INTEGRATION OF PISF RESERVOIRS INTO THE SWAT HYDROLOGICAL MODEL FOR WATER SECURITY MANAGEMENT IN THE PERNAMBUCO SEMIARID REGION

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Introduction

01 Water security is directly related to the ability to ensure an adequate supply of water in both quantity and quality, especially in vulnerable regions. In semiarid areas, water availability is critical, requiring effective management to ensure a balance between water supply and demand (Santos et al., 2023).

02 Water scarcity in the Brazilian semiarid region is intensified by irregular rainfall and high evapotranspiration, impacting both agriculture and urban supply. This makes the region vulnerable to prolonged droughts and highlights the need for mitigation and adaptation strategies to address climate change (Souza et al., 2023).

Introduction

São Francisco River Integration Project

River transposition is a technique that diverts the course of a river to transfer water between watersheds, commonly used in regions facing water scarcity. The São Francisco River Integration Project (PISF) is an initiative aimed at ensuring water security in the northeastern semiarid region by connecting the São Francisco River to local reservoirs (Silveira et al., 2024).
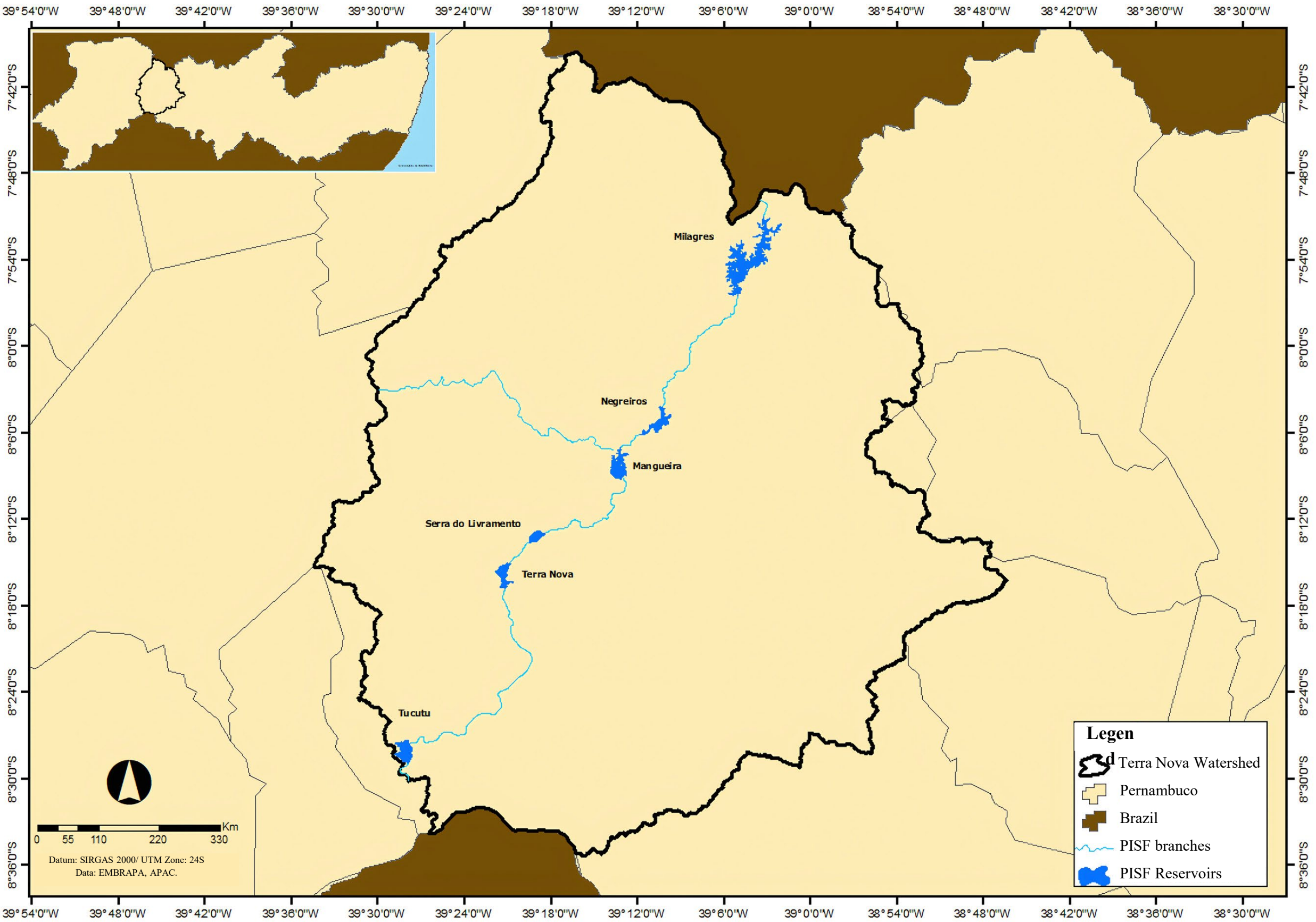

