

Junior Scientists Tandems

Final Report

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Supervisor at International Agricultural Research Center: Dr. Rachel Prado

Start and end date of career exploration stay: 01/12/2024 – 31/05/2025

Title: Assessing the Impact of Land Use and Land Cover Changes and Climate Change on Water-Related Ecosystem Services in Alto Parnaíba Sub-basin, MATOPIBA, Brazil

Funded by the German Federal Ministry for Economic Cooperation and Development (BMZ)



During the ATSAF Junior Scientist Tandem (JST) scholarship, I had the privilege of conducting a research stay at EMBRAPA (Brazilian Agricultural Research Corporation) in Brazil. This opportunity allowed me to engage in high-level scientific work in my home country, addressing issues directly related to sustainability, environmental conservation, and agricultural development in the Global South.

My work was linked to the project “Soil Ecosystem Services Under Sustainable Intensification of Agriculture (SOIL-ES),” which is part of the European Joint Programme on Soil (EJP Soil). While the SOIL-ES project focuses on the development of tools for mapping and monitoring soil ecosystem services under different land use intensification strategies, my specific contribution addressed the water-related ecosystem services at the **watershed scale**—a complementary perspective that adds value to the overall research goals.

The study area was the **Alto Parnaíba sub-basin**, located in the MATOPIBA region of Brazil, which has experienced significant land use and land cover changes in recent decades. As part of my master's thesis, the project aimed to assess how these changes, together with projected climate change scenarios, may influence **dry season baseflow**—a key biophysical indicator of water regulation services. Using the **InVEST Seasonal Water Yield** model, I simulated various land use and climate scenarios to estimate their impact on water flow during the dry season. This analysis is especially relevant in a region where expanding agricultural activities and shifting precipitation patterns pose growing challenges to water security and ecosystem stability.

One of the most enriching aspects of this experience was the **collaborative environment** at EMBRAPA. From the beginning of the project, I worked closely with Dr. Rachel Prado, who served as my supervisor and also coordinates the SOIL-ES project in Brazil. Throughout the research stay, I engaged in regular meetings—both in person and online—with EMBRAPA researchers as well as partners from other academic and research institutions. These exchanges were fundamental to shaping the project's methodology, defining model parameters, and refining data sources. They also allowed me to learn from experts in the fields of remote sensing, GIS, hydrology, and ecosystem services.

A crucial milestone during my scholarship was my participation in the **SOIL-ES Project Workshop**, held in **November 2024 at Embrapa Soils in Rio de Janeiro**. During this event, I presented the objectives, methodology, and preliminary insights from my research to a group of national and international scientists involved in the broader EJP Soil programme. This experience was not only important academically, but also personally rewarding. It gave me the opportunity to articulate my research in a



professional setting, receive feedback, and strengthen my scientific communication skills.

The technical part of my work involved intensive use of **remote sensing tools**, spatial modeling, and data processing. I worked with the **Google Earth Engine** platform to generate time-series land cover maps (for the years 2000, 2010, and 2023) and to collect climatic and hydrological data. The model simulations provided important preliminary insights. Under certain climate change scenarios projected for 2040, the dry season baseflow in parts of the sub-basin is expected to **decrease by up to 40%**, a striking result that emphasizes the vulnerability of water systems in this region. These findings have significant implications for land and water management, and potentially for the development of **payment for ecosystem services (PES)** schemes and **climate adaptation policies**.

In addition to the modeling work, the project also stimulated outputs aimed at knowledge dissemination. I prepared and submitted an abstract and poster for presentation at the **Tropentag International Conference**, scheduled to take place in **Bonn, Germany**. If accepted, this will be an excellent opportunity to present the findings to a broader academic audience and engage with researchers working on similar topics. Furthermore, I am currently working on two additional outputs: a **policy brief** to translate the research findings into accessible insights for decision-makers, and a **scientific paper**, in which I intend to focus on improving the accuracy and robustness of the model through calibration and validation against observed hydrological data. This effort will help enhance the scientific credibility of the results and contribute to methodological improvements in the modeling of water-related ecosystem services.

From a personal perspective, this experience was **deeply meaningful**. Conducting scientific research in Brazil, for Brazil, was a source of pride and motivation. The Cerrado biome, often called the "birthplace of waters," is not only a region of immense ecological importance but also a symbol of the tensions between development and conservation. Being able to work on this region with tools that aim to balance environmental protection and agricultural productivity made me feel that my work had real-world relevance. It also strengthened my sense of responsibility as a scientist working in and for the Global South.

Beyond the scientific output, the JST scholarship helped me grow as a researcher and as a person. I gained practical skills in modeling, spatial data analysis, and interdisciplinary collaboration. I learned how to adapt to new scientific environments, manage complex data, and communicate findings clearly to diverse audiences. I also developed a broader understanding of how research institutions like EMBRAPA operate and contribute to national and international research agendas.

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I am **immensely grateful** to ATSAF for supporting this unique opportunity. It has helped shape my academic career and reaffirmed my commitment to sustainability-driven research. I believe that programs like JST are essential for building bridges between early-career scientists and major research institutions, especially in contexts where local knowledge and scientific capacity are key to addressing pressing environmental challenges. This experience has undoubtedly inspired me to pursue further research in the field of ecosystem services, sustainability, and environmental policy—and to do so with a strong connection to my roots and a deep commitment to scientific excellence.
