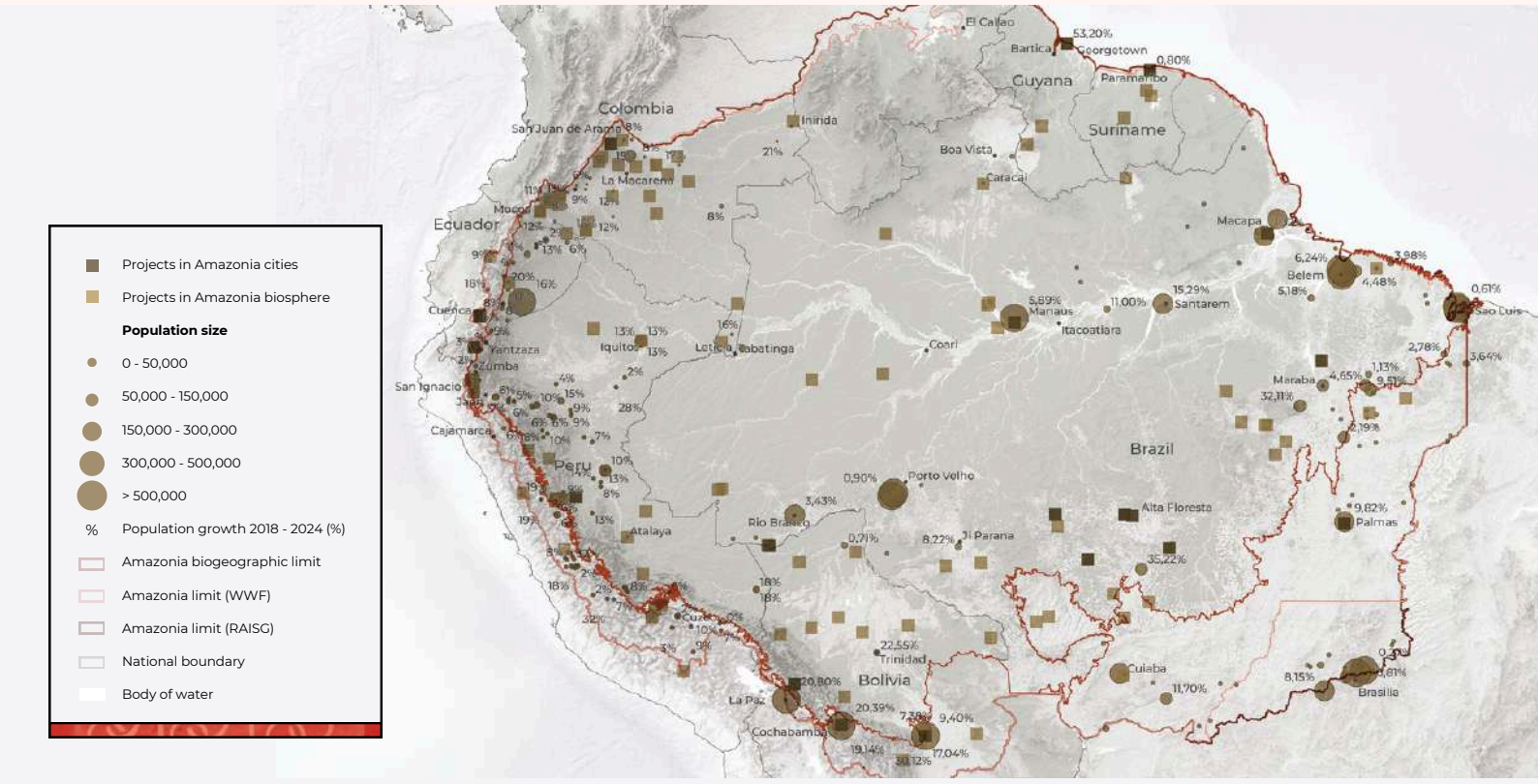
***Gabriella Carolini, Sylvia Jiménez Riofrio, Mrinalini Penumaka, Tatiana Jimenéz, Kathleen Julca (MIT)***

Between 2013 and 2022, philanthropic funding for Amazonia grew markedly — from about 7% to 31% of total philanthropic investments — reaching approximately $186 million in 2022 (Juelsgaard 2024). Despite the region's acute vulnerability to climate hazards, however, only a small share of this funding has been dedicated to adaptation. In 2021, just $21 million — 3% of philanthropic resources — was allocated to adaptation initiatives (Hoover El Rashidy 2021). This stark disparity highlights a critical gap between the region's escalating climate risks and current funding priorities.

Geographically, the majority of climate-related projects are found along navigable rivers, with 80% located within 10 kilometers of a riverscape. This strong fluvial focus has resulted in major urban centers being largely overlooked. Projects with a clear urban focus are limited and tend to cluster along the western and southern borders of Amazonia, by passing key regional hubs like Belém, Santarém, Boa Vista, Inírida, Itacoatiara, and Porto Velho, as well as numerous smaller towns. Even in cities like Leticia, Tabatinga and Iquitos — situated near funded projects — there is minimal attention to climate hazards.

Overall, the current funding landscape does not address both the scale of urbanization and the rapid emergence of new urban areas in central Amazonia (Map 3.3).

***Map 3.3:* Urban Population Growth and Climate-Related Projects**




*Notes: For more information, see Appendix 1, Box A1: Maps, Data Sources and Geographical References.*
*Source: Prepared by the authors based on data from RAISG 2024, OSM 2025, CEPAL 2024, Mayorga 2012, Pereira et al. 2023, IBGE 2024, National Institute of Statistics of Bolivia 2024, DANE 2018, Sinchi 2018, Sinchi 2025, National Institute of Statistics and Censuses of Ecuador 2021, Military Geographic Institute of Ecuador 2024, Official Geoportal of Geospatial Data of Bolivia 2024, National Institute of Statistics and Informatics of Peru 2024, European Spatial Agency 2024.*

## Social Vulnerability to Climate Hazards

Social vulnerability intensifies the impacts of climate hazards, especially for communities experiencing spatial exclusion and systemic disadvantages. Unplanned urbanization combined with extreme rainfall can trigger compound disasters — such as flash floods, water contamination, structural collapses and localized public health emergencies. Indigenous and Afro-descendant populations, as well as residents of informal settlements lacking adequate drainage, are particularly at risk (see Chapter 2.2.i). For instance, peripheral neighborhoods in Belém and Iquitos are highly susceptible to landslides, flooding and disease outbreaks (Rodrigues et al. 2021). Households that are dependent on nearby forests and rivers for subsistence fishing increasingly face resource scarcity and pollution (Sierra-Pérez 2022). Vulnerable groups, including the elderly, children and those living in poorly insulated homes, are most exposed to the dangers of heatwaves (Grossman 2024).

Addressing these layered vulnerabilities requires climate adaptation strategies that are not only technically sound but also socially inclusive, centering the needs, knowledge and rights of the most affected populations.

# REMOTENESS OF URBAN AREAS: CHALLENGES FOR URBAN PROSPERITY

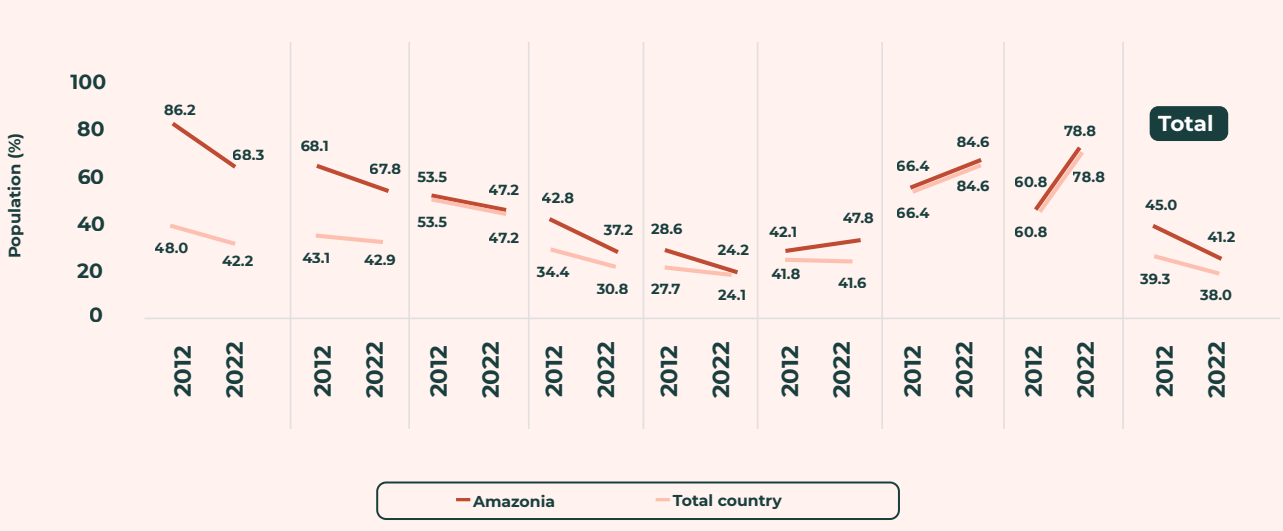
## Poverty in Urban Amazonia

*Jillie Chang, David Cornejo (IDB)*

Remoteness is a major constraint on the economic potential of Amazonia's urban areas (see Chapter 2.2.i), as it limits the development of complex and diversified productive systems (Hausmann et al. 2014). The lack of productive diversity restricts opportunities for sustained economic growth and perpetuates persistent poverty throughout the region (Hanusch 2023).

Despite a modest decline in the poverty rate — from 45% to 41.2% over the past decade — an estimated 48.5 million people in Amazonia still live in poverty, based on the threshold of $8.30 per day (2021 purchasing power parity, or PPP), which defines the upper-middle-income poverty line (IDB 2025). In Venezuela, Suriname, Colombia and Peru, more than half of the Amazonia population remains below the poverty line. Brazil accounts for the largest share of poverty, with 63% of the region's poor — approximately 30.4 million people. Between 2012 and 2022, poverty reduction in Amazonia was uneven, characterized by significant territorial disparities and limited growth in per capita GDP. While national and regional poverty rates generally declined, several countries — including Ecuador, Suriname and Venezuela — experienced rising poverty within their Amazonia territories (Figure 3.9).

***Figure 3.9:* Percentage of Population Living in Poverty in Amazonia vs. National Level, by Country, 2012-2022**




*Source: IDB 2025. "Data and Indicators for Latin America and the Caribbean": https://www.iadb.org/en/sharing-knowledge/data/social-data.*
*Note: Poverty measured as the percentage of population living under the upper-middle-class line of $8.30 per day in 2021.*

**Notably, during this period, rural areas in Amazonia experienced a more significant reduction in poverty — about 8 percentage points — compared with a modest 3-point decline in urban areas.** This finding challenges the common belief that urban environments inherently provide greater economic opportunities. The slower pace of poverty reduction in urban Amazonia may be partly attributed to a 2.3% contraction in industrial activity, which is predominantly concentrated in urban centers (ECLAC/CEPAL STAT 2025).

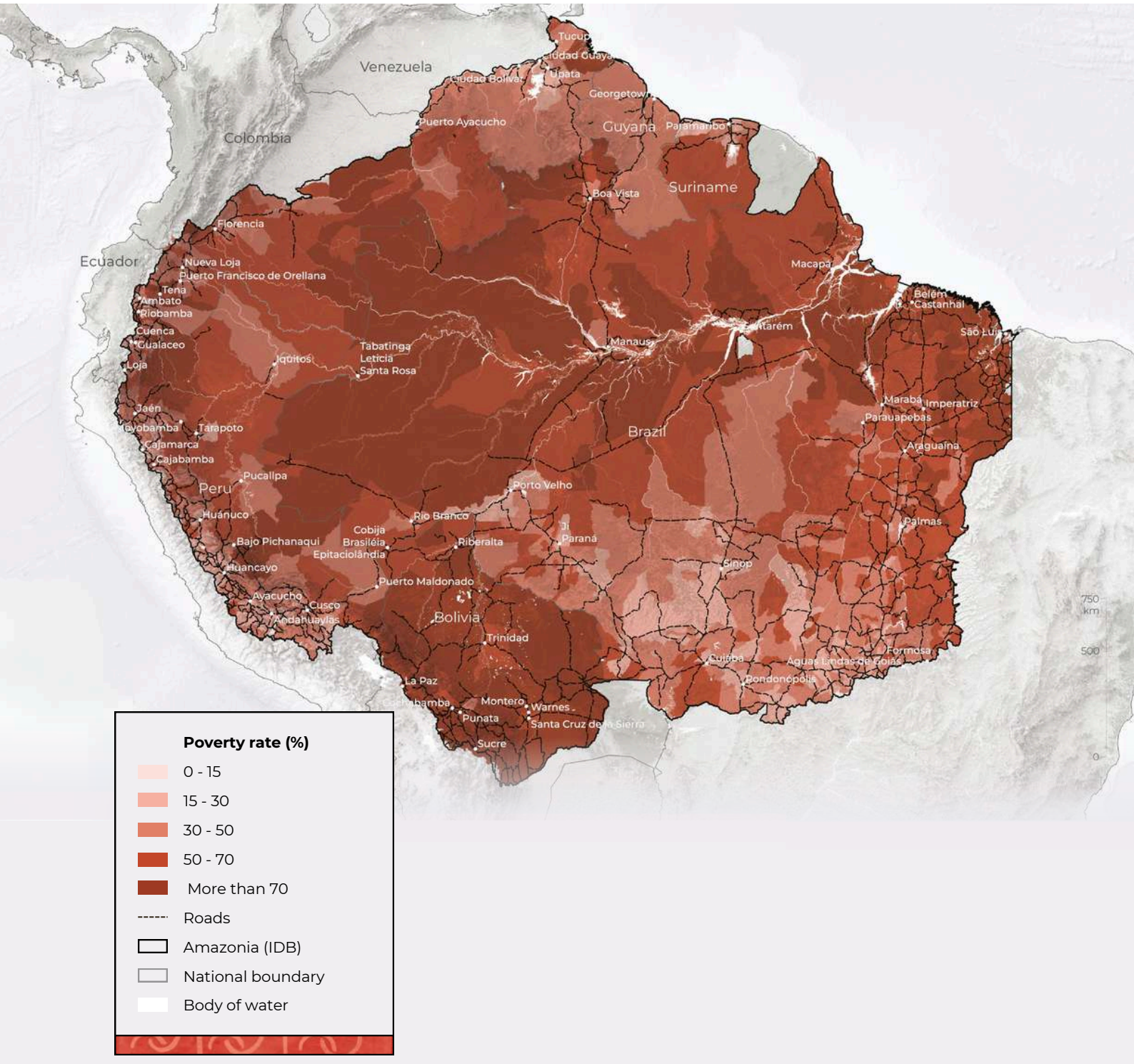
A major obstacle to alleviating urban poverty in Amazonia is the persistently low level of human capital. The average illiteracy rate over the age of 15 in these urban areas remains at 9.7%, highlighting ongoing educational deficits (see Chapter 3.2.ii). Employment rates are also lower in Amazonia, averaging 40.2%, compared with 44.3% in non-Amazonia regions. This disparity is especially pronounced in Brazil, Colombia and Peru, where non-Amazonia areas outperform their Amazonian counterparts by as much as 7 percentage points. Furthermore, Amazonia continues to experience high and rising levels of labor informality, consistently exceeding national averages (see Chapter 3.3.ii).[20]

When examining poverty in urban areas, it is notable that the poverty rate in Amazonia's urban centers decreased from 35% to 32%. Despite this improvement, poverty is more prevalent in these areas than in non-Amazoniain urban centers, where the rate fell from 28% to 27%. Regarding spatial distribution, the subnational administrative units that experience the most severe deprivation are along the banks and tributaries of the Amazonas river, as well as within the Bolivian Amazonia (Map 3.4).

*Tabatinga, Brazil*
*Photo by Christian Braga*

[20] Illiteracy and employment rates were calculated according to the most recent available census data: Bolivia 2012, Brazil 2010, Colombia 2018, Ecuador 2022, Guyana 2012, Peru 2017 and Suriname 2012. Venezuela lacks subnational census data, while microdata from the most recent censuses in Bolivia and Brazil had not yet been released at the time of this publication. Guyana is wholly encompassed within the Amazonia region.

## *Map 3.4:* National Poverty Rate at the Subnational Level in Amazonia




*Source: Prepared by Laura Goyeneche based on IDB 2025.*
*Note: For more information, see Appendix 1, Box A1: Maps, Data Sources and Geographical References. Poverty is measured as the percentage of the population living below each country's specific poverty line. Averages are population-weighted. Administrative areas are classified as urban if urban settlements cover at least 50% of their territory. The smallest administrative units considered are districts (Bolivia, Peru), municipalities (Brazil, Colombia, Venezuela), cantons (Ecuador), and regions (Guyana, Suriname).*

### *Box 3.9: Indigenous Populations in Urban Areas*

***Ellen Serrão Acioli, Verónica Tejerina, David Cotacachi, Amancaya Conde (IDB)***

Poverty, ongoing conflict and environmental degradation — each violating Indigenous Peoples' rights and undermining their traditional livelihoods — have driven many to migrate to urban areas (see Chapter 2.2.i). Yet urban centers are often ill-equipped to support these communities, which continue to face significant income vulnerability and social exclusion.

**A substantial proportion of the Indigenous workforce is employed informally.** Although data specific to Amazonia is limited, regional estimates show that about 82.6% of Indigenous people in the economically active population work in informal jobs — 31.5% higher than their non-Indigenous peers (ILO 2020). In Peru, this figure rises to 89%, with most Indigenous workers lacking access to social security, pensions or health benefits (see Chapter 3.2.i). The absence of labor protections further exposes them to hazardous working conditions (ECLAC 2014).

Often, low income levels push Indigenous residents into peripheral or informal urban neighborhoods, where housing is precarious, access to basic services is scarce and exposure to environmental risks is high. For example, in Iquitos, Peru, flood-prone neighborhoods with large Indigenous populations face persistent threats from natural disasters and environmental contamination (ECLAC 2014). These conditions further restrict opportunities for Indigenous families to escape poverty in urban settings (Ombudsman's Office, Peru 2022).

Indigenous Peoples also face compounded marginalization in cities due to institutional discrimination based on geographic origin, language or cultural identity. Indigenous women, in particular, experience intensified exclusion, with income disparities driven by both gender and ethnicity. In Peru, Indigenous women earn only 57–70% of what Indigenous men earn, compared with the 82–88% parity between non-Indigenous women and men (ILO 2019).