SWAT & SUPer

SWAT (Soil & Water Assessment Tool) is widely used to simulate the hydrological cycle in watersheds, allowing the analysis of factors such as land use and climate (Bressiani et al., 2015). SUPer (Hydrological Response Unit System for Pernambuco) uses SWAT and provides state-level data for water resources management (Soares et al., 2024).
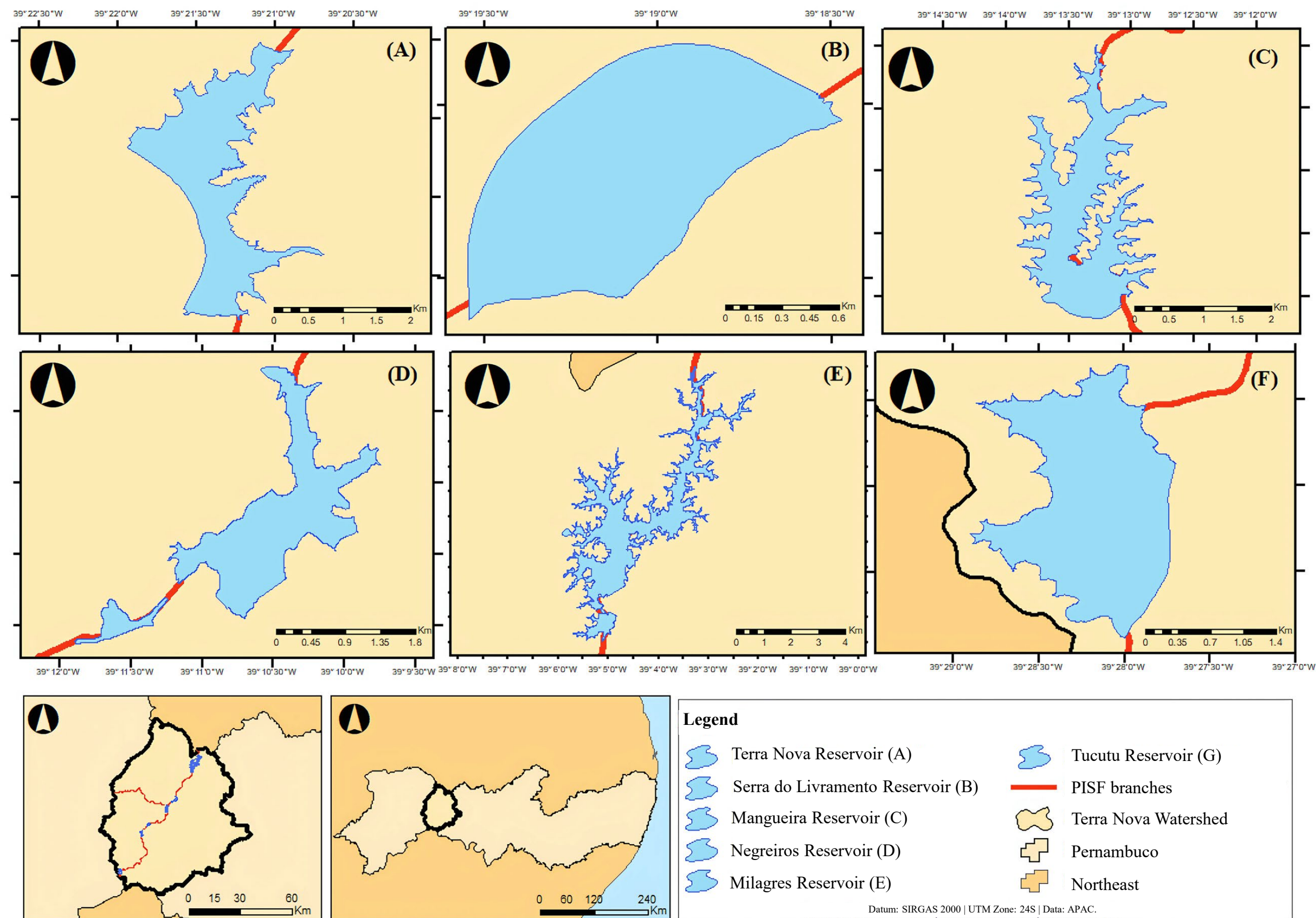
Objective

