

Chapter 1

Introduction



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Abstract The Amazon biome is a crucial element of the world's ecosystem. Its land characteristics encompass a complex system of rivers, streams and wetlands along with a diverse array of vegetation and forest types. This complex ecosystem which is characterized by rich biodiversity, is currently facing challenges related to land use changes. The objective of this chapter is to enhance awareness of the Amazon biome by presenting information about the land characteristics of the Amazon Basin and an analysis of the most significant challenges of the region, specifically addressing the state of Rondônia, in the Brazilian Amazon. It was developed using a multi-method approach, combining bibliographic research and mapping. The results indicate that the most significant drivers of deforestation are the expansion of cattle ranching and agricultural development. Moreover, the construction of infrastructure and the arrival of settlers through colonization projects have been linked to deforestation in the state of Rondônia. The conclusions present reflections on the potential strategies for a more sustainable future.

Keywords Amazon Rainforest · Land Characteristics · Deforestation · Agribusiness

The Amazon rainforest has drawn considerable global attention and political pressure to combat deforestation in recent years, given its significant environmental impact on both local and global climates. The concern is genuine, as the Amazon

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biome has lost 75 million hectares of natural vegetation from 1985 to 2021, comprising 96% of forests. This translates to an area that is a little more than twice the size of Germany.

Most deforestation took place in the Brazilian Amazon, which has lost 60.3 million hectares of forest. Urgent action is required to implement sustainable changes.

The purpose of this book is to examine the deforestation process and propose sustainable changes in specific Amazonian cities within the state of Rondônia. This state, located in the southwestern region of the Brazilian Amazon, presents a valuable case for implementing sustainable urban development due to its recent history of urbanisation and direct connection with deforestation.

The expansion of cattle ranching led to a significant decrease in natural vegetation in Rondônia. From 1985 to 2021, the area covered by natural forest vegetation decreased from 87.10% to 57.58%. In contrast, the proportion of pastureland increased from 8.21% to 36.34% during the same period.

The cities in Rondônia are relatively young, with some being less than 60 years old. Despite being situated in a biodiverse environment, their planning does not follow sustainable practises. Common issues in these cities include insufficient green areas within the urban environment, lack of sewage treatment, dense urban morphology, and inadequate infrastructure of streets and highways.

Additionally, deforestation through slash-and-burn methods presents a problem that has a negative impact on air quality. Another concern is social inequality, which is further compounded by ethnic clashes.

Rondônia has been the subject of research by Prof. Dr. Verônica Garcia Donoso as an Alexander von Humboldt Fellow, with a Georg Forster “Experienced Researcher”¹ grant from October 2022 to May 2024. The research was conducted at RWTH Aachen University in Germany under the supervision of Prof. Dr. Christa Reicher. This research project sought to examine the distinctive characteristics of urban growth and the loss of natural vegetation in the Amazon region. The project focused on the State of Rondônia and employed analytical approaches at two distinct spatial scales. The first approach employed satellite imagery to elucidate the nature and extent of changes in land use at the regional scale. In order to facilitate the contribution to the future local planning process, the second approach involved the implementation of local co-planning workshops. This book presents a comprehensive overview of the research results.

Rondônia was also topic of discussion within the international academic network “Transforming City Regions”, which aims to promote sustainable design and development of regions, cities, and neighbourhoods. As part of this programme, the Chair and Institute of Urban Design at the Faculty of Architecture at RWTH Aachen University offers a Master of Science degree in Transforming City Regions (TCR).

¹ The Georg Forster Research Fellowship awards above-average qualified researchers from all disciplines from developing and emerging countries in cooperation with a German research institution. The research must address questions that are relevant to the further development of the researcher’s country of origin.

This master's programme is unique in Germany, as it is taught entirely in English and attracts students from diverse international and multidisciplinary backgrounds. The curriculum emphasises project-based and design-oriented learning and incorporates numerous disciplines to address territorial challenges on a global scale.

During the summer semester of 2023, a research module was presented to students by Prof. Donoso, with Prof. Reicher supervision, which discussed various cities in the state of Rondônia. The objective of this module was to deliberate the significance of vegetation areas in the Amazon region as indispensable ecosystem services that face intense human pressures. Our research question was: if a city in the Amazon region could be redesigned according to ethno-ecological principles, what would it look like?

The course utilised GIS software for data modelling, and analysed various bibliographic sources to create maps and graphics of Rondônia state's Amazonian cities, with the aim of promoting sustainable development. The course also provided students with an overview of the Amazon region, emphasising its natural environment and ecological global significance, whilst supporting conscious urban planning of the area. Some outcomes of this semester's project were compiled into book chapters and presented in this publication.

This book is divided into three parts. The first part explores the current challenges faced by the Brazilian Amazon and highlights the significance of the debate on Rondônia. It comprises four chapters. The second chapter, titled "*Land characteristics of the Amazon region and its current challenges*", is authored by Donoso. It provides an overview of the Amazon Biome land characteristics and an analysis of the most significant challenges, particularly regarding land use changes, with a focus on deforestation process in Rondônia. The third chapter, "*Land Use Change in the Amazon region: What is driving deforestation?*", also authored by Donoso, analyses land use and land use change in both the international and Brazilian Amazon, examining and discussing the main drivers of the deforestation. The fourth chapter, "*Layers of the Anthropocene: Occupation History of Rondônia*", authored by Donoso and Hirye, delves into the region's history, exploring various layers related to indigenous groups, quilombolas,² migrants, and settlers.

The second part of this book presents the findings of a research module offered in the Master Programme "Transforming City Regions" at RWTH Aachen University, Germany. This section includes four chapters, each with four case studies. Chapter 5, "*Water Sensitive Urban Design in Porto Velho*", discusses Porto Velho, the capital of the state, and seeks to develop solutions for flood adaptation through green and blue infrastructure. The authors, Singla from India and Aktürk from Turkey, focus on strategies to improve urban design and create flood-resilient drainage solutions. Chapter 6, titled "*Rethinking Amazon cities from Rondônia State: The case of Ji-Paraná*", explores sustainable development and conservation efforts in the municipality of Ji-Paraná, the second most populous city in Rondônia.

²Quilombolas are individuals residing in, or with a connection to, quilombos. Quilombos is the name given to the communities that were formed by black slaves who resisted the process of enslavement and escaped by forming secluded enclaves.

The authors, Saeed and Tahir Ali from Pakistan and Gül from Turkey, present practical measures to support these efforts in the urban area. Chapter 7, “*Ariquemes, the 15-Minute City: a conceptual proposal to strengthen social inclusion and sustainable greening through a 15-min urban planning system*”, authored by Thakuria from India and Özdemir from Turkey, suggest implementing a planning system that promotes green living and societal inclusion. Chapter 8, “*Research on Cacaoal Renewal Strategy in the context of Rondônia Rainforest*”, authored by Ziaee from Iran, and Song and Bai from China, examines the development of Cacaoal and proposes the sponge city concept as a solution, focusing on water absorption capacity.

This book concludes with third part, which includes two chapters. Chapter 9, “*The importance of local participatory processes in achieving sustainable changes: the experience of two ecological planning workshops in Ariquemes, Rondônia*”, authored by Donoso, Covalleski and Rocha, provides insights from two participatory and multidisciplinary workshops held in Ariquemes during 2023 and 2024. These workshops were instrumental in developing local actions, projects, and strategies for sustainable development. This chapter also outlines subsequent research actions carried out following the workshops. Chapter 10, titled “*A rethink of urban planning towards and ecological planning perspective*”, authored by Donoso and Reicher, offers concluding thoughts from the book’s experiences.

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