# Labor Market Dynamics in the Capital Cities of the Colombian Amazonia

*Carolina González Velosa,*
*Johanna Ramos Piracoca (IDB)*

Urban areas play a pivotal role in shaping labor market outcomes by bringing firms and workers into proximity, which fosters the exchange of ideas, improves the efficiency of job matching and increases the likelihood of firms finding suitable employees (Duranton and Puga 2004). These agglomeration benefits are most pronounced in dense, well-connected cities (Glaeser 2008). Conversely, weak urban labor markets are often characterized by low economic productivity, limited agglomeration effects and structural barriers to effective labor absorption. Such challenges are evident in the Colombian Amazonia, where high levels of informality, underemployment and limited human capital restrict the productivity potential of urban areas (Hidalgo et al. 2007).

The Colombian Amazonia,[21] which covers 48% of Colombia's continental territory, is the least populated region of the country. It is home to roughly 2.2 million inhabitants — about 4% of the national population — and it includes the departmental capitals of Amazonas (Leticia), Caquetá (Florencia), Guainía (Puerto Inírida), Guaviare (San José del Guaviare), Putumayo (Mocoa) and Vaupés (Mitú).

Labor market indicators in these capitals reveal significant disparities compared to urban areas outside Amazonia. Labor force participation stands at 64%, lower than in other Colombian capitals. Informality is notably high, reaching 55% — well above the national urban average — and vulnerable employment affects 47% of workers. In 2023, Mocoa reported the highest unemployment rate at 27%, Leticia had the highest share of vulnerable employment at 70%, and San José del Guaviare registered the highest informality rate at 76% (Figure 3.10).

**The capitals of the Colombian Amazonia show weaker labor market outcomes than urban areas outside Amazonia.**

[21] According to the definition of Amazonia by the IDB Amazonia Coordination Unit (see Appendix 1)

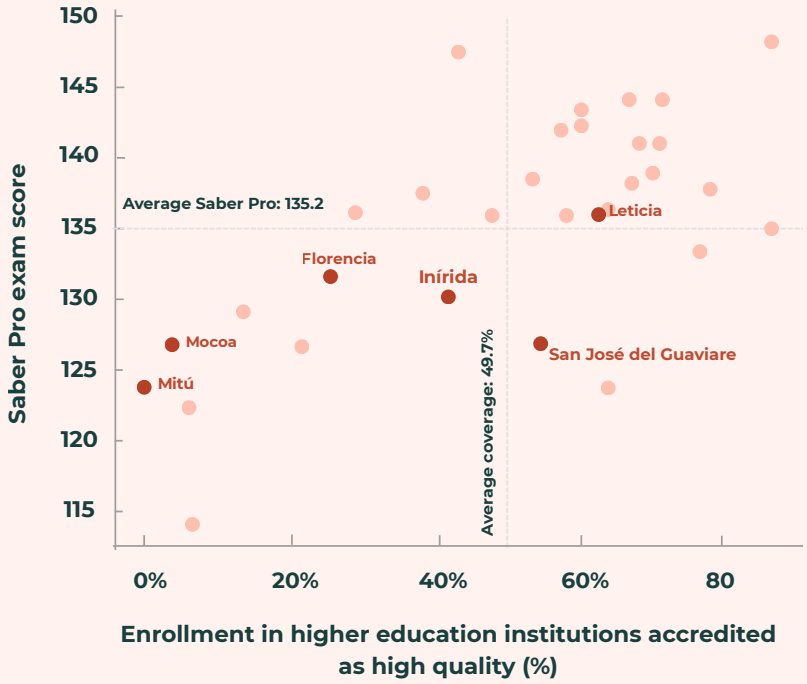
***Figure 3.10:* Variations in Key Labor Indicators in Capital Cities in the Colombian Amazonia, 2023**


*Note: Light red dots indicate RAC department capitals; dark red dots indicate non-RAC capitals.*
*Source: Prepared by the authors based Colombian Private Council for Competitiveness (2024) and DANE (2023).*

Several factors underlie the weak labor market performance in the capital cities of the Colombian Amazonia. High rates of informality and vulnerable employment make these labor markets especially sensitive to changes in national labor regulations. Economic activity in the region is not sufficiently diversified, which restricts job creation and economic resilience. Between 2014 and 2024, the average GDP growth rate in Colombian departments in Amazonia was just 1.8%, well below the national average of 2.5%, and characterized by significant volatility. The region's economic output is driven by public administration, commerce, and agriculture, with manufacturing playing only a minor role. Small, informal enterprises focused mainly on subsistence activities dominate the business landscape. **Business density — measured as registered productive units per 100,000 inhabitants — is far below the national average of 11, and over 97% of formal businesses in the region are classified as small** (Echeverry et al. 2024).

In addition, these cities face substantial challenges in building human capital, due in part to limited access to quality education (see Chapter 3.2.ii). Post-secondary enrollment rates are significantly lower than national averages, with less than 22% of students enrolled in university programs and under 30% in technical and technological programs. Except for Leticia, most cities have a low proportion of higher education institutions accredited as high quality, and they underperform on national exit exams such as Saber Pro (Figure 3.11). Furthermore, the available post-secondary programs are often misaligned with the region's current economic development needs, focusing mostly on traditional sectors like agriculture. For instance, of nearly 1,000 nationally accredited technical training programs offered in Amazonia, fewer than 10% have an environmental focus, limiting their relevance to the region's productive potential and future growth opportunities (Echeverry et al. 2024).

***Figure 3.11:** Saber Pro Scores and Accredited Higher Education in Capital Cities in the Colombian Amazonia, 2022*




*Source: Prepared by the authors based on the Colombian Private Council for Competitiveness (2024) and DANE (2023).*

## *Box 3.10: Urban Wage Gaps in Bolivia, Colombia, Ecuador and Peru*

***Luis Quintero (IDB)***

Urban areas in Amazonia are typically remote, sparsely populated, and characterized by limited access to skilled labor and incomplete infrastructure coverage (see Chapter 2.2.i). These factors are associated with lower productivity. Empirical evidence shows that a city's geographic location significantly shapes its access to markets and its exposure to natural advantages or constraints, such as climate and proximity to transportation networks (Ellison and Glaeser 1999). Higher population density is also strongly associated with increased productivity, as dense urban environments foster knowledge spillover, expand labor markets and enable firms to share resources more efficiently (Duranton and Puga 2004). Additionally, a well-educated workforce drives innovation, learning and the development of complementary skills, further boosting productivity (Dingel et al. 2021).

To assess productivity differences between cities in and outside Amazonia, household survey data from 2000 onward are used for Bolivia, Colombia, Ecuador and Peru, covering approximately 72% of the population in these countries (SEDLAC 2025).[22]

[22] The Socio-Economic Database for Latin America and the Caribbean (SEDLAC) covers 24 countries, including five of the eight countries with territory in Amazonia. Although Brazil is part of the database, it is excluded from this analysis due to the use of anonymized location codes, which prevent subnational comparisons. The dataset includes detailed information on the working-age population (ages 14 to 65), such as education level, age, gender and marital status.

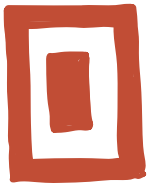
The dataset includes observations from 45 provinces in Bolivia (representing 62% of the population), 136 municipalities in Colombia (50%), 651 parishes in Ecuador (83%), and 1,431 districts in Peru (94%). It covers urban areas consistently across countries and over time. Wages are used as a proxy for productivity, based on the standard economic assumption that in competitive labor markets, more productive workers tend to earn higher wages (Glaeser and Mare 2001).

A basic comparison of wages shows that urban areas in Amazonia consistently exhibit lower wage levels than their counterparts elsewhere. Applying the method developed by Quintero and Roberts (2023),[23] the unadjusted wage gaps are estimated at 15% in Bolivia, 18% in both Colombia and Ecuador, and 38% in Peru.

However, once the analysis controls for individual characteristics — such as education, age, gender and marital status — as well as local variables like population density, ruggedness of terrain and climate factors (mean annual temperature and precipitation), the wage gaps shrink substantially or disappear entirely. The most influential factors in this convergence are differences in educational attainment and in urban population density. Overall, lower average education levels and lower urban density are consistently correlated with lower observed productivity in urban areas of Amazonia (see Chapter 3.2.ii).

*Leticia, Colombia*
*Photo by Christian Braga*

[23] The method estimates competitive wages by modeling a representative firm's input costs and output prices, assuming a Cobb-Douglas production function. It accounts for worker heterogeneity by controlling for individual characteristics such as education, age, gender, and marital status, as well as urban-level factors including population density, average human capital, and geographic conditions like climate and terrain. Wages are measured as nominal hourly wages in the primary occupation, adjusted to 2005 purchasing power parity (PPP) exchange rates. Geographic data points — such as population density, terrain ruggedness, mean annual temperature, and precipitation levels — are sourced from the GeoData Center at the University of Southampton. For more details, see Quintero and Roberts 2023.



# 4 Taking Action

## 1. RESPONSIVE AND PEOPLE-CENTERED GOVERNMENT SERVICES



## 2. INTEGRATED APPROACHES TO TERRITORIAL STEWARDSHIP



## 3. SUSTAINABLE ECONOMIC GROWTH

# RESPONSIVE AND PEOPLE-CENTERED GOVERNMENT SERVICES

## Technology and Partnerships to Address Insecurity

*Fernando Cafferata, Gonzalo Croci, Federico Veneri, Rodrigo Serrano-Berthet, Eduardo Vergara, Nathalie Alvarado (IDB)*

As illegal markets expand and organized crime gains influence across Amazonia, urban areas are emerging as critical hubs for institutional response and innovation. Far from being mere sites of vulnerability, these cities increasingly serve as platforms for proactive actions, coordination and innovation. Their effectiveness is significantly amplified when supported by monitoring platforms, financial traceability systems, cross-border and international cooperation, and dedicated security units; all of these strengthen the institutional capacity to address the region's complex governance (see Chapter 3.1.i). and security challenges (Chapter 3.1.iii).

### Monitoring Platforms and Early Detection Systems

**The integration of satellite technologies, geospatial analysis and advanced surveillance systems has improved the ability of state institutions to monitor, prevent and respond to illegal markets in Amazonia.** For example, the Brasil MAIS program — an integrated criminal analysis platform led by Brazil's Federal Police — combines georeferenced data, satellite imagery and predictive algorithms to identify and prioritize zones of organized crime activity. This platform enables authorities to detect spatial patterns in crimes such as illegal deforestation, unauthorized gold mining and drug trafficking. Its algorithm classifies high-risk areas based on historical and operational variables, supporting evidence-based decision-making and resource allocation. Through its visual and interoperable interface, security forces can plan operations, coordinate resources and generate automatic alerts. Additionally, the platform has been instrumental in regionalizing analytical capabilities, as its logic can be replicated in other Amazonia contexts (National Secretariat of Public Security, Brazil n.d.).

The Guacamaya Project is a binational initiative led by a partnership of the private sector and academic and government institutions in Colombia and Peru. It uses artificial intelligence and data analytics to strengthen biodiversity conservation. In Colombia, the project is carried out in collaboration with an AI research center at the Universidad de los Andes (Centro de Investigación y Formación en Inteligencia Artificial), and the Instituto Amazónico de Investigaciones Científicas SINCHI (SINCHI 2025). In Peru, the project was recently expanded through a partnership with the Ministry of the Environment, focusing on the protection of strategic ecosystems and protected natural areas (Ministry of Environment, Peru 2025). By integrating high-resolution satellite imagery,

bioacoustic recordings and infrared camera traps, the platform efficiently detects changes in forest cover and species and watches over human activities such as illegal logging. Its open-source design enables adoption by other organizations, broadening its impact on ecosystem monitoring and conservation (Microsoft Latin America 2024).

## Financial Traceability Systems

**Disrupting the financial and logistical networks that sustain criminal economies requires robust traceability and interoperability systems.** Brazil's Ouro Alvo program, led by the Federal Police, exemplifies this approach. It tracks gold from extraction to export by integrating electronic records, satellite imagery, banking data and advanced forensic tools. Technologies such as X-ray fluorescence and isotope analysis identify gold's geochemical fingerprint, which is then cross-referenced with the national Ouroteca database to verify its origin. This system helps to expose illegal mining operations and associated money laundering activities (APCF 2024; Federal Police, Brazil 2024).

Similarly, the World Forest ID platform combats illegal timber trade by analyzing the geochemical signature of wood products, using mass spectrometry and isotope analysis. The platform is supported by a global reference database. This approach enables precise origin verification, strengthens supply chain transparency and supports legal investigations, while promoting responsible sourcing in partnership with governments, businesses, and NGOs (World Forest ID n.d).

## Cross-Border and International Cooperation

Regional command and control centers, along with interoperable databases, have improved the exchange of information on illicit activities. An example of this collaboration is the Safe and Sustainable Amazonia Initiative, promoted by the IDB to foster cooperation among police forces in Amazonia countries. This technical platform makes it possible to design common protocols, strengthen state capacities and coordinate responses to threats such as drug trafficking, illegal mining and money laundering. This approach reinforces the principle that security in Amazonia must be addressed through shared, sustainable visions rather than solely from national perspectives (IDB2024a).

A key operational component in this regional architecture is the International Police Coordination Center, in Manaus, Brazil. This unit functions as a real-time intelligence exchange hub connected with INTERPOL, AMERIPOL and the federal police forces across Amazonia. It allows for joint analysis of transnational criminal networks, cross-referencing of biometric and financial data, and coordination of cross-border operations. Additionally, it works closely with platforms such as Brasil MAIS, the Ouro Alvo program and the Safe and Sustainable Amazonia Initiative, generating synergies between technology, governance and operational action.

CRIMEJUST, a collaboration between UNODC, INTERPOL and the European Union, further enhances international cooperation among criminal justice agencies across Latin America, Africa and the Caribbean. Through joint training, protocols and intelligence sharing, CRIMEJUST enables coordinated action against transnational crimes — including drug trafficking, human trafficking and natural resource laundering — especially in complex regions like Amazonia (European Union - Service for Foreign Policy Instruments 2024).

## Dedicated Security Units

The remoteness of many areas of Amazonia requires specific policing models (see Chapter 2.2.ii). In response, several countries have established dedicated security units on environmental and organized crime, capable of operating in complex and hard-to-reach environments. The Arpão Base on the Solimões river in the state of Amazonas, Brazil, is a notable example. Inaugurated in 2020 as part of the National Border and Borderline Security Program, this base integrates coordinated actions by the Federal Police, Military Police, and the Brazilian Army. In its first year of operation, Arpão achieved significant results, including the seizure of over four tons of drugs, 30 vessels and 86 firearms, and the arrest of 194 individuals during the commission of crimes. It also seized more than 42.5 tons of illegally caught fish, demonstrating its impact both in intercepting illicit substances and in environmental protection (Ministry of Justice and Public Security, Brazil 2021). This model of joint action has served as a regional reference for the challenging task of developing interagency forces, Brazil's Integrated Force to Combat Organized Crime coordinates the actions of multiple institutions, avoiding duplication and increasing operational effectiveness. These units can adapt to the dynamics of criminal activity that, involves multiple overlapping illegal markets (Federal Police, Brazil 2024).

Strengthening institutional capacities requires specialized human capital. Given the increasing sophistication of environmental and transnational crimes, ongoing training for police, prosecutors, and judicial operators is essential. An example is the Environmental Inspection Course, organized by Brazil's Federal Highway Police. It included participants from key institutions such as Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute of Environment and Renewable Natural Resources), Instituto Chico Mendes de Conservação da Biodiversidade (Chico Mendes Institute for Biodiversity Conservation), and Secretaria de Estado de Meio Ambiente Pará (State Environment Authority for the State of Pará). The course covered legal tools, inspection techniques, and inter-institutional strategies to address illegal mining, timber trafficking and other complex environmental crimes. As part of the operational follow-up to this training, Operation Sumaúma was developed. This operation was an interagency deployment that carried out environmental inspection actions at 11 bases within the Brazilian Amazonia, focused on reducing environmental crimes through territorial surveillance and the strategic use of intelligence (Federal Highway Police, Brazil 2023).

***Box 4.1: Policies for Safer Urban Areas***

**Antônio Sampaio, Gabriel Funari (Global Initiative Against Transnational Organized Crime)**

To effectively enhance citizen security in cities in Amazonia, public security policies must be tailored to address the region's unique characteristics and needs. The following strategies are essential for building safer, more resilient urban communities:

**Empower Local Civic Servants**
Invest in the training and ongoing support of local civil servants and criminal justice systems, with a particular emphasis on prosecutors' offices, courts, human rights agencies and environmental protection agencies. Strengthening these institutions should be paired with increased investment in modern equipment and advanced technologies, enabling more effective protection of Amazonia territories — especially the riverine systems in the tri-border region of Colombia, Peru and Brazil.

**Pilot Innovative Citizen Security Initiatives**
Adapt successful urban infrastructure innovations from other LAC cities to the Amazonia urban context to improve public safety. For example, upgrading transportation networks can expand access to economic opportunities and reduce vulnerability, while creating safe spaces for youth — such as those developed in Medellin, Colombia (Moncada 2016) . This can foster community engagement and prevent crime.

**Foster Strong Community Relations**
Consolidate local security coordination and build stronger relationships with community members, drawing on best practices from cities like Pelotas, Brazil. Reinforcing urban planning and enforcement capacities of local municipalities is also crucial to prevent the informal occupation of urban and peri-urban land, ensuring orderly development and reducing risks associated with unplanned growth.

## Charting the Path Forward: Innovative Solutions and Remaining Challenges

Initiatives such as Brasil MAIS, Ouro Alvo, World Forest ID and the Guacamaya Project illustrate the transformative potential of emerging technologies and platforms to strengthen environmental oversight, bolster state operational capacity and combat illicit economies that threaten Amazonia ecosystems. Similarly, the establishment of regional cooperation platforms, alongside the creation of specialized police units tailored to the Amazonia context, underscores the critical importance of inter-institutional, integrated and sustained responses. Continuous professional training, system interoperability and the

implementation of robust financial control mechanisms are foundational pillars for tackling the complexity of illicit economies in the region.

Despite the progress made, significant challenges persist, including institutional fragmentation, weak state presence in strategic territories, insufficient integration of data systems, and the limited inclusion of Amazonia regions in national development agendas. Moreover, the long-term sustainability and legitimacy of interventions depend on ensuring that technological and operational solutions are embedded within inclusive, participatory strategies. To build more effective, sustainable, and legitimate security governance in Amazonia, it is essential to adopt a territorial and evidence-based approach — one that is responsive to the unique characteristics, needs and dynamics of each local context. Only by grounding innovation in local realities and fostering broad-based collaboration can the region move toward lasting solutions that protect both its people and its ecosystems.