The objective of this study was to incorporate the Tucutu, Terra Nova, Serra do Livramento, Mangueira, Negreiros, and Milagres reservoirs, located in Pernambuco along the Northern Axis of the PISF, into the SWAT model, and subsequently make them available in the Hydrological Response Unit System for Pernambuco (SUPer)

Legend
- Terra Nova Watershed
- Pernambuco
- Brazil
- PISF branches
- PISF Reservoirs

Milagres
Negreiros
Mangueira
Serra do Livramento
Terra Nova
Tucutu

Datum: SIRGAS 2000/ UTM Zone: 24S
Data: EMBRAPA, APAC.

Legend
- Terra Nova Reservoir (A)
- Serra do Livramento Reservoir (B)
- Mangueira Reservoir (C)
- Negreiros Reservoir (D)
- Milagres Reservoir (E)
- Tucutu Reservoir (G)
- PISF branches
- Terra Nova Watershed
- Pernambuco
- Northeast

Datum: SIRGAS 2000 | UTM Zone: 24S | Data: APAC.

Methodology

01

The PISF channels were incorporated into the SWAT model through a shapefile containing the hydrography and artificial channels, which was used in the burn-in process to ensure the model correctly identified the location of its structures.

02

To incorporate the artificial channels into the hydrography, a 10 km² threshold was adopted for the delineation of the drainage network. Data from the Pernambuco Agency for Water and Climate and the Ministry of National Integration were used, considering volume, surface area of the water body, and year of operation.

