CLIMATE CHANGE AND COFFEE PRODUCTION IN THE AMAZON

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Changement climatique et production de café en Amazonie

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Introduction

The temperatures and precipitation that are characteristic of the Amazon region create a climate that is favorable for the development of high-quality coffee beans. The forest also creates an environment conducive for coffee production in agroforestry systems (AFS). This combination of climatic factors provides Amazonian coffee producers with the opportunity to explore unique sensory and aromatic nuances in the coffees produced in the region. As a result, regional coffee production has the potential to contribute to the conservation of the biome.

The region, which is so fragile and vital to the environmental balance of South America, is facing major challenges due to climate change. The increase in average temperatures, the changes in rainfall patterns, and the greater frequency of extreme weather events are factors that can have a negative impact on the Amazonian ecosystem and have a direct impact on the quality and sustainability of coffee production in the Amazon. The aim of this study is to use statistical techniques to examine the changes in temperature and precipitation patterns that occurred between 1961 and 2019 in four speciality coffee producing regions of the Brazilian Amazon (Acre, Matas de Rondônia, Mato Grosso, and Rondônia) (Fig. 1).

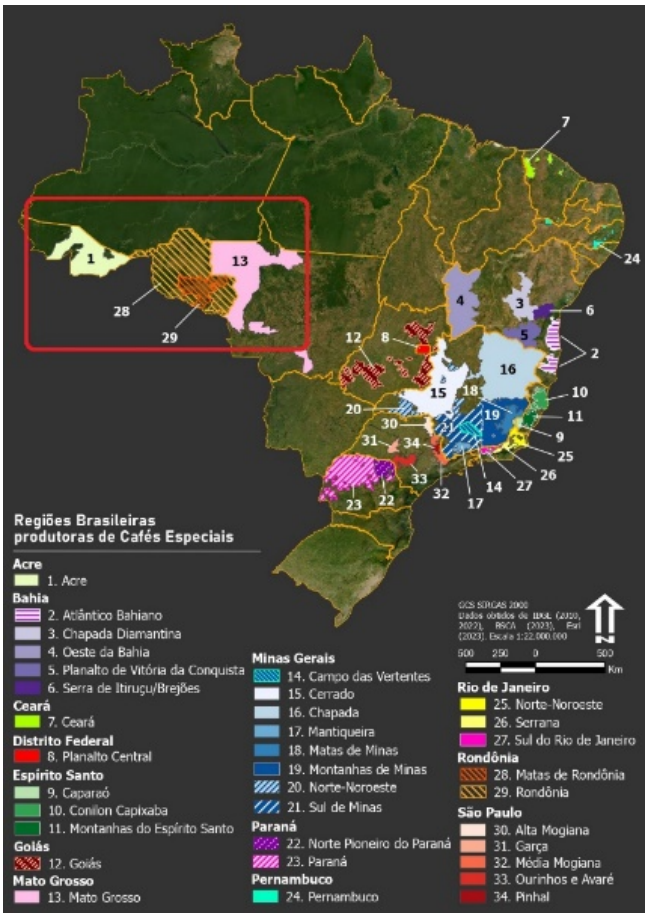

Figure 1. Location of specialty coffee producing regions in the Brazilian Amazon region (red square).

1. Materials and methods

To this end, climate data from the database of Xavier et al (2022) of the regions for the period from 1961 to 2019 were used. Climate indices were generated using the RClimDex package in the RStudio software. The three indices generated were: monthly temperature amplitude (DTR) (based on the difference between minimum and maximum temperatures); number of tropical nights (TR) (annual count of days with minimum daily temperature > 20°C) and number of summer days (SU) (days with temperature above >30°C).

2. Results and discussion

The monthly temperature amplitude index (DTR) showed an increasing trend for all regions studied, with the months of July, August and September (winter) registering the highest thermal amplitudes (average of 13.88°C) and the months of December, January and February (summer) registering minimum thermal variation (average of 9.79°C).

The index of the number of tropical nights (TR) showed an increasing trend from 1961-1989 (n=226) as well as from 1990-2019 (n=277) in all regions studied. Hotter nights in the Amazon can affect biodiversity by affecting the life cycle of plants and animals that are most sensitive to high temperatures. In coffee production, high nighttime temperatures can disrupt the growth cycle, increase the risk of disease, and affect the quality of the beans, posing a challenge for coffee growers (Torres *et al.,* 2022).

The number of summer days index (SU) increased for days with temperatures above 30°C. With the exception of Acre, which showed a decrease in the number of days with temperatures below 30°C, all other regions showed an increasing trend in the number of summer days. It is worth noting that temperatures close to 30°C during the flowering period can induce the abortion of flower buds, leading to losses in the quantity produced (Torres *et al.,* 2022). In addition, the most sensitive biodiversity of the forest may be affected. Examples include small amphibians and plants that are sensitive to large thermal variations (SILVA *et al.,* 2023).

The identified changes require on coffee producers in the Amazon the need to adopt resilient agricultural practices. The challenge is to find a balance between the preservation of Amazonian biodiversity with the production of specialty coffees. The expansion of AFS aid in increasing resilience and preserving the forest.

Conclusion

These changes can negatively affect the balance of the forest ecosystem and the quality of coffee produced in the Brazilian Amazon regions. To enhance resilience and preservation, agroforestry systems can be employed.

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