*Cobija, Bolivia*
*Photo by Christian Braga*

# Innovations in Health Services

*Sofía Castro Vargas, Laura Goyeneche, Sebastian Bauhoff (IDB)*

Disparities in healthcare access and utilization between Amazonia and the countries as a whole are still a persistent challenge (see Chapter 3.2.i). Addressing these disparities at the urban level requires a multi-faceted approach (Libertun de Duren et al., 2022), one that includes strengthening primary healthcare through community-based and culturally adapted models; overcoming geographic and infrastructure barriers (see Chapters 2.2.ii and 3.1.ii); expanding the health workforce with an emphasis on shifting some tasks to less-specialized personnel and traditional healers; improving maternal and neonatal health through integrated, context-sensitive strategies; and building climate-resilient health systems (see Chapter 4.2.i).

## Building Culturally Adapted Primary Healthcare Models

Hospital data from Amazonia reveal that many patients reach hospitals only when their conditions are severe, often because local primary healthcare is inadequate (Ziller et al. 2024). Improving its reach, continuity and equity goes beyond simply increasing the number of facilities; it requires improving service delivery, ensuring continuity of care and tailoring interventions for populations historically excluded from health systems. Healthcare infrastructure and services are unevenly distributed, with Indigenous and remote communities facing the greatest barriers (Sousa et al. 2022). Urban centers in Amazonia struggle to provide continuous, high-quality health services, particularly in informal settlements. Expanding culturally adapted care models in peri-urban areas — where population pressures are high and infrastructure is fragile — can help bridge the gap between rural exclusion and urban neglect.

**A variety of community-based and context-adapted interventions have shown promise in improving primary healthcare delivery, especially those rooted in task-shifting, culturally sensitive healthcare and health system integration.** Brazil's Family Health Strategy, one of the world's largest programs of its kind, has achieved widespread coverage. In the Brazilian Amazonia, a 40% increase in coverage was associated with a 22% reduction in hospitalizations for conditions that can be managed at the primary care level (Carneiro et al. 2021). Other interventions, such as health worker training and patient education in rural Brazil, have improved outcomes for hypertension and diabetes (Lemos Macedo et al. 2021). The HealthRise initiative, a community-based program focused on the prevention and management of hypertension and diabetes in underserved populations, also showed notable reductions in blood pressure and blood sugar levels. In Brazil, it was implemented between 2016 and 2018 in Vitória da Conquista, Bahia, and in Teófilo Otoni, Minas Gerais. By the end of the program, 73% of enrolled hypertension patients and 63% of diabetes patients showed

improved clinical outcomes. However, its overall impact was limited by short program durations and social and demographic challenges (Flor et al. 2020).

In the Peruvian Amazonia, a nursing-led initiative addressed water supply, nutrition and the integration of traditional and western medicine. It improved community health outcomes by empowering nurses and community health workers to assess, plan and intervene. (Badanta-Romero et al. 2021). Mobile health tools have increased follow-up rates and reduced unhealthy dietary behaviors, even if their impact on clinical outcomes is modest (Beratarrechea et al. 2016). In urban areas like Cruzeiro do Sul, Brazil, targeted cervical cancer screening programs have dramatically increased detection rates, highlighting the value of focused interventions (Zuben et al. 2007). Reviews emphasize that these localized efforts are most effective when they are part of system-wide strategies that support task-shifting, health education, and coordination among local and external actors (Ruby et al. 2015).

**In addition, expanding the roles of less-specialized healthcare workers is essential to address workforce shortages and broaden primary care coverage across Amazonia, thereby improving rural health outcomes and easing the demand on urban health centers.** Actively engaging local actors as trusted intermediaries can help bridge the gap between communities and health services, supporting outreach, care coordination and culturally sensitive interventions in both rural and urban settings in Amazonia (Arias-Murcia and Penna 2022). Targeted investments in training, mobility and improved coordination can enhance the effectiveness of well-trained local auxiliary nurses, as proved by Brazil's Programa Mais Médicos, which has deployed physicians to underserved areas since 2013 (Carvalho et al. 2016).

## Bridging Geographic and Infrastructure Gaps in Healthcare Access

Health infrastructure is heavily concentrated in urban areas, with over 70% of facilities found in urban settlements — many of which are basic-level or face supply shortages — further disadvantaging people in non-urban areas who must travel long distances at high cost (Del Mastro N. 2022; Hernández-Vásquez et al. 2022).[24]

Innovative solutions have emerged to reach remote, river-dependent communities. In Brazil, *Floating Primary Health Centers*, officially supported by the Ministry of Health, travel along rivers; these centers are staffed by multidisciplinary teams and equipped to offer a range of services. While the floating centers significantly expand access in underserved areas (Fortes-Filho et al. 2024), their brief visits tend to focus on short-term needs rather than long-term care continuity (Garnelo et al. 2020). Urban referral centers such as Manaus, Iquitos and Belém serve as critical nodes for diagnostic services and specialized care, but weak referral systems and long travel distances can

[24] These inequities were evident during the COVID-19 pandemic, when mortality fluctuations in the Brazilian Amazonia were partly explained by geographic disparities and healthcare shortages (Brizzi et al. 2022).

hinder follow-through for rural patients. Conversely, low-income urban neighborhoods often face delays due to overwhelmed capacity. Strengthening linkages between floating services and urban hospitals is essential to ensure timely and consistent care, particularly for patients requiring follow-up or advanced treatment (Sousa et al. 2017).

*Floating Healthcare Centers*


*Iguaraçu Fluvial Mobile Clinic Pilot Project in Borba, Brazil*

*Source: Fortes-Filho et al. 2024; Schweickardt 2017.*

Telemedicine presents a scalable and transformative solution to reduce travel burdens and improve continuity of care across Amazonia. As digital connectivity continues to expand, telehealth platforms can deliver primary care consultations, follow-up and health education without requiring costly and time-consuming travel for patients or providers. Although direct evidence from Amazonia is limited, promising results from other regions — such as improved continuity of care for diabetic patients in Colombia — demonstrate telemedicine's potential to enhance health outcomes (Tejedor Bonilla et al. 2024). With thoughtful adaptation to local infrastructure and cultural contexts, telemedicine can complement existing services and significantly expand access in remote areas. Urban centers, which typically have higher digital connectivity, can serve as telehealth hubs for surrounding communities. Policy support for these hubs would help strengthen regional primary care networks and ensure more equitable healthcare delivery.

## Improving Maternal and Neonatal Health

Maternal and neonatal conditions are a leading cause of hospitalization and mortality in Amazonia, driven by preventable factors such as inadequate prenatal care, a lack of skilled birth attendants, and long travel times to health facilities (Batista et al. 2018; Pinto et al. 2024). Research shows that travel times exceeding one hour, as well as unnecessary cesarean sections, are linked to increased maternal complications and mortality (Cecatti et al. 2015).

Culturally adapted, community-based strategies have succeeded in addressing these challenges. In Cotopaxi, Ecuador, the involvement of traditional birth attendants increased postnatal care and reduced neonatal mortality (Broughton et al. 2016). Otavalo's intercultural childbirth model — which incorporates vertical delivery positions, Indigenous language use and family participation — has achieved zero maternal deaths since 2008 (Matute et al. 2021). Similarly, in Ayacucho, Peru, culturally adapted birthing centers increased births in these facilities from 6% to 83% (Gabrysch et al. 2009).

Community health agents play a vital role in sustaining care in remote areas. For example, the Mamás del Río program in the Peruvian Amazonia kept prenatal visits during the COVID-19 pandemic through trained local workers, despite disruptions to healthcare facilities (Reinders et al. 2020). In Ecuador, national intercultural health policies and sustained infrastructure investment raised prenatal care and skilled birth attendance from 27% to 75% over 14 years (Ríos-Quituizaca et al. 2024).

In urban settings, strategies such as maternity waiting homes and improved referral systems have reduced delays for high-risk pregnancies, particularly in rapidly growing cities (Lonkhuijzen et al. 2012).

**Effective maternal health interventions in Amazonia often rely on three pillars: infrastructure, human resources and cultural adaptation.** Infrastructure improvements include expanding maternity services, setting up health posts and maternity homes, and developing referral and emergency transport systems (Lazo-Gonzales et al. 2023). Human resource strategies focus on training and supervising community health workers and traditional birth attendants to ensure coverage in remote areas (Del Mastro N. 2022). Cultural adaptations — such as vertical birthing, family involvement, and respectful integration of traditional practices — have significantly improved service acceptability and uptake (Gabrysch et al. 2009).

Brazil's Rede Cegonha, a national maternal health strategy adapted to Amazonia, exemplifies coordinated care from prenatal to postpartum, with investments in nurse and midwife training and infrastructure (Leal et al. 2019). In Amazonia, this initiative led to a fourfold rise in prenatal visits, earlier initiation of care, and a 150% increase in adherence to labor-related best practices (Gomes et al. 2021). Neonatal outcomes also improved: skin-to-skin contact increased by 140%, delivery-room breastfeeding by 82%, and airway aspiration rates dropped by 65%. However, persistently high maternal mortality and the prevalence of unnecessary cesarean highlight the ongoing need for more targeted interventions (Assis et al. 2019).

## *Box 4.2: The New Social Cartography of Amazonia*

**Reginaldo Conceição da Silva (Universidade do Estado do Amazonas)**

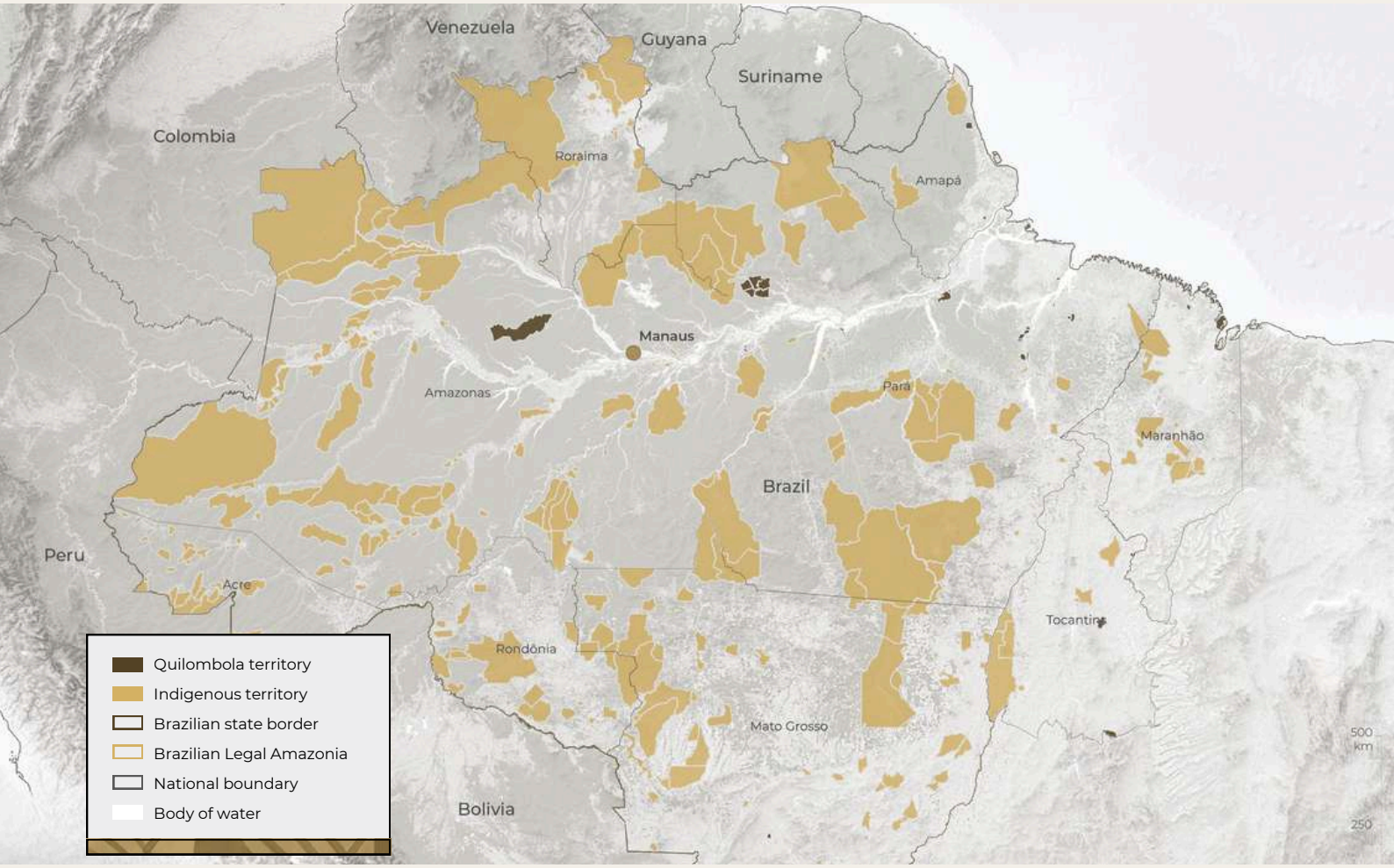
Indigenous and Quilombola peoples living in urban areas of Amazonia face distinct barriers to accessing health services. The New Social Cartography of Amazonia is a participatory research approach designed to make these challenges visible and to drive solutions. Unlike conventional research approaches, it integrates traditional knowledge with interdisciplinary methods, offering a holistic view of local issues. By actively involving community members, this approach bridges academic research and lived experiences. For example, it has highlighted the complexities of maternal health and childbirth in Indigenous communities; as described by a local nurse helping to inform more culturally appropriate health interventions:

> *Births are attended by midwives, accompanied by the women of the family and husband. If the delivery gets complicated, the pregnant woman is taken to the base, often with the family boat; the time of the journey will depend on the power of the engine and on the river, whether it is in the dry or the flooding season. (Silva 2024, p. 81) (...) The city (hospital) is reserved for more delicate cases, to move from communities to the city requires a larger boat and even helicopters (Silva 2024, p. 86).*

A central element of this approach is the development of situational maps (Marin 2013), which integrate geographical data with ethnographic insights to vividly capture the lived experiences of these communities. The New Social Cartography of Amazonia has proved invaluable in examining the territorial dimensions of *Quilombola* identity (Farias Júnior 2025) and in uncovering social dynamics that are often missed by broad national surveys, precisely because they are highly localized and complex (Map 4.1).

*San José del Guaviare, Colombia*
*Photo by Christian Braga*

***Map 4.1:* Indigenous and Quilombola Territories in the BLA**




*Source: Prepared by the authors based on IBGE, Fundação Nacional dos Povos Indígenas (National Indigenous Peoples Foundation), Instituto Nacional de Pesquisas Espaciais (National Institute for Space Research), and the Instituto Nacional de Colonização e Reforma Agrária (National Institute of Colonization and Agrarian Reform).*
*Note: For more information, see the Appendix 1, Box A1: Maps, Data Sources and Geographical References.*

## Reducing Health Disparities in Urban Areas of Amazonia

Tackling health disparities in Amazonia requires coordinated, context-specific strategies that bridge rural and urban divides. Key priorities include strengthening primary care, closing infrastructure gaps, expanding the health workforce, and improving maternal and environmental health through community-based models and intercultural approaches. Sustained policy commitment and robust cross-sector collaboration are essential to achieving these goals.

Expanding preventive infrastructure, including access to clean water, improved sanitation and effective waste management, is especially critical in urban and peri-urban areas where high population density and informal settlements increase the risk of waterborne diseases, particularly among children (Ferreira et al. 2021, Naveca et al. 2019). Urban centers can further enhance their response by linking regional disease surveillance with rapid resource deployment.

For maximum effectiveness, health interventions need to be aligned with environmental, local and Indigenous governance structures. Cross-sector collaboration is vital to ensure that public health efforts are responsive to the region's unique social and environmental realities.

*Cobija, Bolivia*
*Photo by Christian Braga*

# INTEGRATED APPROACHES TO TERRITORIAL STEWARDSHIP

## Pathways for Sustainable Development

*Mariel Juárez Olvera, Luis Mora (IDB)*

Urban areas in Amazonia are uniquely positioned to lead the way in building resilience to climate and environmental challenges (see Chapter 3.2.iii). By embracing forward-thinking strategies, these cities can set new standards for sustainable development across the region.

Adaptation efforts across the region are increasingly driven by locally led initiatives, with subnational governments, civil society, Indigenous groups, the private sector and transnational networks all playing pivotal roles. This collaborative, multi-actor approach is essential for building resilient, inclusive and sustainable cities in Amazonia (Table 4.1).

***Table 4.1:* Urban-Led Climate Adaptation in Amazonia**

| Stakeholder | Role in adaptation | Urban example (2020-2025) | Type of contribution | Source |
|---|---|---|---|---|
| Subnational governments | Implement land-use plans and infrastructure | Integrated green urban planning and flood control measures through Trees in Cities Challenge in Barcarena, Brazil | Infrastructure | UN-Habitat Brazil 2023 |
| Local communities | Lead community-based plans | Development of local Youth Climate Plans in eight communities in the State of Pará, Brazil | Community-led plans | IDB Lab 2024 |
| Civil society and NGOs | Support participatory planning and advocacy; implement pilot actions | Community forest governance and reforestation efforts in Tefé, Brazil | Capacity-building | IIEB 2023 |
| Indigenous Peoples' organizations | Provide ecological stewardship | Indigenous Ticuna communities co-developed water management plans with local authorities in Puerto Nariño, Colombia | Co-design plans | SINCHI; UNDP Colombia 2024 |
| Private sector | Invest in resilient infrastructure and nature-based solutions | Public-private partnership for green corridors and stormwater management with local construction sector in Manaus, Brazil | Investment in infrastructure | ICLEI 2023 |
| Academia | Produce data, risk assessments and policy-relevant research | Vulnerability assessment tools (MVI) developed for Rio Branco and Cruzeiro do Sul at Universidade Federal do Acre | Scientific modeling and decision support | UFAC 2023 |
| Multilateral & donor agencies | Finance technical cooperations, knowledge and projects. | Support for nature-based solutions and flood risk management in Macapá, Brazil | Blended finance and technical support | GCF 2024 |
| Regional bodies | Coordinate regional strategies and intergovernmental programs | Water security program between Leticia, Colombia, and Tabatinga, Brazil | Cross-border coordination | OTCA 2024 |
| Urban networks | Support peer learning and technical guidance | Development of GHG inventories and adaptation strategies in Belém and Manaus | Technical capacity-building | ICLEI-LACS 2025 |
| Multi-stakeholder platforms | Enable collaborative governance and co-financing mechanisms. | Launch of the Amazon Cities Forum, a platform for local governments in Amazonia to promote sustainable and resilient urban development (45 cities from eight countries participating) | Regional cooperation | IDB 2023 |

*Source: Prepared by the authors.*

The spatial configuration of cities in Amazonia is a critical factor influencing their exposure to natural hazards, access to essential services and overall institutional capacity. To effectively address these challenges, vulnerability indicators must be both spatially and socially disaggregated. The Municipal Vulnerability Index in the state of Amazonas, Brazil, exemplifies this approach by integrating metrics such as temperature anomalies, rainfall variability, land degradation, public health, institutional capacity and infrastructure access (see Chapter 3.1.ii). The index provides essential data for urban planning and helps prioritize capital investments (Menezes et al. 2018). When combined with mapping of informal settlements, it enables the identification of high-risk areas — such as flood-prone neighborhoods lacking adequate drainage — allowing for targeted interventions (Brondizio et al. 2019).