Methodology

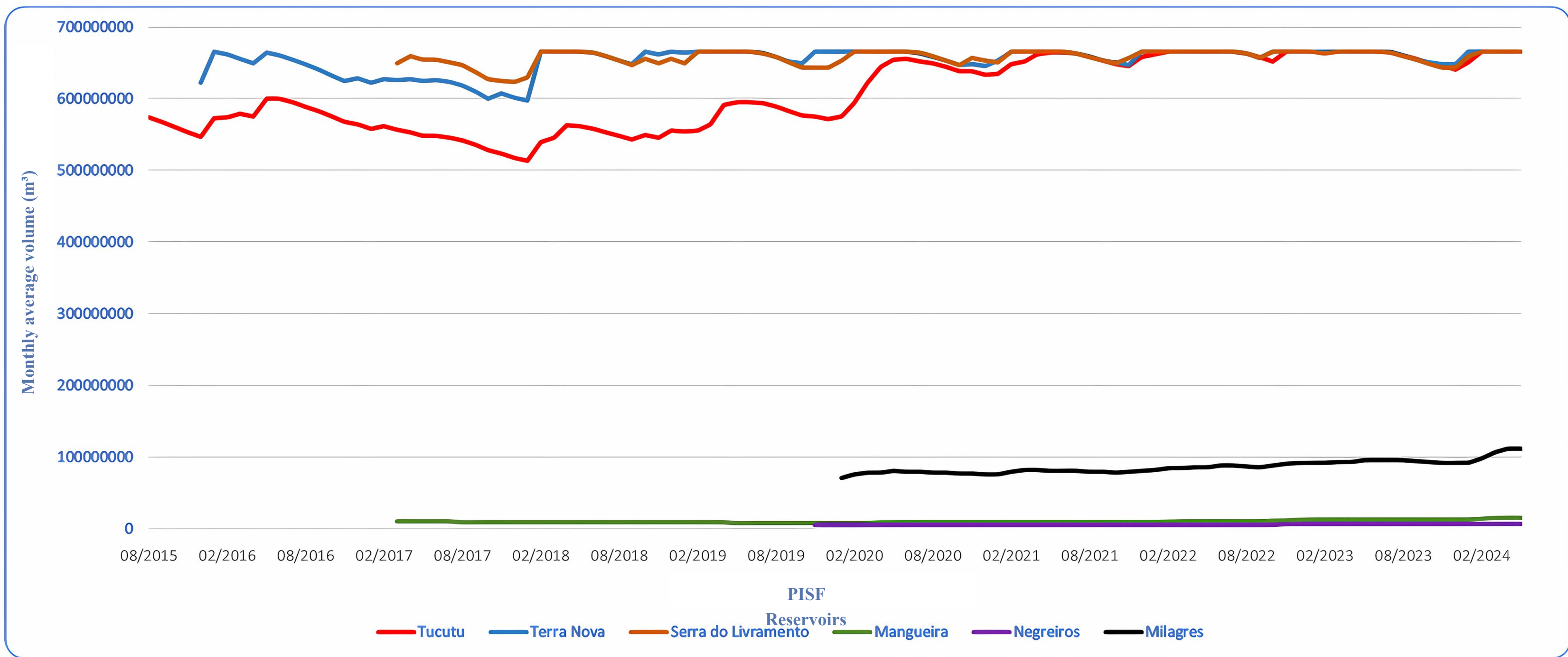| Sub-basin	Reservoirs
27	Tucutu
35	Terra Nova
25	Serra do Livramento
33	Mangueira
3	Negreiros
32	Milagres