**Technological advancements are further enhancing the effectiveness of monitoring, evaluation and learning frameworks in urban Amazonia** (Olazábal et al. 2019). Tools such as remote sensing, geospatial analysis and digital platforms — when paired with community-based monitoring — offer real-time, spatially detailed insights into the expansion of the urban footprint, deforestation, ecosystem degradation and social vulnerability. Cities like Manaus and Santarém are at the forefront of participatory mapping initiatives, merging satellite data with local knowledge to track informal settlements in flood-prone areas, find infrastructure gaps, and inform relocation and zoning decisions (SPA 2021).

Collaboration between neighboring cities is also gaining traction. For example, Leticia and Tabatinga have partnered to address shared water challenges, implementing community-based groundwater quality monitoring and joint decision-making to improve infrastructure (ACTO 2024). These partnerships underscore the importance of local leadership and cross-border cooperation in advancing sustainable urban development throughout Amazonia.

## Adaptation Pathways Approach

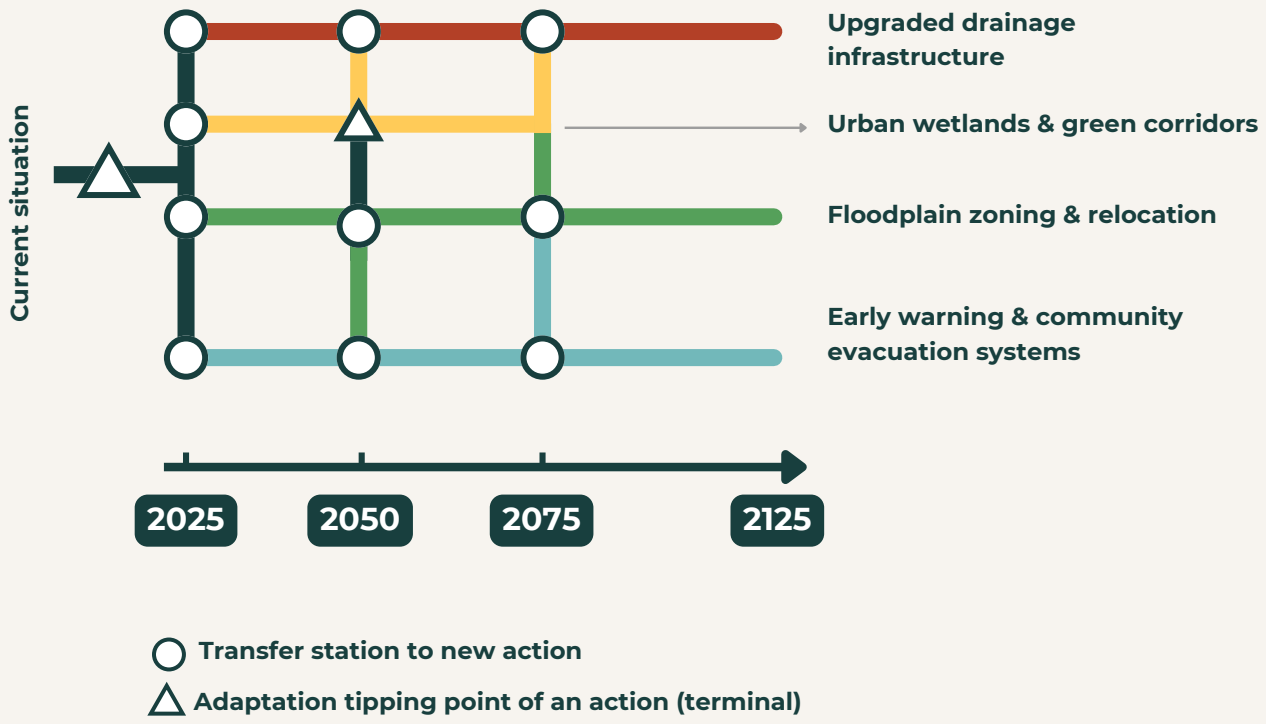
Urban areas can significantly strengthen their environmental strategies by implementing the Adaptation Pathways Approach. This forward-looking methodology guides cities through a series of milestones, enabling proactive and flexible responses to evolving climate risks. Key steps include: (i) defining adaptation tipping points linked to ecological indicators, such as peri-urban deforestation rates; (ii) sequencing immediate actions (e.g., urban tree planting) with medium- and long-term initiatives; (iii) integrating co-benefits; and (iv) establishing strong monitoring systems and adaptive governance structures (Werners et al. 2021).

For instance, consider an adaptation pathway designed to manage flood risk over a 100-year horizon (2025–2125) in a riverine urban area. The process begins with a baseline assessment in 2025, followed by a phased response as flood events intensify. The initial strategy remains effective until a tipping point is reached, at which time cities can

choose among several options: (i) investing in drainage infrastructure (red path) offers long-term protection, potentially lasting a century; (ii) restoring wetlands (orange path) may require a strategy shift around 2050 as conditions change; (iii) floodplain management and relocation (green path) offer extended resilience but may need adjustment before 2125 if risks escalate. Early warning systems (blue path) can be implemented alongside all other measures to enhance preparedness and response (Figure 4.1).

This approach empowers decision-makers to visualize options, anticipate when to act, and identify alternative strategies if conditions surpass the capacity of existing measures. Ultimately, it supports smarter investments and better coordination across short-, medium- and long-term urban policies.

*Figure 4.1:* ***Adaptation Pathways Approach***




*Source: Prepared by the authors, adapted from Deltares 2021.*

## *Box 4.3: Deforestation and Urban Growth*

***Nora Libertun de Duren, Paloma Martín (IDB)***

**The direct impact of urbanization on deforestation in Amazonia is still limited.** Despite a generally low-density settlement pattern, the total urban footprint across the region is relatively small. For instance, the total direct urban footprint of Amazonia covers only 0.2% of the region, while the 117 cities — home to approximately 50% of Amazonia's population — occupy just 0.1% of its land area.

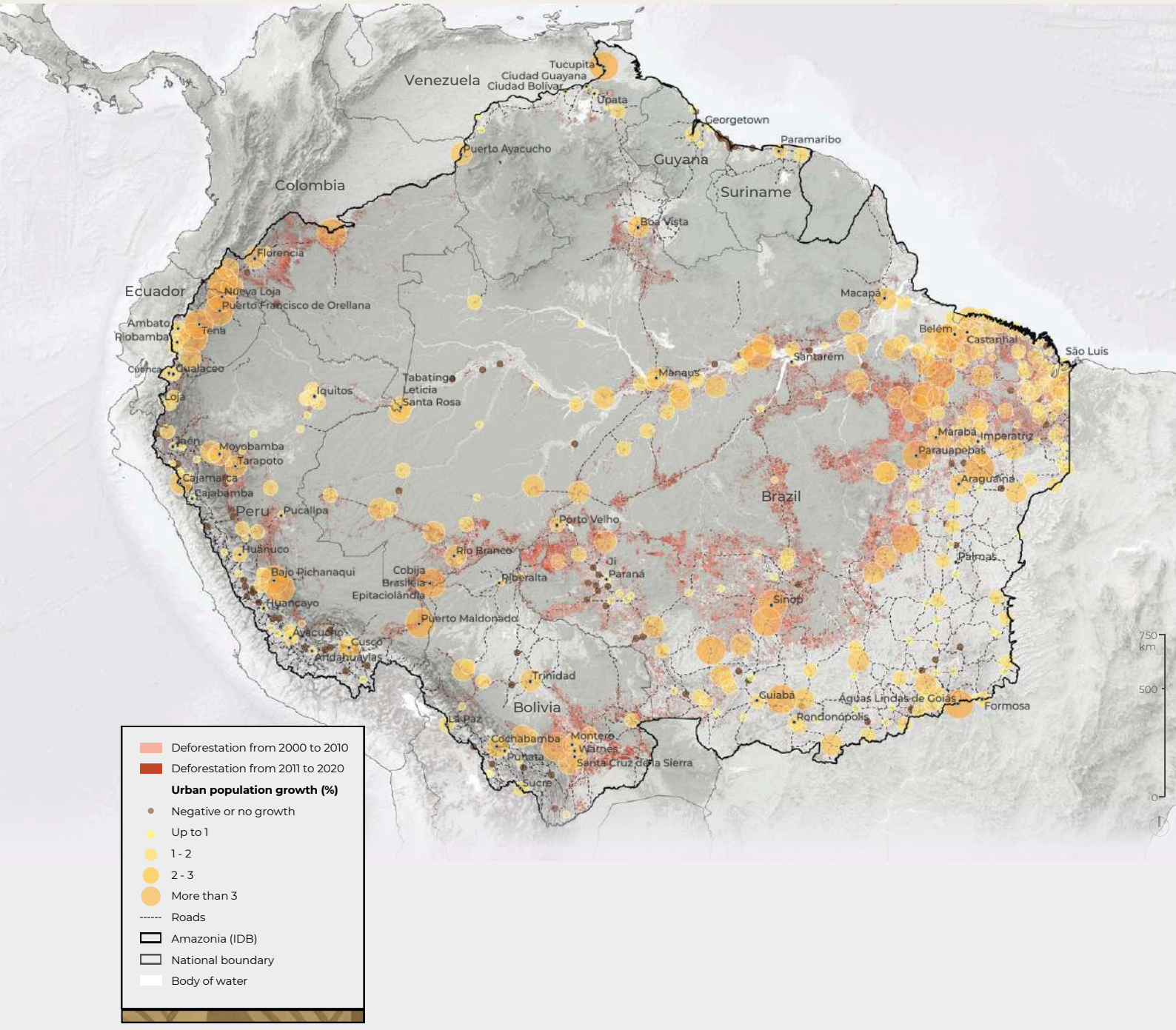
In terms of indirect impacts, growing evidence suggests that urban areas in Amazonia **often appear as byproducts of resource extraction activities rather than as primary drivers of deforestation** (Cabrera-Barona et al. 2023). However, the environmental outcomes of urban growth are shaped by a combination of governance quality, land use regulations, infrastructure planning and economic diversification (Hanusch 2023).

A recent study analyzing data from 490 municipalities in the Brazilian Legal Amazonia between 2002 and 2011 — a period of rapid economic growth and a marked reduction in deforestation under strong environmental policies — found that higher municipal GDP is significantly associated with a non-linear decline in deforestation, especially in middle- and high-income areas. Urbanization is identified as a key mechanism, as it is linked to a less forest-intensive economic structure. Conversely, higher levels of municipal poverty (see Chapter 3.3.i) are associated with increased rates of deforestation (De Barros and Baumgratz Chimeli 2025).

These findings underscore the importance of promoting inclusive urban development and sound governance alongside broader strategies to reduce deforestation and support sustainable futures in the region.

*San José del Guaviare, Colombia*
*Photo by Christian Braga*

## *Map 4.2:* ***Urban Population Growth and Deforestation, 2000-2020***




*Source: Prepared by Paloma Martín and María de los Ángeles Scetta based on the Global Human Settlement Layer (GHS-BUILT, GHS-POP, GHS-LAND version 2023) and RAISG 2022.*

## Expanding Access to Finance

The countries that make up Amazonia have established a robust legal framework for environmental action. The landmark Belém Declaration endorsed by all members of ACTO — Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela — reaffirms a collective commitment to rainforest conservation and social justice. It recognizes Indigenous rights and promotes integrated water and forest management, sustainable urban development and the creation of a new scientific panel to advance research on climate and biodiversity in Amazonia. Complementing these efforts, ACTO also coordinates the *Leticia Pact*, which prioritizes anti-deforestation action, biodiversity protection and the promotion of sustainable, inclusive economies.

To effectively complement these critical advancements across Amazonia, it is imperative to secure adequate financial resources for the implementation of adaptation initiatives. Recent innovations are paving the way for more inclusive and effective solutions. **The *Amazonia Bond Issuance Guidelines*, developed by the IDB, offer a pioneering framework for structuring sovereign, subnational and corporate bonds that channel resources toward both environmental and socio-economic priorities across the region (IDB 2024b).** In parallel, the *Amazonia Finance Network*, supported by IDB Invest, is expanding access to climate finance by fostering collaboration among public banks, private investors and municipal governments. This network has already financed pilot projects that promote inclusive and sustainable urban development, with a strong focus on gender equity, Indigenous participation and ecosystem-based adaptation (IDB Invest 2024). Additionally, platforms such as the Green Coalition for Amazonia are mobilizing blended finance and philanthropic capital to support scalable, nature-positive investments that embed adaptation co-benefits into local economies (Green Coalition 2024). These efforts are helping to unlock new sources of funding and drive innovative approaches to climate resilience.

An example of an innovative carbon credit initiative is Guyana's leadership in the region, leveraging its extensive forest cover — approximately 85% of the country — to generate revenue through forest protection and conservation (Smith et al., 2023). Under this system, companies buy carbon credits to offset their emissions, effectively paying Guyana for the carbon sequestered by its forests. Guided by its Low Carbon Development Strategy 2030, which outlines how the country can benefit from the climate services its forests provide (Government of Guyana, 2020), Guyana became the first nation in the world to receive jurisdictional forest carbon credits under the UN-backed Architecture for Reducing Emissions from Deforestation and Forest Degradation Transactions (ART – Archictecture for REDD+ Transactions) (UNFCCC 2021). In 2024, these credits were also the first globally to be certified as eligible for Phase I of the United Nations' Carbon Offsetting and Reduction Scheme for International Aviation (ICAO 2024). Total carbon credit sales are projected to reach approximately $750 million over the

2022–2032 period, with Guyana having received $234.5 million by the end of 2024 (REDD+ Secretariat 2024). These funds are being invested in development projects in the country's hinterland regions, including infrastructure such as drainage systems and solar power farms (Ministry of Natural Resources, Guyana 2024).

Collectively, these initiatives signal a shift toward locally driven, inclusive climate finance architectures.

## Rethinking Urban Futures: Pathways to Sustainable and Resilient Cities in Amazonia

Building sustainable and resilient urban futures in Amazonia demands a transformative approach to urban governance, finance and environmental stewardship. True resilience in the region must be anchored in partnerships that bridge local knowledge and leadership, scientific expertise and robust transnational collaboration. Safeguarding the rainforest and its communities is not only a moral responsibility, but also a strategic priority for achieving global sustainability and climate goals.

# Environmental Governance

*Marcela Ángel, Marco Herndon (MIT)*

Cities in Amazonia play a pivotal dual role: managing their own environmental impacts while indirectly supporting forest conservation by concentrating populations in urban areas (Fernández and Angel 2020). Fulfilling this responsibility requires integrated strategies that address the complex, interconnected challenges spanning urban–rural gradients (see Chapter 2.2.i). Achieving this challenge demands a paradigm shift in environmental governance across Amazonia's cities, driven by three key entry points: transformative environmental and land-use planning, biodiversity-driven development models, and robust multi-level governance (see Chapter 3.1.i). Together, these interlinked strategies can reposition the region's cities from drivers of environmental degradation to catalysts of socio-ecological transformation.

## Transformative Environmental and Land-Use Planning

Community-based conservation models have proved highly effective in preserving biodiversity. For instance, between 2006 and 2011 Indigenous territories in the Peruvian Amazonia achieved deforestation rates twice as low as other protected areas with similar ecological conditions and accessibility (Schleicher et al. 2017). More recently, Quilombola and *Maroon communities* in the Brazilian and Surinamese Amazonia have shown deforestation rates 55% lower than other protected areas (Sangat et al. 2025). These findings highlight the importance of curbing urban sprawl and safeguarding Indigenous lands as critical actions for conservation in Amazonia.

**Protective urban planning can further prevent deforestation. The use of buffer zones — where land use is partially restricted and small-scale agro-ecology initiatives are encouraged — has shown promise.** For example, federally protected conservation units in Manaus experienced almost no deforestation between 2018 and 2022 (Lopes and Tsuyuki 2024). Similarly, in Puyo, Ecuador, land-use change monitoring and forest inventories have helped find areas of low environmental value suitable for urban expansion (Huera-Lucero et al. 2020).

To support these efforts, municipalities must strengthen their capacity for data management and analysis, using tools such as machine learning, generative artificial intelligence and early warning systems. These technologies enable the identification at high resolution of risks — such as fire, flooding, and sea-level rise, — and aid targeted planning to address existing vulnerabilities (Mataveli et al. 2024).

## Biodiversity-Driven Development Models

Urban areas in Amazonia can foster the sustainable infrastructure needed for a high-value, innovation-driven bioeconomy (Nobre and Nobre 2020). Manaus, for example, has shown that a service-based urban economy can achieve lower deforestation rates than agricultural-based economic centers along Brazil's *Arc of Deforestation*, such as Porto Velho, where rural production is closely linked to forest loss (Hanusch 2023).

Strengthening urban economies in Amazonia should incorporate the concept of an Urban-Riverine Territorial System (Bartoli 2017), which recognizes the dynamic relationship between urban centers and surrounding rural areas. Research on Brazilian açai producers, for example, shows that *multi-sited households* support rural livelihoods while relying on cities for essential services (Padoch et al. 2008). This framework helps characterize cities as opportunity nodes for capital accumulation (e.g., Puyo, Trinidad, Iquitos, Leticia, Manaus, Belém) and service nodes for remote, primarily Indigenous populations (e.g., Coca, Rurrenabaque, Nauta, Tefé) (Hanusch 2023).

However, inadequate infrastructure remains a major challenge (see Chapter 3.1.ii). Addressing this requires integrated urban planning, technological innovation and participatory approaches. Brazil's "social technology" approach has improved access to clean water in small settlements through solar-powered groundwater pumps and community cisterns (Magalhães et al. 2024). Larger cities, meanwhile, require more sophisticated governance and infrastructure solutions. Moyobamba, Peru, offers a pioneering example: since 2009, its "payment for ecosystem services" model has funded upstream conservation through modest contributions by the residents, improving water quality, reducing treatment costs, and strengthening cross-sector coordination (Ministry of Environment, Peru 2020).

Waste management is another pressing issue, with most cities in Amazonia relying on open-air dumps. Strategic partnerships are essential for setting up sanitary landfills, as seen in Mitú, Colombia, where collaboration between the Ministry of Housing and the Association of Colombian Capitals made this possible. With about half of urban waste being organic, there are significant opportunities for composting facilities in peri-urban areas, which can be linked to urban agriculture programs to enhance food security (De Oliveira and De Medeiros 2020). Cities should also lead waste prevention initiatives and foster regional cooperation for recycling, while larger cities (with more than 100,000 residents) may consider energy recovery from waste (Rodrigues et al. 2024).

***Box 4.4: Circular Waste Management in Puerto Nariño, Colombia***

*Source: Puerto Nariño, October 2024. Photo: Marcela Ángel*

Puerto Nariño, Colombia's first municipality with a sustainable tourism certification, launched a seven-phase, $8.5 million waste management strategy in 2023. Its public utility, PUENAR, currently serves over 500 users with an integrated system that includes a sanitary landfill, recycling and composting. About 40% of waste — mainly organic — is managed through household composting and traditional agroforestry. In its first year, the town sorted 50,000 kilos of glass and 30,000 kilos of plastic, and composted 30,000 kilos of organic matter. Puerto Nariño has banned single-use plastics, imposed fines for improper waste disposal, and plans to expand recycling and diversify its energy sources. This model highlights how local, circular economic solutions can deliver environmental and socio-economic benefits.

Transportation networks in Amazonia face significant challenges, as traditional road construction often leads to negative impacts on forest conservation and ecosystem integrity. To address these complexities, a context-sensitive approach — combining highways, rivers and air routes — is essential. Colombia's Plan for Intermodal Sustainable Transportation in Amazonia exemplifies this strategy, with 121 community-driven projects that include port upgrades, zero-emission boats and air infrastructure (Ministry of Environment and Sustainable Development and Ministry of Transport, Colombia 2023). For such initiatives to be truly transformative, they must be part of a broader, interconnected metropolitan network that supports sustainable mobility and regional integration.

## Robust Multilevel Governance

National governments play a pivotal role in empowering municipalities to protect the environment. In 2023, Brazil introduced an innovative program that provides technical resources and financial incentives to Amazonia municipalities for reducing deforestation through a performance-based system (Ministry of Environment and Climate Change, Brazil 2023). Research institutions also contribute by

offering data and training, as seen in the Ciudades para la vida en la Amazonía program in Colombia, led by the Instituto Amazónico de Investigaciones Científicas, SINCHI (Guhl Samudio and Riaño Umbarila 2022), which helps address critical talent gaps among officials and community leaders.

**Effective governance in Amazonia also requires addressing the institutional and political barriers that often hinder progress on cooperative agreements. In this context, the meaningful participation of local communities is essential.** For instance, setting up specialized municipal units dedicated to Indigenous affairs — such as those modeled after successful experiences in La Paz, Bolivia (Horn 2018) — can provide vital intercultural support by facilitating access to employment, education, and communication for rural migrants (see Chapter 3.3.ii). Bogota's approach to public space planning, which includes mapping Indigenous sacred sites and implementing culturally sensitive design guidelines, illustrates how urban design codes and protocols can be adapted to respect cultural heritage (Bermúdez-Urdaneta et al. 2025). The principle of *el buen vivir* (*bom viver*), rooted in Andean-Amazonian Sumak Kawsay worldviews and enshrined in Ecuador's 2008 Constitution, further underscores the importance of circular economies and biodiversity preservation at the urban scale.

Indigenous organizations, such as the Coordinator of Indigenous Organizations of the Amazon Basin, have been instrumental in rainforest conservation through land titling efforts and advocacy. Ultimately, empowering local governments to become proactive stewards of regional sustainability requires more than decentralization; it demands sustained investments in capacity-building, co-governance and long-term partnerships.

## *Box 4.5: Multilevel and Regional Coordination in Amazonia*

**Fernanda Balbino (IDB)**

Several key initiatives supported by the IDB — *Amazonia Forever*, the Amazon *Cities Forum*, and the Amazonia Working Group of the Forum of Ministers and High-Level Authorities of Housing and Urban Development of Latin America and the Caribbean (*MINURVI*) — have been instrumental in strengthening multilevel coordination and fostering regional collaboration.

*Amazonia Forever* is the IDB's comprehensive regional coordination program dedicated to promoting sustainable and inclusive development across Amazonia. By partnering with public and private sectors, multilateral development banks, and non-governmental and civil society organizations, *Amazonia Forever* works to align efforts and resources for the long-term well-being of the region. It focuses on three core areas — expanding funding, enhancing knowledge exchange, and strengthening regional coordination among the eight IDB member countries of Amazonia.

*The Amazon Cities Forum* serves as a city-led regional cooperation platform, currently bringing together 44 local governments from all ACTO member countries. Its mission is to identify shared challenges and opportunities, foster knowledge exchange, and coordinate collective action in urban planning. Both the *Belém Declaration* and the Bogotá *Declaration* call for integrating the *Amazon Cities Forum* into ACTO to strengthen regional cooperation among local authorities. As part of its first biennial work plan, the forum has initiated thematic meetings among local leaders and their technical teams to deepen discussions on strategic topics. It also focuses on three main projects: (i) Experimenting Pathways: Pilot projects featuring an open-source tool that uses satellite imagery to map urban trees and support green planning. Cities receive technical assistance to analyze data and inform policies on urban growth, conservation and restoration of degraded areas; (ii) Strengthening CapaCities: A training and mentoring program to help selected cities develop resilience projects and secure resources; and (iii) Connecting Experiences: Sharing sustainable urban development practices across Amazonia to encourage peer learning and increase regional visibility.

[Learn more] (https://www.redus.org.br/foro-de-ciudades-amazonicas).

The *MINURVI Amazonia Working Group* is a platform launched in 2024, in partnership with the IDB and UN-Habitat, to advance a Strategic Framework for Sustainable Urban Development in Amazonia. The initiative brings together focal points from national ministries and expert knowledge partners across Amazonia to exchange knowledge, promote regional cooperation and analyze trends on urbanization, territorial planning, housing, and financing. These insights will guide policy recommendations aimed at integrating sustainability principles into urban development strategies across the region.

[Learn more] (https://plataformaurbana.cepal.org/en/minurvi).

## Cities as Catalysts for Sustainable Development and Biodiversity Conservation

Cities play a crucial role in managing population and economic growth, helping to reduce pressure on pristine forests and safeguard global ecological commons in Amazonia. Achieving sustainable urbanization in this region requires tailored approaches that reflect the diverse roles of different urban centers. While improving conditions in large cities is essential (Fajardo 2023), medium-sized cities act as strategic hubs connecting rural populations to services and markets, and smaller towns — often overlooked — play vital roles in supporting local, resource-based economies (Bartoli et al. 2017).

For international stakeholders and national governments, prioritizing sustainable urban development is essential — not only as a driver of regional prosperity, but as a cornerstone of effective conservation of biodiversity. To reposition Amazonia's cities as engines of biodiversity-based socio-economic development, policy initiatives should build on the legacy of conservation strategies — such as spatial conservation units, buffer zones and nature-based solutions.

Urban hubs and corridors can serve as foundations for circular bio-economies and regional well-being, while integrating Indigenous and traditional land-use practices into standardized urban planning frameworks. Fostering robust multilevel collaboration and leveraging the expertise of national scientific institutions will be critical for empowering cities to design and implement effective climate and environmental initiatives. By embracing these strategies, Amazonia's cities can become leaders in sustainable development, balancing urban growth with the protection of the rainforest and its invaluable biodiversity.

*Belém, Brazil*
*Photo by Christian Braga*

# Nature-Based Solutions

*María Irene Gauto Espinola, Duval Llaguno Ribadeneira (IDB)*

Nature-based solutions (NbS) are increasingly recognized as cost-effective and adaptive strategies for tackling the complex challenges of urbanization in ecologically sensitive and socioeconomically vulnerable regions such as the Amazonas river basin (see Chapter 3.2.iii) (WWF 2022). These are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits (UN Environment Assembly 2022).

## NbS 1: Increase the Water Absorption Ecosystem in Urban Areas

Rapid urbanization in floodplains, deforestation of riparian zones, and the proliferation of impermeable surfaces have significantly diminished the capacity of ecosystems in Amazonia to absorb and regulate water. Major cities such as Manaus, Iquitos and Belém are increasingly vulnerable to extreme flooding, a risk heightened by the disruption of the region's natural flood pulse — a seasonal hydrological rhythm essential to Amazonia's ecological balance (Fassoni-Andrade et al. 2021). This flood pulse is driven by rainfall patterns across the Andes and Amazonia lowlands. Each year, vast expanses of floodplain forests and wetlands — such as the fertile lowlands called *várzeas* — are submerged for months, followed by dry periods that allow for ecological regeneration. This cyclical flooding is crucial for nutrient distribution, fish migrations, forest productivity and sediment transport, making it a keystone ecological process (Junk et al. 1989). In cities like Manaus, water levels can rise by up to 10 meters during peak months, while in the Andean foothills, daily fluctuations of four to nine meters are common.

To address these challenges, nature-based solutions should focus on restoring riparian forests, coastal areas and wetlands, implementing bioswales, and increasing the use of permeable pavements to enhance natural water absorption. **In Amazonia, these efforts can be further strengthened by embracing *amphibian cities*. This approach not only mitigates flood risks but also ensures that urban development is harmonized with the region's unique hydrological and ecological cycles.**

### *Box 4.6: Amphibian Cities*

*Amphibian cities* are unique urban settlements in Amazonia situated within the flood-prone lowlands known as *várzeas*, where the region's seasonal hydrological cycles shape the rhythm of daily lives. Cities such as Anamã and Careiro da Várzea exemplify this model, experiencing regular submersion during annual floods that transform the urban landscape from dry land to submerged landscapes. In response, residents have pioneered innovative designs — ranging from floating and stilt-based architecture to flexible, water-based transportation and seasonal livelihoods — that enable communities to thrive amid these dynamic conditions.

These *amphibian cities* exemplify a profound symbiosis with Amazonia's natural rhythms, fully embracing the principles of nature-based solutions. Rather than resisting the forces of nature, their built environments and cultural practices are harmonized with the flood pulse, creating a form of urbanization that is ecologically integrated rather than disruptive. This unique socio-ecological adaptation not only enhances resilience to climate variability but also safeguards the ecological integrity of the floodplain. As such, *amphibian cities* offer a compelling blueprint for sustainable urban living in sensitive environments, proving how human settlements can thrive in harmony with nature (Lima 2024).


*Belém, Brazil*
*Photo by Christian Braga*

## NbS 2: Increase Evapotranspiration and Shade

Rapid urban expansion of urban areas over vegetated landscapes in Amazonia is intensifying urban heat islands (UHIs) and degrading local microclimates, placing vulnerable populations at greater risk of thermal stress. Research shows that a 10% increase in urban tree cover can lower local ambient temperatures by up to 3°C, underscoring the vital role of urban vegetation in mitigating heat (Elmqvist et al. 2013). In Belém, for example, significant increases in land surface temperature between 1986 and 2023 were most pronounced in central neighborhoods with the greatest vegetation loss and unregulated development (Raiol et al. 2024). Spatial analyses further confirm that these elevated surface temperatures are closely linked to reduced vegetation and increased impervious surfaces, which trap heat (Silva et al. 2021). In Ji-Paraná, the conversion of forests to urban land has increased daily temperature swings by about 2°C, altering humidity and rainfall patterns (Antonucci et al. 2025). These local effects are compounded by broader climate trends, as urbanization across Amazonia — such as in Porto Velho — continues to erode the natural climate-regulating functions of ecosystems (UNEP 2023).

Effective NbS strategies include urban reforestation, creation of pocket parks, installation of green roofs, and restoration of native vegetation. These interventions enhance shade and evapotranspiration, helping to cool urban environments and improve resilience for at-risk communities (UNEP 2023).

## NbS 3: Treat Wastewater from Informal Settlements

Many informal urban settlements discharge untreated domestic wastewater directly into rivers and streams, severely degrading aquatic ecosystems that are essential for drinking water, fisheries and cultural traditions in Amazonia (Anderson et al. 2022). In Belém, creeks running through densely populated suburbs are now unsuitable for human or ecological use, with high levels of heat-tolerant coliforms, depleted oxygen and a scarcity of fish larvae (Souza et al. 2016). In Araguaína, Brazil, monitoring of the Neblina stream has revealed significant contamination from both domestic and industrial sources (Saviato et al., 2022). Similarly, in the Ecuadorian Amazonia, 56% of urban wastewater is released untreated into rivers, with more pesticide runoff from agriculture further degrading water quality and aquatic biodiversity (Cabrera et al. 2023).

**NbS approaches such as community-based wetland systems offer practical solutions to reduce nutrient and microbial pollution in Amazonas river tributaries, particularly where formal infrastructure is lacking** (see Chapter 3.1.ii) (Cabrera et al. 2023). Protecting and restoring wetlands and riparian vegetation not only enhances water purification but also boosts the resilience of aquatic ecosystems (Anderson et al. 2022).

## NbS 4: Restore Biodiversity and Ecological Connectivity

Unregulated urban development in Amazonia — often driven by short-term economic or aesthetic goals

— has led to the fragmentation of vital forest habitats and riverine corridors, disrupting the migration routes of aquatic species and undermining ecological connectivity (WCS 2021). This fragmentation poses a significant threat to native biodiversity, especially in cities like Leticia, Manaus, and Belém, which are located at the intersection of critical hydrological and ecological zones (Fassoni-Andrade et al. 2021). The widespread use of non-native and potentially invasive plant species in urban landscapes further compounds this issue. For example, in Leticia, up to 83% of ornamental plants in public spaces originate from outside the Amazonia biome (Cárdenas López et al. 2004), while in Brazilian urban areas, only 14.1% of tree species are exclusive to Amazonia, despite 65.3% being native to Brazil (Vieira and Panagopoulos 2020). Prioritizing native species is essential — not only to provide habitat and food for local fauna, but also to bolster ecosystem resilience against climate extremes and invasive species.

Nature-based responses include restoring and preserving floodplain forests, removing small-scale barriers and installing fish passages adapted to the local hydrology to keep river connectivity and support aquatic biodiversity (Anderson et al. 2022). Urban planning should also prioritize the use of native Amazonia flora, as seen in Santarém and Tarapoto (Peru), where native species are promoted in urban parks (WWF Peru 2023).

## NbS 5: Safeguard Cultural-Ecological Connections

Territorial pressures and urban expansion are increasingly disconnecting communities from forested areas, resulting in the loss of ancestral knowledge, spiritual practices, and cultural identity (Rival et al. 2019). Traditional ecological knowledge is not only a vital cultural heritage but also a key resource for biodiversity conservation and sustainable resource management. For example, research with Tsimane' communities in the Bolivian Amazonia found a strong link between high levels of this knowledge and well-preserved forest landscapes, highlighting the essential role of Indigenous knowledge in maintaining ecological integrity (Paneque-Gálvez et al. 2018).

Indigenous practices such as swidden-fallow agroforestry and selective harvesting are closely aligned with nature-based solutions, promoting ecological regeneration and resilience. Co-designed green spaces that honor Indigenous cosmologies — such as *malocas* in the Colombian Amazonia or ritual gardens maintained by Huni Kuin families in peri-urban Rio Branco, Brazil — serve as important sites for storytelling, healing and ceremony, and should be recognized as cultural ecosystem services (Alves Carvalho 2021). Nature-based solutions can also drive inclusive green employment. For instance, the Xingu Seed Network [Learn more] (https://www.sementesdoxingu.org.br/what-is-the-xingu-seeds-network-and-who-are-we) in Brazil's Amazonia and Cerrado regions brings together over 600 seed collectors from more than 30 municipalities, supplying native seeds

for the restoration of over 7,000 hectares of degraded land.

This initiative has generated nearly $1 million in income ( 5.3 million reais) through the sale of over 250 tons of native seeds, supporting local livelihoods while advancing forest conservation.

## Advancing Nature-Based Solutions for Urban Resilience in Amazonia

Successfully scaling nature-based solutions across cities in Amazonia requires a multifaceted approach that combines innovative policy frameworks, institutional transformation, and inclusive governance (see Chapter 3.1.i). Municipal zoning regulations should be updated to mandate green infrastructure in new developments and protect ecologically sensitive areas.

These regulatory efforts must be supported by coordinated action among local governments, civil society, academic institutions and Indigenous communities — ensuring that diverse knowledge and perspectives shape urban planning.

Platforms like CitiesWithNature (https://citieswithnature.org/) and UrbanShift (https://es.shiftcities.org/) offer valuable opportunities for capacity building and knowledge exchange. Importantly, nature-based solutions must be recognized not only as ecological interventions but also as tools for social protection. By sustaining healthy ecosystems, these solutions support the livelihoods of vulnerable populations and can generate inclusive green jobs — especially for women, youth, and Indigenous peoples, whose ancestral knowledge is essential for sustainable stewardship of the land and water.