Results
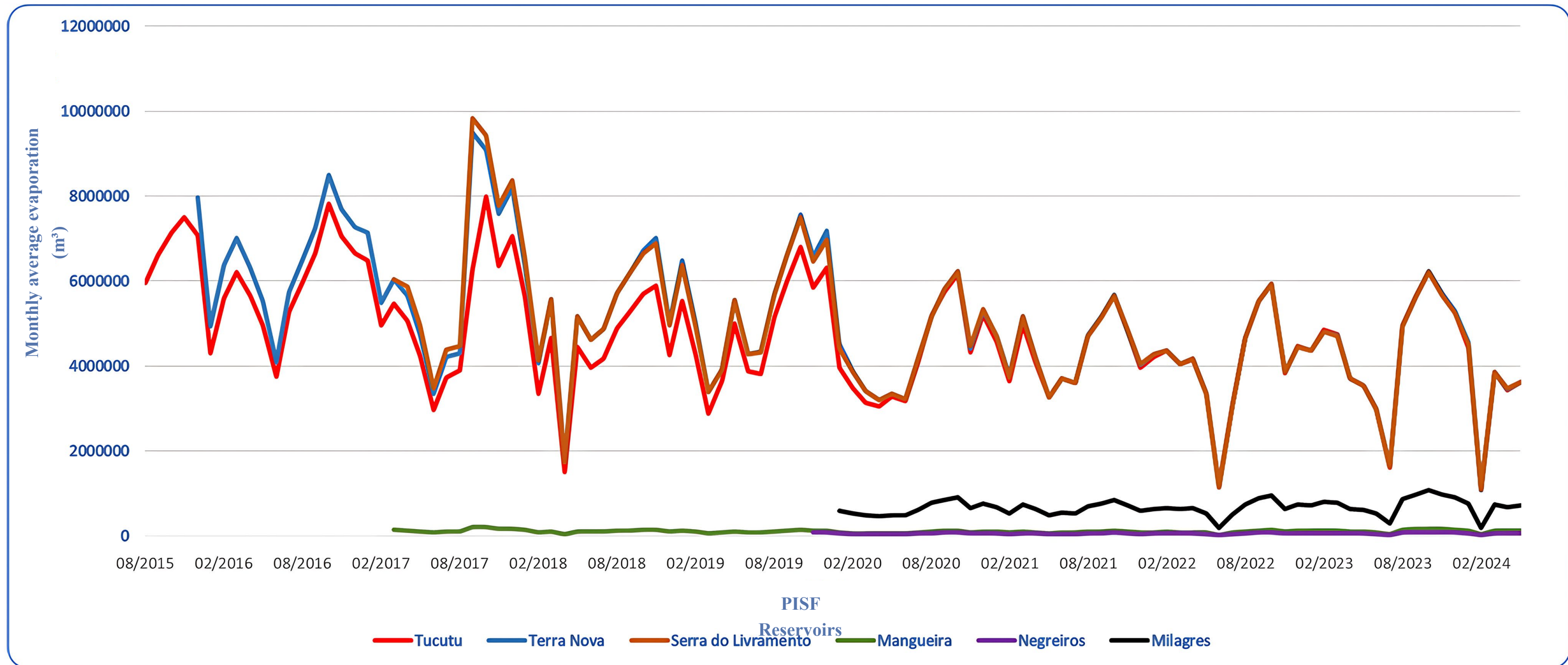
Evaporation rates show strong seasonal and interannual variability, with reservoirs like Terra Nova reaching peaks over 9 million m³.

High evaporation in the semiarid region demands refined estimation methods and detailed reservoir data (Sancheset al., 2023).

Results

PISF Reservoirs

Monthly average volume (m³)

Legend: Tucutu, Terra Nova, Serra do Livramento, Mangueira, Negreiros, Milagres

▶ Reservoirs such as Milagres and Mangueira show consistent volume increases over time, highlighting their growing storage role.

▶ Stored volumes are sensitive to climate variability and extreme events, emphasizing the need for adaptive water management.