*Belém, Brazil*
*Photo by Christian Braga*

# SUSTAINABLE ECONOMIC GROWTH

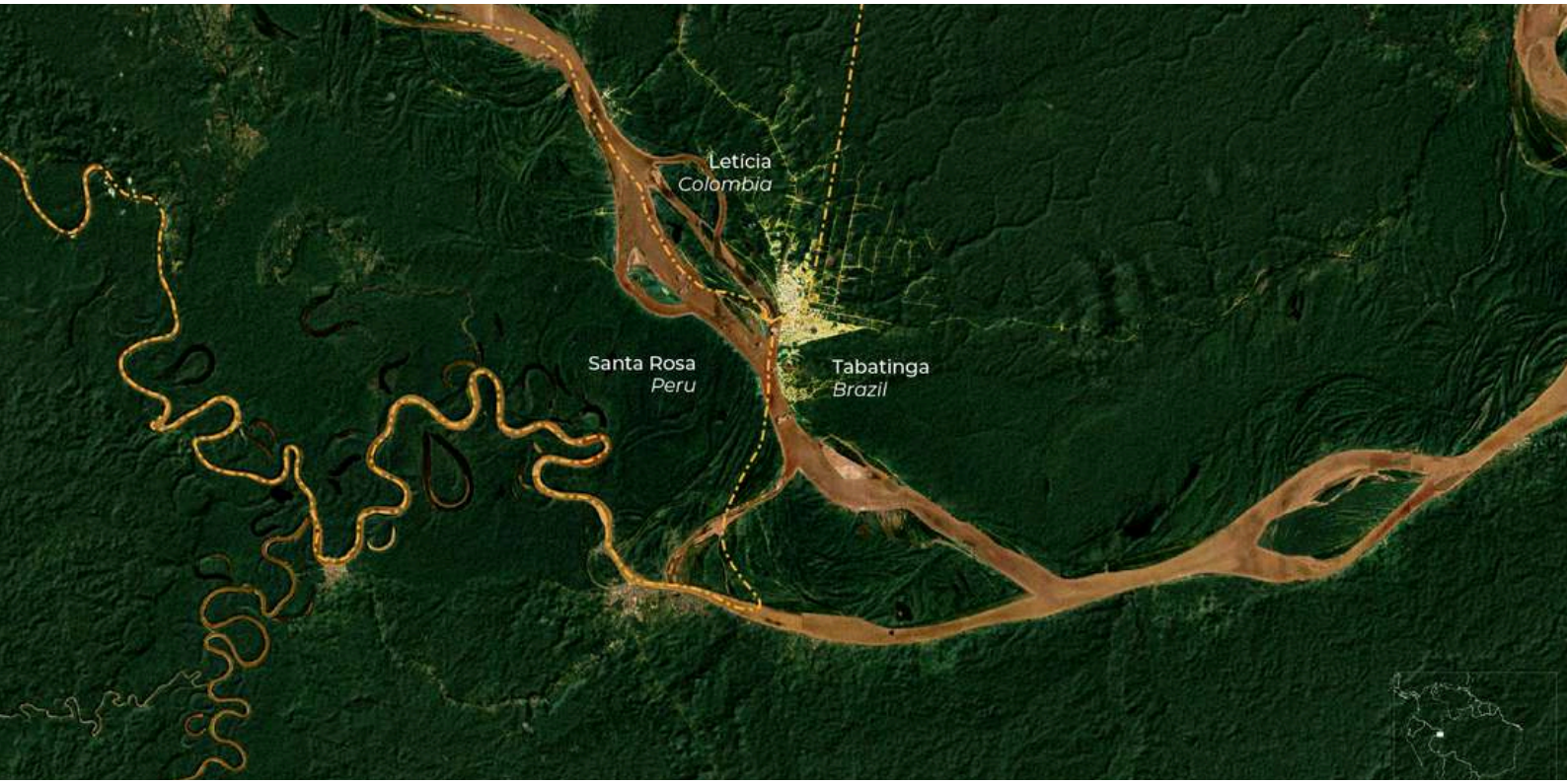
## Strategic Planning For Urban Areas in Border Regions

*Sebastián González Saldarriaga, Vanesa García Sánchez (IDB)*

The tri-border area where Brazil, Colombia, and Peru meet, at the confluence of the Amazonas and Putumayo rivers, is a dynamic zone marked by intense movement of goods and people. However, the urban areas in this region face persistent challenges due to weak institutional coordination, which undermines regional integration and perpetuates high informality in cross-border financial flows, whether from remittances, investments or criminal networks. Poverty rates remain high on both sides of the border (see Chapter 3.3.i), and access to basic services such as drinking water, sanitation, and electricity is limited (see Chapter 3.1.ii). The region's heavy reliance on river transportation increases its isolation, leaving *riverine communities* particularly vulnerable to water shortages and food insecurity.

Within this tri-border region is the binational city of Leticia-Tabatinga, divided between Colombia and Brazil. Leticia receives most of its agricultural products from Brazil and Peru, while its tourism sector generates employment in both cities. The constant cross-border movement of people and goods highlights a deep interdependence that calls for stronger institutional integration.

***Map 4.3:* Binational city of Leticia-Tabatinga, in the Colombia-Brazil-Peru Tri-Border Region**




*Source: Prepared by Gabriel Kozlowski based on Google (2015), ESRI, OSM (2025), Database of Global Administrative Areas (2022).*

## A Strategic Development Proposal

Despite these challenges, the Leticia-Tabatinga region holds significant potential for sustainable development and deeper regional integration. Trade already serves as a key driver of improved income and security in urban areas (see Chapter 3.1.ii), with robust demand in Leticia for food and construction materials from Brazil and Peru. On the Brazilian side, trade flows include food products, consumer goods, fuels, textiles and growing tourism activities—all contributing to local economic vitality.

**One of the most promising sectors is low-impact environmental tourism, which leverages the region's unique ecological assets while providing locally sourced services.** The sector benefits from existing infrastructure, such as the air bridge between Leticia and Bogotá and the air connection between Manaus and Tabatinga, which provide direct access to international markets.

There are also clear opportunities to streamline the export process. Simplifying the current approval procedures — which often require permits from distant state or national capitals — could reduce administrative burdens and open new paths for formal trade and entrepreneurship.

The region is well-positioned to become a model for cross-border cooperation in Amazonia. By formalizing existing informal exchanges through a harmonized legal framework, the area could lower transaction costs, reduce incentives for illegality (see Chapter 3.1.iii) and enable the freer movement of goods, people, labor and capital (see Chapter 3.3.ii). Such reforms boost local livelihoods and demonstrate that sustainable, inclusive development in Amazonia is both necessary and entirely achievable.

### *Box 4.7: IDB's Strategy for Productive Development in Border Regions*

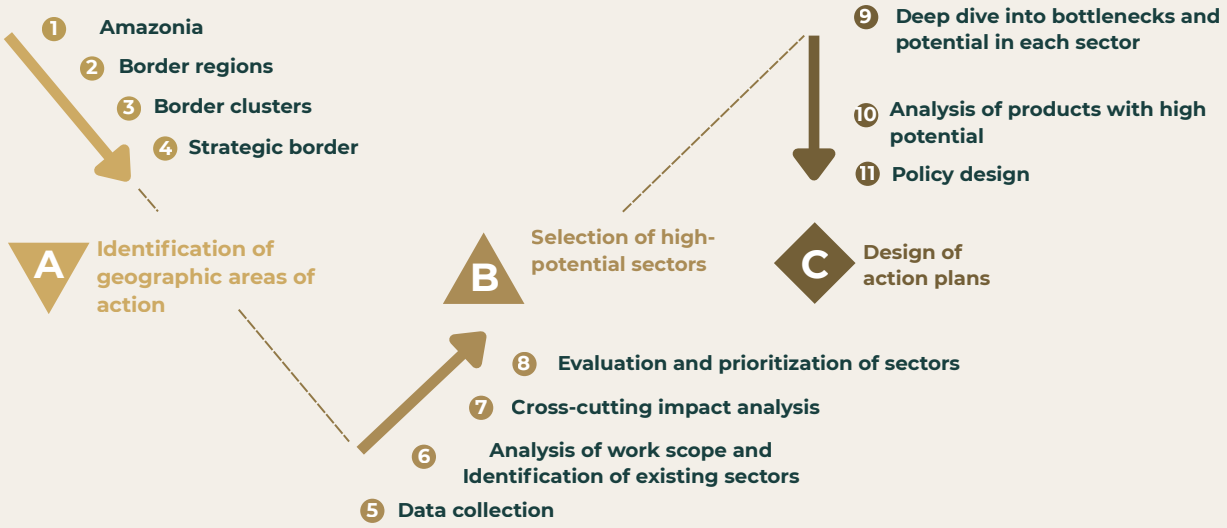
The IDB's strategy for fostering productive development in border regions in Amazonia is organized into three distinct phases (IDB 2023b):

**Phase A: Identification of Tri-Border Clusters**
This phase involves a comprehensive analysis of the region's physical, human, and economic geography. Clusters are identified and prioritized based on criteria such as strategic commercial positioning, ecosystem diversity and the richness of natural capital. The three key tri-border clusters identified are: Brazil-Colombia-Peru Brazil-Bolivia-Peru, and Brazil-Guyana-Venezuela.

**Phase B: Selection of High-Potential Productive Sectors**
After prioritizing the geographic focus areas, this phase uses fieldwork to identify productive sectors within each cluster that offer the greatest potential for economic growth, regional integration, environmental sustainability and job creation. The goal is to pinpoint sectors that can drive inclusive and sustainable development.

**Phase C: Development of Sustainable Action Plans**

In this final phase, specific opportunities are found in products and services with strong potential to deliver economic, social and environmental benefits. Tailored programs are then designed to support local communities and producers, fostering a holistic and sustainable development approach within each cluster.





*Leticia, Colombia*
*Photo by Christian Braga*

# Economic Prosperity With Environmental Preservation

*Timothy Cheston (Harvard University)*

Research from the Growth Lab at Harvard University[25] makes it clear: **economic prosperity in Amazonia does not have to come at the expense of the rainforest.** The widely held belief that economic growth and rainforest protection are mutually exclusive is a false dichotomy. This conclusion is supported by studies examining economic development in four departments in Amazonia — Loreto in Peru, and Caquetá, Guaviare and Putumayo in Colombia (Bustos and Cheston 2022; Cheston and Rueda-Sanz 2023). These studies reveal that the factors that drive prosperity and deforestation are distinct and often occur in different locations. While deforestation is concentrated at the agricultural frontier — one of the world's most biologically diverse regions — the real potential for large-scale economic growth lies in urban centers, far from the forest edge. Many areas in Amazonia are caught in a lose-lose cycle of low prosperity and high deforestation. Alarmingly, the recent surge in deforestation, often linked to the construction of secondary roads, has not resulted in greater economic growth. Rather than providing solutions to the region's economic challenges, it deepens them.

**A key factor behind Amazonia's low prosperity is the lack of thriving urban centers.** Surprisingly, the majority of people in the four regions studied live in urban areas — even in the most remote parts of Amazonia (see Chapter 2.1.iii). This underscores the need to strengthen local productive capacities, diversify urban economies, and foster more complex economic activities (Hausmann et al. 2014). Yet, most private philanthropy and multilateral donor funding is directed toward the most remote forest edges, often neglecting the basic needs and development potential of the region's cities (see Chapter 3.2.iii).

## Overcoming Remoteness: The Critical Role of Connectivity

Cities in Amazonia are also hindered by a connectivity trap. Their remoteness and lack of efficient links to external markets severely limit economic complexity and investment (see Chapter 2.2.ii).[26] This remoteness restricts the ability of cities to attract new investment and diversify their economy and simultaneously undermines the profitability of agro-industrial and agroforestry processing, especially for perishable goods. Transport costs from major Amazonia cities to other urban centers within the same country are two to nine times higher than those from non-Amazonia regions. For example, in Guaviare, the cost to reach a port is more than double the national average, and in Putumayo and Caquetá, it is about 50 percent higher. Many roads are single lane,

[25] This brief is based on Cheston and Rueda-Sanz 2023. The Economic Tale of Two Amazons: Lessons in Generating Shared Prosperity while Protecting the Forest in the Peruvian and Colombian Amazonia. Center for International Development at Harvard University. CID Working Paper No. 145. Available at: https://growthlab.hks.harvard.edu/publications/economic-tale-two-amazons. The brief also includes references to the series of research papers on the Colombian Amazonia and the Peruvian Amazonia by the Growth Lab teams cited in the reference section.

[26] Economic complexity refers to a region's ability to produce a wide and sophisticated variety of goods and services, resulting from local knowledge and capabilities. This theory has shown that places with greater complexity tend to have higher incomes and better prospects for future growth.

making them vulnerable to disruptions that add to further costs and uncertainty. Iquitos, in Peru's Loreto department, is a striking example of isolation: Accessible only by river or air, it is one of the world's largest cities without road access. The nearest Peruvian city, Yurimaguas, is 400 kilometers away and requires a three- to four-day boat journey. This extreme isolation limits production to local demand, as the time and cost of exporting goods from Iquitos make access to external markets unfeasible. Such distances and travel times are a major barrier to competitiveness across Amazonia.

Unlocking shared prosperity in Amazonia depends on improving connectivity and expanding economic opportunities in its cities. The ability of a city to export goods and services is a fundamental driver of economic prosperity (Hausmann and Klinger 2007). Yet cities in Amazonia export very little, and their economies are heavily reliant on public administration and retail trade — more so than in other regions. In Colombia, the Amazonia departments of Guaviare, Putumayo and Caquetá rank among the lowest in economic complexity, further limiting their ability to import essential goods and inputs for more advanced industries. Expanding exports and improving connectivity are therefore critical coordination challenges for the region.

### *Box 4.8: Urban Rehabilitation Program in Paramaribo, Suriname*

**Manuela Palacio Giraldo (IDB)**

The Paramaribo World Heritage Site in Suriname embodies a unique blend of European and Indigenous cultures, shaped by the Caribbean's diversity, its connection to the Amazon biome and its historic role as a global crossroads.

To safeguard and revitalize this heritage, the IDB launched the Paramaribo Urban Rehabilitation Program, which promotes cultural preservation as a foundation for inclusive, sustainable urban development. Key initiatives include the restoration of at least 10 historic buildings (five already completed), the redevelopment of 10,000 square meters of public waterfront space, and the planned upgrade of two key street corridors. These efforts are supported by, a new parking policy, the creation of spaces to provide a sense of place and community, and strategies to enhance walkability, attract diverse uses and promote local cultural identity. The program also includes the upgrade of a 220-meter flood protection wall and the afforestation of mangroves, alongside measures to strengthen institutional capacity through improved planning tools, governance structures and financing mechanisms.

The program is backed by two IDB loans totaling $50 million. The first phase was approved in 2017 with the Ministry of Finance and Planning as borrower and the Ministry of Education, Science and Culture as executing agency. In 2023, the European Union contributed a 2.8 million euro grant to support adaptation to flood and sea-level rise. The second phase followed in 2024, expanding revitalization efforts and reinforcing institutional sustainability. The program is expected to conclude in 2029.

*Paramaribo, Suriname*

## Unlocking Prosperity in Amazonia

One promising example is Peru's Executive Roundtables (Mesas Ejecutivas), a government initiative launched in 2016 to enhance sectoral competitiveness through public-private dialogue and streamlined bureaucracy. These roundtables have brought together government, industry and civil society to find and remove barriers in key sectors such as forestry, aquaculture and mining, resulting in faster permitting, increased exports and greater private investment (Ghezzi, 2019). Regions in Amazonia could benefit from similar institutions — such as an Amazonia Roundtable — to coordinate public-private efforts and advocate for improved urban connectivity. Just as ProColombia and ProInversión in Peru work to attract investment, an Amazonia Roundtable could help local governments draw investors to cities in the region. Achieving shared prosperity will require not only better public services in cities, but also stronger connections with other urban centers both within and beyond national borders.

A clear framework for environmental protection and urban development would enable a strategic approach, prioritizing vital connections for cities while preventing unchecked road expansion in forested areas.

Ultimately, cities are Amazonia's most underutilized asset for economic prosperity. A new social pact is needed to shift from the current extractive model (see Chapter 2.1.ii) to one that leverages the productive potential of urban areas. An effective strategy should span three opportunity zones: (i) urban centers — such as Florencia, Iquitos, San Jose del Guaviare, Puerto Asis and Mocoa — through tourism, transport, professional services and agricultural processing; (ii) non-forest rural areas, with more intensive crops and sustainable agroforestry; and (iii) forest areas, focusing on ecotourism, carbon markets for reforestation and forest protection services. Fostering complex urban production is central to creating shared prosperity in Amazonia, with the added benefit of safeguarding the rainforest for future generations.

# 5 Navigating Paradoxes and Charting Sustainable Futures in Amazonia

# NAVIGATING PARADOXES AND CHARTING SUSTAINABLE FUTURES IN URBAN AMAZONIA

*Nora Libertun de Duren (IDB)*

Through this volume, we have gained a deeper understanding of the urban areas of Amazonia, revealing that the region's current urbanization is the result of centuries of layered historical, political, and economic processes. These forces have produced a fragmented and uneven urban system. Indigenous peoples have shaped Amazonia for over 13,000 years, developing extensive networks of roads and settlements — evidence of complex, large-scale societies that coexisted with the forest. **More recent transformations, such as the *rubber boom*, highway expansion and national development plans, have triggered waves of urban growth, often at significant environmental and social cost.** Today, more than 895 urban areas exist across the region, many created in the last 50 years. While most urban growth is still low-density, there is a gradual shift toward more compact development, offering new opportunities for sustainability.

This evolving landscape operates within an urban-nature continuum, where cities and forest communities are economically and territorially interdependent. Amazonia's hybrid urban areas integrate formal and informal economies, with Indigenous and Afro-descendant populations at the core. Migration to cities — driven by both opportunity and environmental pressures — has created a distinctive urban expression, shaped by the interplay of local traditions and national and global influences. Despite this richness, most cities in Amazonia remain remote from national and international markets, limiting access to economic opportunities, goods and services. Connectivity, whether via roads, rivers, air routes or digital infrastructure, is uneven and often unreliable. Poor road quality is closely linked to deforestation, climate variability reduces river navigability, and digital access is still limited in many areas. These structural constraints continue to hinder regional integration and economic development.

Urban areas across Amazonia face persistent governance and service delivery challenges that limit their ability to meet residents' growing expectations, worsened by regional fragmentation. Most local governments rely heavily on central transfers and lack the technical and financial resources to manage rapid urbanization, despite having clear legal mandates. This results in unplanned growth and high levels of informality. Infrastructure deficits are severe: fewer than 25% of residents have reliable access to potable water, and many cities lack basic sewage and waste collection services. Waste is often dumped in open pits or drainage channels, posing serious health and environmental risks. A weak institutional presence also allows criminal networks to assert territorial control, with limited police coverage and some municipalities reporting homicide rates well above national and global averages.

**Public services often fall short of addressing Amazonia's urban-nature hybridity, which demands tailored, context-specific delivery.** Urban health centers often serve as referral points for remote and Indigenous populations, especially in severe maternal and neonatal cases, while climate-sensitive diseases and gaps in facilities further strain health systems. Educational access remains limited, particularly at the upper secondary level, where over 80% of school-age youth in more than 700 localities live far from schools — contributing to high dropout rates and reduced human capital. The proximity to natural ecosystems also increases vulnerability to climate hazards such as extreme heat, prolonged droughts, and both fluvial and pluvial flooding. These impacts disproportionately affect marginalized communities and those who depend on rivers for connectivity and food security. Meanwhile, rapid urban population growth without adequate services has led to increased pollution of rivers and soil, threatening ecosystems and contaminating water sources.

**These systemic weaknesses are intensified by the geographical remoteness of many urban centers, which increases the cost-of-providing services and delays development.** Nearly 48.5 million people in the region continue to live in poverty (IDB 2025). Over the past decade, urban poverty has declined only slightly — from 35% to 32% — and is significantly higher than in urban areas (27%) outside Amazonia. Labor markets have high levels of informality and economic vulnerability. In Colombia's Amazonia capitals, for instance, informal employment is as high a 55%. Similarly, wage levels in Amazonia cities across Bolivia, Colombia, Ecuador and Peru are consistently lower than in urban areas in other parts of their countries.

Despite these challenges, Amazonia's cities are emerging as hubs of innovation, offering valuable lessons for advancing a new model of urbanization. In places where local governments have tailored services to fit local realities, leveraging new technologies and participatory approaches, meaningful improvements have followed. For example, the Guacamaya Project, a binational artificial intelligence initiative between Colombia and Peru, uses satellite imagery and predictive algorithms to identify high-risk zones for deforestation, illegal mining, and drug trafficking. Brazil's *Floating Primary Health Centers* and telemedicine programs are expanding healthcare access for remote and riverine populations, showcasing scalable models suited to local geographies.

Cities like Manaus and Santarém are pioneering innovative tools to manage climate risks and environmental pressures. Participatory mapping and remote sensing are being used to tackle flood risks and the growth of informal settlements. Manaus's implementation of buffer zones helped achieve near-zero deforestation between 2018 and 2022. Locally rooted infrastructure solutions, such as Brazil's social technologies for clean water access, show how low-cost technologies can effectively deliver essential services. Nature-based solutions are also gaining traction as cost-effective, adaptive strategies that combine traditional ecological knowledge with modern urban needs. Drawing on traditional

amphibian city models, which align urban design with seasonal hydrological cycles, initiatives like wetland-based wastewater treatment and urban reforestation help control flooding, reduce pollution, and mitigate urban heat islands.

These innovations are increasingly supported by emerging financing tools and political commitments — such as those outlined in the *Belém Declaration*, which signal growing regional leadership. Institutional coordination is also gaining traction through platforms like the *Amazon Cities Forum*, enabling knowledge exchange, stronger governance frameworks and shared agendas for sustainable urban development. Complementing these efforts, the work carried out by institutions such as the RAISG and the IDB through the AmazoniaForever360+ platform is highly valuable for ensuring comprehensive territorial intelligence that supports evidence-based collaboration across the entire region.

**Local and international actors are aligning efforts to enhance prosperity in Amazonia's cities, recognizing that thriving urban centers are key to improving livelihoods, reducing the influence of illicit economies and protecting environmental integrity.** Economic development and rainforest conservation are not mutually exclusive; investing in cities is the most effective strategy to achieve both. Unlocking Amazonia's potential will require expanding urban productive capacity, improving transport and digital connectivity, and fostering complex industries. These steps are critical for driving inclusive, sustainable growth while safeguarding Amazonia's ecological and cultural wealth for future generations.

## What Remains Unknown

In crafting this volume, critical knowledge gaps are still present, gaps that constrain effective policymaking and long-term planning. While urbanization in Amazonia is advancing rapidly, the social, economic and environmental dynamics it generates are still not fully understood. Better insight into these uncertainties is essential for designing more responsive, equitable and sustainable interventions. Key areas include:

**Land tenure and property rights:** Unclear and often informal or illegal land appropriation continues to drive the growth of informal settlements and complicated urban planning. As cities expand, conflicts over land use involving Indigenous territories and conservation areas are likely to intensify. Meanwhile, the policy tools and governance mechanisms to manage these overlapping claims are still weak and fragmented. More robust data and research are needed to support effective land governance, prevent displacement and avoid environmental degradation.

**Migration:** This is one of the most important yet understudied dynamics reshaping the region. Rural-to-urban migration is transforming Amazonia, but it is still unclear whether younger generations will keep ties with rural territories or sever them. These shifts could profoundly alter the hybrid urban–rural systems that currently define cities in Amazonia. Meanwhile, international migration to and within the region is growing, yet its effects on urban culture, labor markets, service delivery and demographic composition are poorly understood.

**Data and evaluation:** There is an urgent need to improve data collection and develop robust frameworks to scale and evaluate successful innovations. While numerous initiatives — such as AI-driven environmental monitoring or mobile health services — show promise, the lack of comprehensive, reliable data at subnational and remote levels severely limits the ability to measure impact, adapt interventions and guide evidence-based policymaking. Strengthening data systems is essential for tracking progress, informing adaptive strategies, improving local governance and urban planning capabilities, and supporting informed, effective decisions that respond to Amazonia's complex urban realities.

## Looking Forward: Toward Sustainable Urban Futures in Amazonia

Addressing these knowledge gaps is essential as we look ahead to the future of urban development in Amazonia, a future marked by profound and interconnected tensions. These are not simple tradeoffs, but paradoxes that demand thoughtful, context-sensitive, and inclusive policy approaches. Balancing economic growth with environmental protection, local needs with global priorities, and traditional ways of life with modern urbanization patterns will define the path forward.

**One of the most pressing paradoxes lies in improving connectivity without sacrificing conservation.** Road and transport links are vital to integrating cities in Amazonia into national and global markets, reducing isolation and unlocking economic opportunities. Yet expanding these networks often accelerates deforestation, fragments habitats and encourages unregulated land uses and land speculation, threatening the region's ecological balance. To navigate this tension, policies must promote multimodal transport strategies that carefully balance access and mobility with stringent conservation goals. This requires integrated land-use planning that protects ecological corridors and prevents harmful expansion.

**At the heart of governance lies another paradox: the clash between local and global interests.** Amazonia's urban areas exist within a complex web of overlapping authorities — local, regional, national and international. While local governments are tasked with meeting immediate community needs, they often lack the resources for long-term planning or urgent response. Indigenous and traditional governance systems, critical for territorial stewardship, frequently remain marginalized in political decision-making. Meanwhile, national and global actors may prioritize global ecological outcomes, sometimes overlooking the economic prosperity and well-being of local communities. This disconnect is compounded by fragmented institutional structures that rarely align with the region's geographic and social realities. Effective urban policy must strengthen local governance capacities, integrate plural governance models that empower all residents, and foster meaningful collaboration across all levels of government to harmonize conservation with development.

Adding further complexity is the paradox between traditional and modern modes of urbanization. Amazonia's cities embody a unique hybridity, a blend of nature and urban life reflected in cultural traditions, architectural styles and growth patterns. This hybridity offers valuable lessons in harmonizing built and natural environments to create cities that respect and incorporate their ecological surroundings. Yet it remains uncertain how this distinct form of urbanization can support the dense, large-scale urban patterns typically linked to economies of urban agglomeration and prosperity. Urban development models must honor local identities and cultural heritage while promoting efficient, sustainable growth. Service delivery and infrastructure must be tailored to meet the needs of both concentrated urban populations and dispersed rural or Indigenous communities, preventing urban expansion from becoming a source of pollution or ecological harm. Furthermore, to fully take part in the global economy, residents must gain broader education and access to diverse economic opportunities beyond traditional and extractive industries.

Ultimately, the future of urbanization in Amazonia hinges on embracing these paradoxes through collaboration and shared commitment. It demands a fundamental shift from fragmented, reactive, short-term responses to strategic, integrated, long-term planning that acknowledges and embraces the region's complex realities. This transformation can be realized only through genuine partnerships uniting diverse stakeholders — Indigenous peoples and traditional communities, governments at all levels, civil society organizations, academia, the private sector, and multilateral institutions. Each has a vital role in co-creating context-sensitive and effective solutions.

**Approached with humility, transparency and mutual respect, Amazonia can become a global model of sustainable urban development — showing how cities can thrive in harmony with nature while supporting vibrant communities.** The choices made today will resonate for generations, shaping a future where the region's unique cultural and ecological heritage is preserved and its people flourish.

*Puerto Maldonado, Peru*
*Photo by Christian Braga*

# GLOSSARY OF URBAN AMAZONIA

**Arc of Deforestation:** Refers to the westward encroachment of deforestation in the eastern half of Amazonia, from Macapa in the north to Porto Velho and Cobija. Forest areas at risk of disturbance are those where current tree cover is near deforested areas, making them vulnerable to deforestation.

**Açaí:** A small, dark purple fruit native to the Amazonia rainforest, widely consumed for its nutritional value and often used in juices, smoothies and bowls.

**Aldeia:** Portuguese word for village. In the Indigenous context of Brazil, it refers to a community rooted in cultural continuity, spiritual meaning, and a deep connection to nature.

**Amazonia Bond Issuance Guidelines:** A set of standards and best practices designed to guide the issuance of bonds that finance sustainable development projects in Amazonia. These guidelines aim to ensure transparency, environmental integrity, and social responsibility in raising capital for Amazonia-related initiatives.

**Amazon Cities Forum:** A dynamic regional cooperation platform, currently bringing together 40 local governments from all Amazon Cooperation Treaty Organization member countries.

[Learn more] (https://www.iadb.org/en/news/amazon-cities-forum-launched-idb-support).

**Amazonia Finance Network:** A collaborative platform or network of financial institutions, investors, and stakeholders focused on mobilizing and coordinating financial resources for sustainable development and conservation efforts in the region.

[Learn more] (https://www.idbinvest.org/en/news-media/idb-invest-and-ifc-launch-amazonia-finance-network).

**Amazonia Forever:** A regional coordination program for sustainable and inclusive development that collaborates with the public and private sectors, multilateral development banks, and non-governmental and civil society organizations for Amazonia.

[Learn more] (https://www.iadb.org/en/who-we-are/topics/amazonia).

**Amphibian cities:** Urban centers where land and water are equally central to spatial organization and daily life. Rivers serve as vital connectors, integrating urban infrastructure with aquatic ecosystems to form an adaptive socio-spatial system.

**Belém Declaration:** A joint statement issued in 2023 by the Amazonas basin countries during a summit in Belém, Brazil, outlining commitments to protect the rainforest, promote sustainable development and strengthen regional cooperation against deforestation.

[Learn more] (https://otca.org/en/wp-content/uploads/2023/10/Declaration-of-Belem.pdf).

**Bogotá Declaration:** A joint statement to strengthen the common agenda of the eight countries that share Amazonia and chart a course toward the COP30 Climate Change Conference, to be held in November 2025 in Belém. The agreement establishes commitments to curb deforestation, strengthen regional cooperation and guarantee stable financing for the protection of tropical forests.

**Brazilian Legal Amazonia:** An administrative region established in 1953 that covers 60% of Brazil's national territory and 59% of the IDB designated working area of Amazonia.

**Caboclo:** A person of mixed Indigenous Brazilian and European ancestry, or, less commonly, a Indigenous person living outside an indigenous area.

**Dendritic urban network:** An urbanization pattern that follows the Amazonas river and its tributaries, concentrating human settlements and economic activity along these waterways.

**Ecological isolation:** A form of reproductive isolation where different species or populations live in distinct habitats within the same area, reducing the likelihood of interbreeding due to their separation by ecological factors.

**Encantados:** Spiritual beings linked to rivers, forests and other natural elements present in indigenous cosmologies. They often appear as animals, people or natural forces, embodying the spiritual dimension between the human and non-human worlds.

**Extended urbanization:** The process by which urban characteristics and influences spread beyond traditional city boundaries into rural and forested areas, creating complex urban-rural interfaces.

**Floating Primary Health Centers:** Mobile healthcare units, typically boats or barges, equipped to provide primary health services to remote and *riverine communities* in Amazonia, improving access to medical care where traditional infrastructure is lacking.

**Geoglyphs:** Large earth structures with geometric shapes, often connected by intricate road networks, created by ancient peoples in Amazonia.

**Guaraná:** A climbing plant native to Amazonia, known for its caffeine-rich seeds used in beverages and energy products.

**Jabuticaba:** A fruit-bearing tree native to Brazil, producing small, dark purple fruits that grow directly on its trunk and branches, commonly used in jellies and wines.

**Jenipapo:** A fruit native to Amazonia. Its pulp produces a dark bluish-black dye traditionally used by many Indigenous peoples for body painting. The color is associated with protection, ceremony, and cultural identity.

**Leticia Pact:** An agreement signed in 2019 by several Amazonia countries in Leticia, Colombia, to coordinate efforts in combating deforestation, protecting biodiversity and promoting sustainable development in the Amazonia rainforest.

[Learn more] (https://otca.org/en/leticia-pact-amazon-countries-support-the-strengthening-of-acto/).

**Malocas:** Large communal houses traditionally built by indigenous peoples of Amazonia, serving as centers for social, cultural, and spiritual activities.

**Manioc:** Also known as cassava, a starchy root vegetable native to South America, widely used as a staple food in Amazonia.

**Maroon communities:** These communities were formed in remote, often forested or mountainous areas. They have a strong cultural identity, often blending African, Indigenous, and local influences. They played a crucial role in resisting slavery and in shaping the social and cultural landscape of the regions where they settled.

**MINURVI Amazonia Working Group:** Ministers of Housing and Urban Development of Latin America and the Caribbean Working Group. This initiative guides national and subnational urban policies toward greater sustainability and resilience.

**Multi-sited households:** Families that circulate between forest and city, sharing dwellings and livelihoods, a trend driving the rapid growth of small urban areas across Amazonia.

**Paxiúba palm:** A species of palm native to Amazonia, valued for its strong wood and used in construction and crafts.

**Pistoleiros:** This refers to gunmen or hired shooters, often associated with criminal activities or enforcement in rural or frontier areas.

**Quilombola:** Descendants of Afro-Brazilian slaves who established independent Indigenous communities (quilombos) in remote areas, often recognized for their unique cultural and social practices.

**Ramais:** Unofficial or secondary roads, typically unpaved, that branch off from main roads and are often used for local access in rural or forested regions.

**Reticular urban network:** A network of intersecting roads or pathways that form a mesh-like grid, enabling new settlements, economic developments, and more direct, multidirectional connectivity independent of natural river courses.

**Riverine communities:** Settlements located along rivers, streams, or other bodies of water in Amazonia. These communities typically rely on the river for transportation, fishing, agriculture, and other daily activities. The proximity to water shapes their lifestyle, economy, and culture, often making them distinct from inland or urban communities.

**Rubber boom:** A period in the late 19th and early 20th centuries when global demand for wild rubber fueled economic growth and migration in Amazonia, especially for manufacturing industrial goods such as car tires.

**Terras pretas:** Highly fertile and stable soils formed by Indigenous groups in Amazonia through the management of organic waste. These soils (anthropic dark soils) are known for their rich black color and agricultural productivity.

**Urucum:** Also known as annatto, urucum seeds produce a vibrant red-orange pigment, used for body paint, cosmetics, and food coloring. In many indigenous traditions it is a symbol of the sun, and of spiritual protection.

**Varadores:** Road networks connecting settlements separated by kilometers, facilitating movement and communication across remote areas.

**Várzeas:** Seasonally flooded floodplain areas found along rivers in the Amazonas river basin. These fertile lowlands are periodically inundated by river waters, which deposit nutrient-rich sediments highly productive for agriculture.

# APPENDIXES

## Appendix 1: Definition of the Amazonia as a Region

*Yves Lesenfants, Roberto Prato Ochoa (IDB)*

The studies in this volume adopt the definition of Amazonia used by IDB Amazonia Coordination Unit, under the *AmazoniaForever360+* initiative, in alignment with ACTO and RAISG. The *Amazonia Forever* working area covers more than 8.3 million square kilometers across the eight IDB member countries with territories in the region.

### Definitional Criteria

The region is defined through four interrelated criteria:

**1. Hydrological:** Encompasses the full Amazonas river basin (5.9 million km²), parts of the Orinoco and Araguaia-Tocantins basins, and other connected drainage systems.

**2. Biogeographic:** Includes ecological corridors, transition zones, and key ecosystems—such as tropical forests, wetlands, savannas, and highland areas

**3. Geopolitical:** Covers the Amazonia areas of Bolivia, Brazil (coinciding with the BLA), Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela, and supports coordination across borders, protected areas, and shared infrastructure and markets.

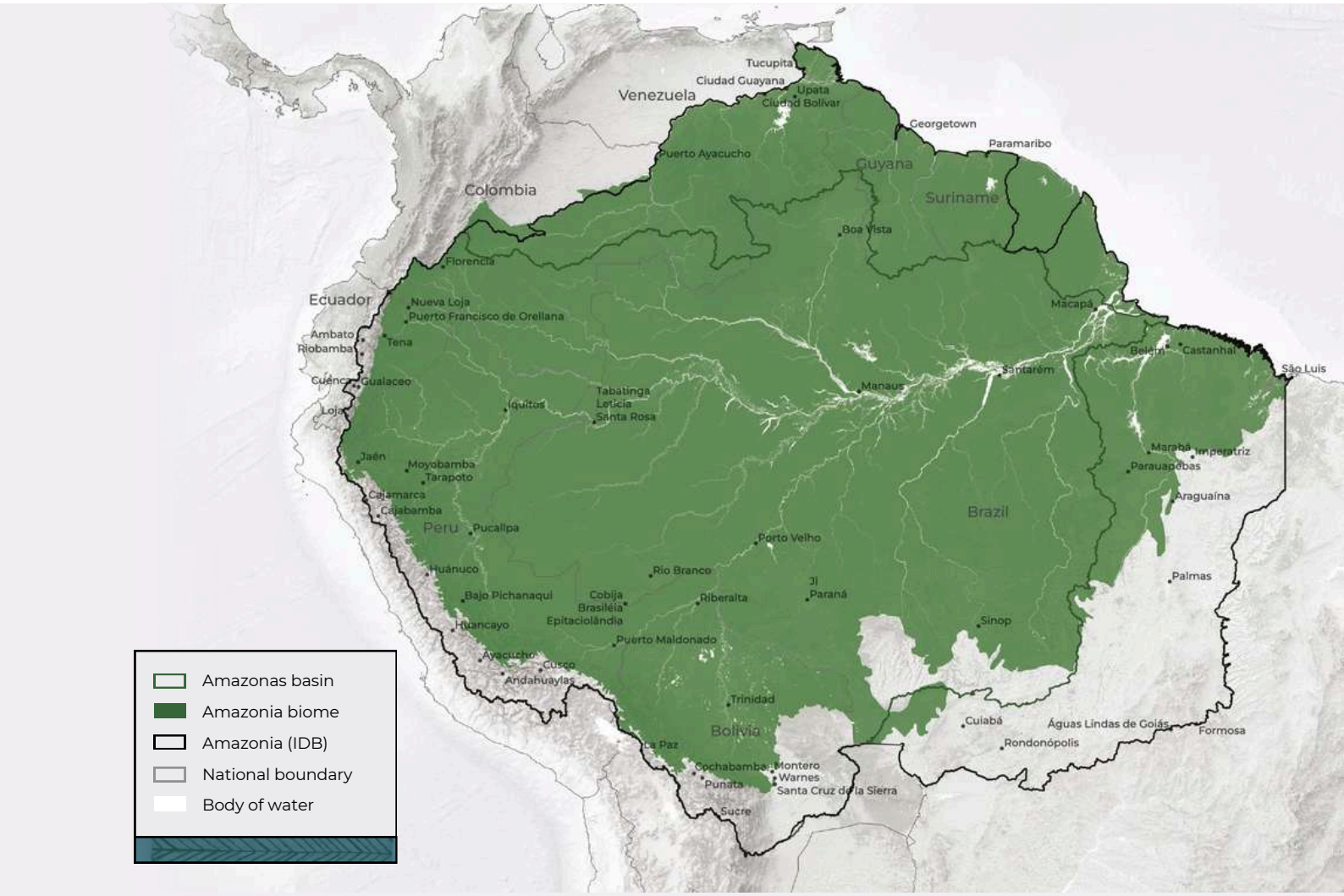
**4. Socio-Cultural:** Recognizes the cultural and territorial connectivity of Indigenous Peoples and traditional communities across national boundaries emphasizing their role as stewards of biodiversity and cultural heritage.

## *Table A1.1: Territorial Definitions of Amazonia*

| Territory Definition | Source | Area (million km²) | % of Pan-Amazonia | Description |
|---|---|---|---|---|
| Pan-Amazonia | RAISG and OTCA | 8.4 | 100 | Pan-Amazonia area |
| Amazonia Forever | IDB | 8.3 | 98.4 | Area of Pan-Amazonia IDB member countries |
| Amazonia Biome | RAISG | 6.8 | 81 | Ecological region |
| Amazonas Basin | HydroBASINS | 5.9 | 70.5 | Hydrological basin area |

*Source: GIS measurements by AmazoniaForever360+; Albers Equal Area projection.*
*Note: The difference between Pan-Amazonia and Amazonia Forever is that the former includes French Guiana, not included in the IDB definition*

## *Map A1.1: Territorial Definitions of Amazonia*




*Notes: For more information see Box A1: Maps, Data Sources and Geographical References.*
*Source: Author's own elaboration based on the Amazonia Forever Program and RAISG 2022.*

### *Box A1: Maps, Data Sources and Geographical References*

The cartographic data presented here, along with other types of data, come from public access sources, unless explicitly specified licenses or rights are mentioned. These data are provided solely for general reference purposes and should not be used for precision applications or for decision-making in emergency situations. They do not represent the official stance of the Inter-American Development Bank on any matter depicted, nor do they imply support for any parties involved in disputes over territorial boundaries or jurisdiction. Although the data have undergone careful geographic processing, they may contain inadvertent errors or inaccuracies inherent to such processes.

- Territory limits modified from RAISG (Amazon Network of Georeferenced Socio-Environmental Information): https://www.raisg.org/en/maps/
- Military Geographic Institute of Bolivia: http://www.igmbolivia.gob.bo/
- Brazilian Institute of Geography and Statistics: https://www.ibge.gov.br/
- Agustín Codazzi Geographic Institute, Colombia https://www.igac.gov.co/es
- Military Geographic Institute of Ecuador: http://www.geograficomilitar.gob.ec/
- National Geographic Institute of Peru: https://www.gob.pe/ign
- Land cover: European Spatial Agency - Copernicus Global Land Service (CGLS): https://land.copernicus.eu/global/
- NASA MODIS Water Mask: https://modis.gsfc.nasa.gov/data/dataprod/mod44w.php Natural Earth project: https://www.naturalearthdata.com/
- World Cities Database: https://simplemaps.com/data/world-cities
- GRIP global roads database: https://www.globio.info/download-grip-dataset

# Appendix 2: Data and Methods

## A. DEGURBA Method (Chapter 2)

*Paloma Martín, María de los Ángeles Scetta (IDB)*

Population and Settlement Data Population and area estimates were obtained from the Global Human Settlement Layer, which integrates census or administrative unit data for the years 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2015, and 2020. The spatial extent of human settlements was derived from Landsat satellite imagery for the same time periods. Settlement names were primarily sourced from OpenStreetMap (OSM).

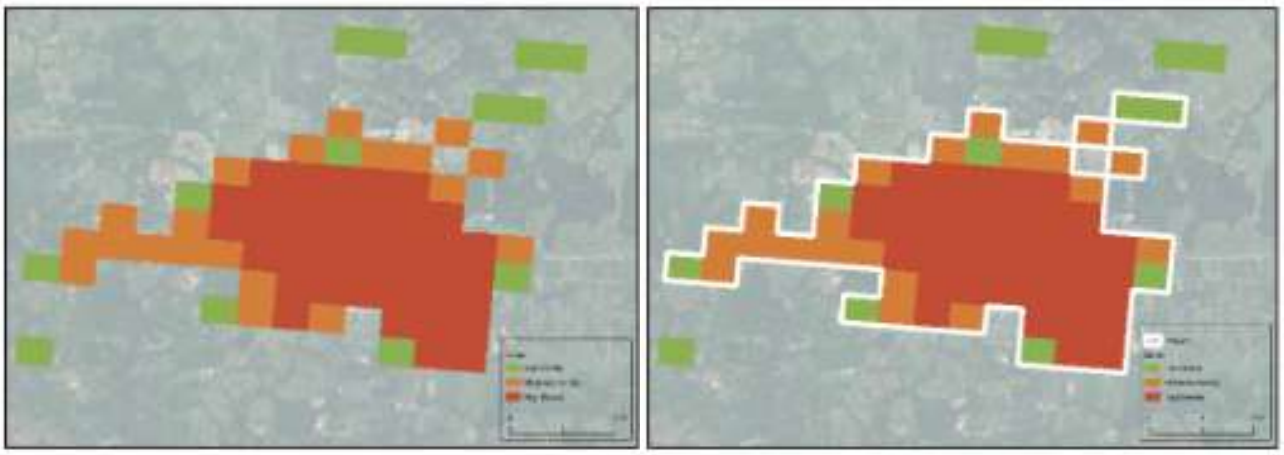
### DEGURBA Methodology Application in Amazonia

The analysis applies step 1 of level 1 of the DEGURBA (Degree of Urbanization) methodology ([Learn more](https://ec.europa.eu/eurostat/web/degree-of-urbanisation/methodology). The methodology was adapted for Amazonia by lowering the rural cluster population density threshold to 200 inhabitants/km², targeting settlements with total populations between 300 and 5,000 inhabitants. For non-Amazonian areas in the same countries, the standard DEGURBA thresholds were applied without modification.

### Spatial Processing and Classification

Population and urbanization classification pixels were loaded according to the adapted thresholds (DEGURBA Step 1). Polygons were then created by aggregating contiguous adjacent pixels in eight directions (the four cardinal directions plus four diagonals directions), forming spatial units representing discrete settlements (DEGURBA step 2) (Figure A2.1).

***Figure A2.1:* Step 1 (Pixel Classification) and Step 2 (Pixel Grouping)**



*Source: Prepared by the authors.*

Once polygons were delineated, settlement names were assigned based on OpenStreetMap data. However, approximately 18% of polygons (≈1,800) lacked a direct name match. To resolve this, Azure Maps was used to retrieve the nearest named settlement based on geographic coordinates. These were labeled using the prefix “Near” followed by the settlement name (e.g., Near San José).

## Contributions relying on the DEGURBA method

### In Chapter 2

1.iii Contemporary Urbanization

Box 2.3 Measuring Remoteness

### In Chapter 3

1.iii. Security Challenges in Urban Amazonia

2.i. Availability of Health Systems

2.ii. Access to Public Education

3.i. Poverty in Urban Amazonia

# B. Measuring Remoteness (Box 2.3)

*Antonio Vázquez Brust (IDB), Rodolfo Figueroa (Instituto Tecnológico de Monterrey)*

## Data Sources

**Travel speed:**
Global Friction Surface 2019 (https://developers.google.com/earth-engine/datasets/catalog/Oxford_MAP_friction_surface_2019).

**Road coverage:**
Global Roads Inventory Project (GRIP) (https://www.globio.info/download-grip-dataset) and Global Roads Open Access Data Set, Version 1 (gROADSv1) (https://data.nasa.gov/dataset/global-roads-open-access-data-set-version-1-groadsv1).

## Methodology for Estimating Travel Times to the Nearest City

For each city, the shortest path and minimum travel time to every other settlement within a 600 kilometer physical distance are calculated. To identify settlements with low accessibility (i.e., long travel times), a spatial correlation analysis is conducted using minimum travel time as the target variable, based on the calculation of the Getis-Ord Statistic. Settlements with a value of G*i > 0 are identified as remote areas, or regions.

# C. Availability of Health Systems (Chapter 3)

*Sofía Castro Vargas, Laura Goyeneche, Sebastian Bauhoff (IDB)*

## Data Sources

**Hospital Discharges (2021–2022):** Brazil: SUS; Colombia: RIPS; Ecuador: National Institute of Statistics and Censuses of Ecuador; Peru: SIS.

**Population Data (2011–2022): Census data as follows:** Bolivia (2012), Guyana (2012), Suriname (2012), Venezuela (2011); Brazil: IBGE (2022); Colombia: DANE (2022); Ecuador: National Institute of Statistics and Censuses of Ecuador (2022); Peru: MINSA (2022).

**Health Infrastructure (Official Records):** Bolivia: Ministry of Health; Brazil: CNES; Colombia: REPS; · Ecuador: Ministry of Health; Guyana: Essential Obstetric Neonatal Care network; Peru: Ministry of Health.

**Other Sources:** healthsites.io (2024, crowdsourced).

## Methodological Approach: Geospatial Analysis of Healthcare Services

Geospatial analysis was used to evaluate healthcare service availability and use. Service availability was mapped across all countries, hospital use was analyzed in Brazil, Colombia, Ecuador, and Peru. Four key indicators were assessed: number and types of health facilities; age and sex standardized hospitalization rates per 100,000 people; hospitalization rates for ambulatory care-sensitive conditions (ACSCs) by disease group; and hospital quality and efficiency (intra-hospital mortality and average length of stay).

The analysis was conducted at different levels — national, non-Amazonia, Amazonia, and urban Amazonia levels, using standardized population weights and administrative health data from municipality, canton, or province levels. Amazonian regions were defined using IDB boundaries.

Limitations include reliance on public hospital data, potential data quality issues, impacts from COVID-19, and possible misclassification of urban versus rural areas.

# D. Access to Public Education (Chapter 3)

*Cecilia Giambruno Michelini, Claudio Ortega, Nicolás Castro (IDB)*

## Data Sources

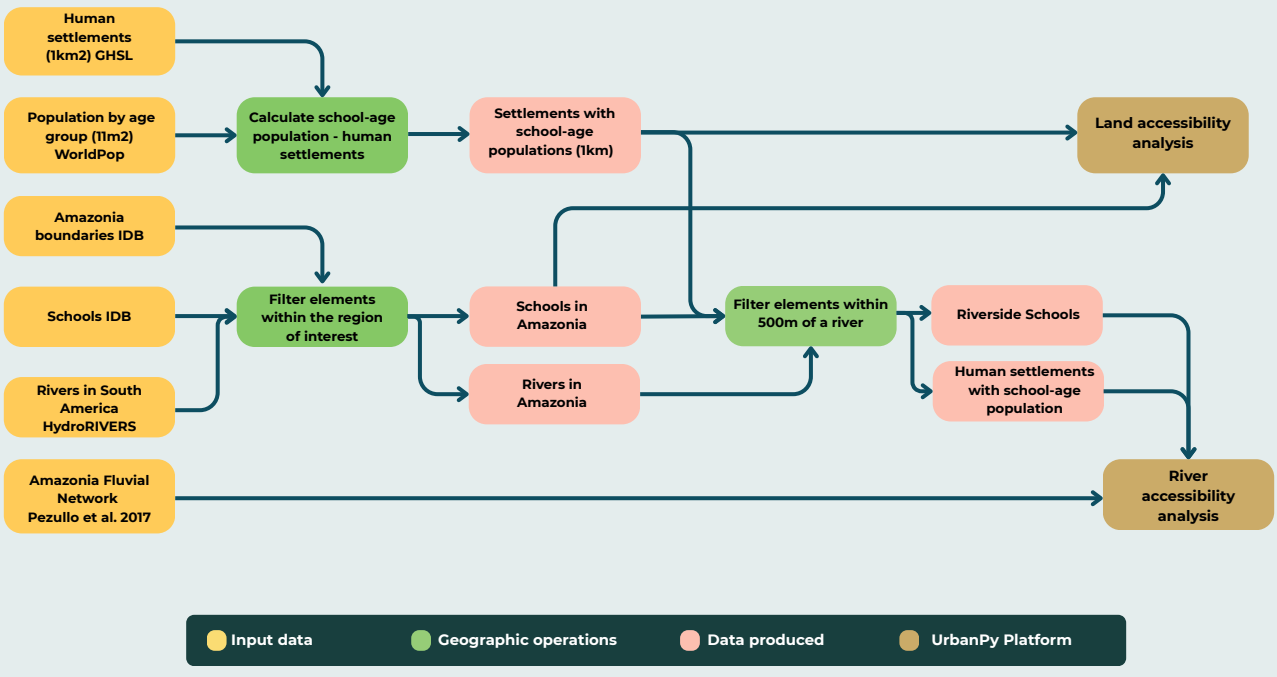
**Educational center locations and levels:** IDB's Amazonia Educational Establishments Layer, which compiles georeferenced data from official national sources.

**School-age population.** WorldPop Open Spatial Demographical Data and Research. Segmented by age group (5–9 for primary, 10–14 for lower secondary, 15–19 for upper secondary).

## Methodology for Estimating Accessibility to Public Educational Services in Amazonia

Geospatial analysis was employed to estimate walking times to the nearest public school (primary, lower secondary, and upper secondary) for school-age children residing in Amazonia settlements across Brazil, Bolivia, Colombia, Ecuador, and Peru. Following the DEGURBA methodology, the study utilized a one-square-kilometer grid to map public school locations, the distribution of the school-age population, and road networks. Walking times for each urban cell were calculated using the UrbanPy Platform, which models routes based on both formal and informal roads as well as terrain characteristics (Figure A2.1).

***Figure A2.2: Accessibility to Public Educational Services in Amazonia***




*Source: Prepared by the authors.*

## Methodology for School Access by River in Amazonia

The study used a one-square-kilometer population grid over navigable rivers (HydroSHEDS; Lehner and Grill 2013) and defined riverine populations and schools as those within 500 meters of a navigable river. Accessibility was analyzed using the Open Source Routing Machine and a custom Amazonas river network dataset, calculating the shortest river travel time between each school and settlement.

# Appendix 3: Amazonia's Climate Profile

*Mariel Juaréz Olvera, Luis Mora (IDB)*

The Amazonas basin plays a vital role in continental climate regulation, supplying moisture to the Andes, Cerrado, and La Plata river basin (Zemp et al. 2017). It supports diverse ecosystems and features a consistently warm, humid climate, with average daily temperatures between 24–28 °C. Urban centers like Manaus often record highs above 31 °C and lows rarely below 22 °C (NASA 2021; Climate-Data.org 2024).

## Temperature

Over the past 50 years, Amazonia has experienced significant warming, especially during the dry season. Since the 1960s, mean annual temperatures have increased by 0.5–1.5 °C, with the southern and eastern regions most affected (IPCC 2022). Urban areas such as Mato Grosso and southeastern Peru now report more than double the number of extreme heat days (>35 °C), impacting both dry and wet seasons (USAID 2018).

Daily maximum temperatures are rising fastest during the dry season. Cities like Tefé, Brazil, have recorded heatwaves reaching 41 °C (Grossman 2024). Some areas have experienced dry season warming rates of 0.6 °C per decade, with current maximums over 2 °C higher than 40 years ago (Flores et al. 2024). Under high-emissions scenarios, projections indicate potential increases of up to 4 °C by 2050, increasing UHI effects and its health risks (Grossman 2024).

By 2100, temperatures in Amazonia could rise by 1.5–4.5 °C, with the greatest warming again in southern and eastern regions (IPCC 2022; Flores et al. 2024). Urban areas—already vulnerable due to heat islands and limited vegetation—may face sustained daily temperatures above 40 °C, increasing health impacts, energy demand, and productivity losses (Marengo and Souza 2018).

The frequency and duration of extremely hot days are projected to rise across the basin, with the seasonal temperature cycle expanding by up to 1 °C (Espinoza et al. 2024). These trends are most pronounced in deforested and transitional zones, where warming rates may reach 0.3 °C per decade during the dry season (Flores et al. 2024). Reduced evapotranspiration due to forest loss will further limit surface cooling, increasing exposure to prolonged heatwaves (Ritchie et al. 2022).

## Rainfall Patterns

Annual rainfall ranges from nearly 3,000 mm in the west to 1,500–2,000 mm in the southeastern and northern regions (Salati and Vose 1984; Espinoza Villar et al. 2009). The rainy season occurs from December to April in the north, beginning earlier in the south (USAID 2018). Historically, up to 50% of rainfall was recycled through forest evapotranspiration; this is — now down to 25–35%, particularly in the southwest.

While total annual rainfall in Amazonia has remained relatively stable, its distribution and intensity have shifted significantly. The region now experiences more frequent intense rainfall events and longer dry seasons, particularly in the southern basin (Espinoza Villar et al. 2009; Espinoza et al. 2024). These shifts are driven by climate variability, deforestation, and global climate forces.

Severe floods now occur every four years since 2000—compared to once every 20 years previously, especially affecting northwestern and central Amazonia. These events damage infrastructure, disrupt transport, and increase public health risks (Barichivich et al. 2018). In contrast, extreme droughts—such as Manaus's record-low river levels in 2023—threaten urban water security (Espinoza et al. 2024).

Future projections show longer dry periods, greater rainfall variability, and more intense wet-season storms, particularly in southern and southeastern Amazonia (Magrin et al. 2014). These trends, driven by deforestation and global warming, increase the risk of both droughts and floods, and threaten urban water supplies (Bottino et al. 2024; Qin et al. 2025).

By the end of the century, annual precipitation in central and southern Amazonia could decline by over 40%, with dry seasons extending up to 60 days and more frequent rainless periods (Bottino et al. 2024). Cities will likely face less frequent but more intense storms, worsening flood risks, while prolonged droughts will strain water infrastructure and supply systems (Qin et al. 2025).

This growing hydrometeorological instability—marked by more frequent floods and droughts proposes serious challenges for urban infrastructure, water management, and public health and demand adaptive urban planning and resilient infrastructure solutions (Ritchie et al. 2022).

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