Results

The reservoirs were successfully incorporated into the SWAT model and made available within the Hydrological Response Unit System for Pernambuco (SUPer), enhancing the platform's capacity to represent key water infrastructure along the PISF'sNorthern Axis.
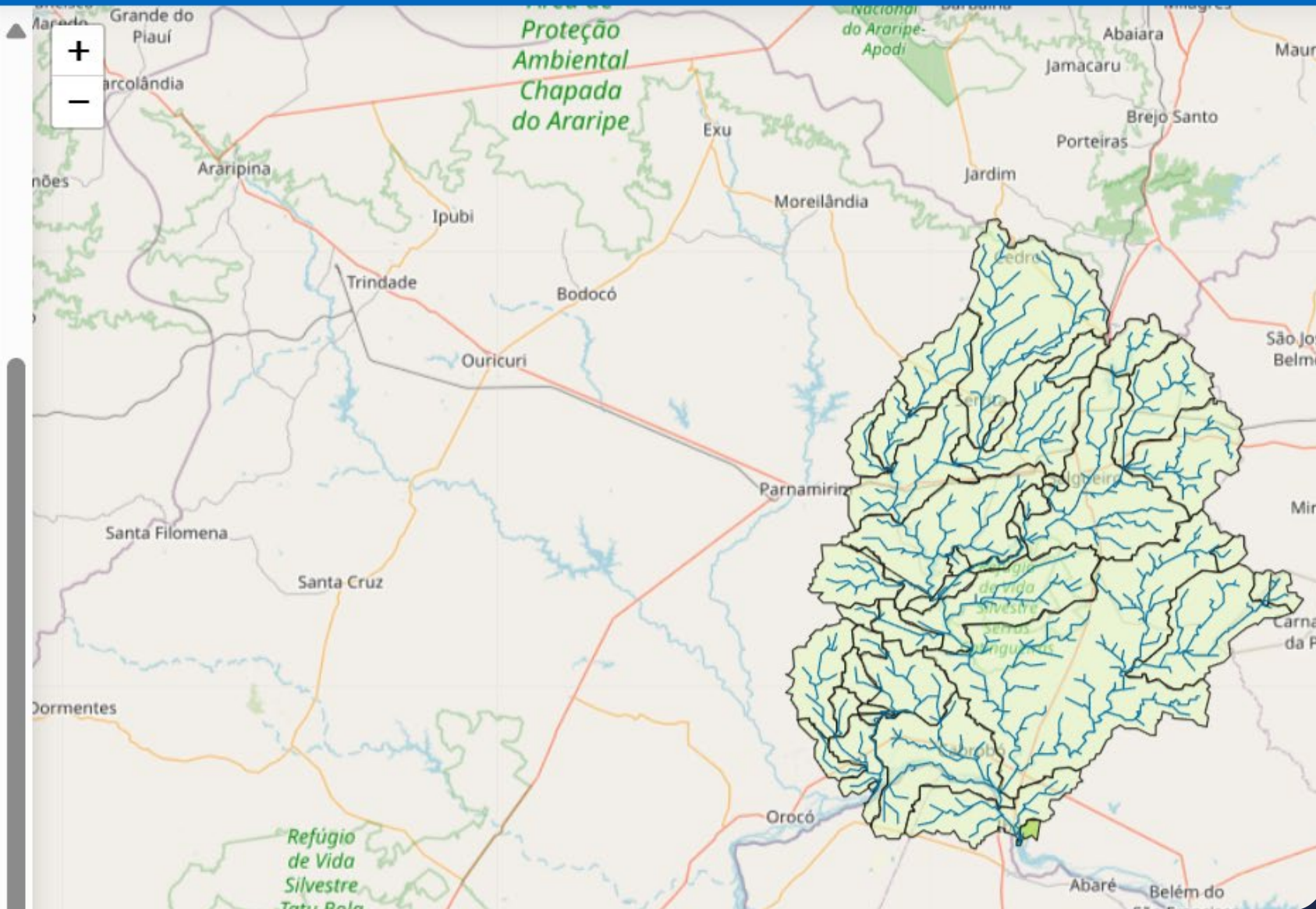
Results

01

Reservoirs like Tucutu, Terra Nova, and Serra do Livramento show the highest evaporation rates—averaging over 4 million m³—reflecting intense water loss driven by climatic factors.

02

Milagres, despite being the largest reservoir, maintains moderate evaporation levels and shows the greatest increase in stored volume, highlighting its strategic importance.

03

Evaporation and storage patterns across all reservoirs reveal the effects of strong climatic seasonality, reinforcing the need for adaptive and integrated water management strategies.

CONCLUSION

The integration of the Northern Axis reservoirs into the SWAT model and SUPer platform enhances understanding of their hydrological dynamics. High evaporation rates and variable storage volumes highlight climate-driven challenges, reinforcing the need for adaptive water management to ensure sustainable supply in Pernambuco's semiarid region.
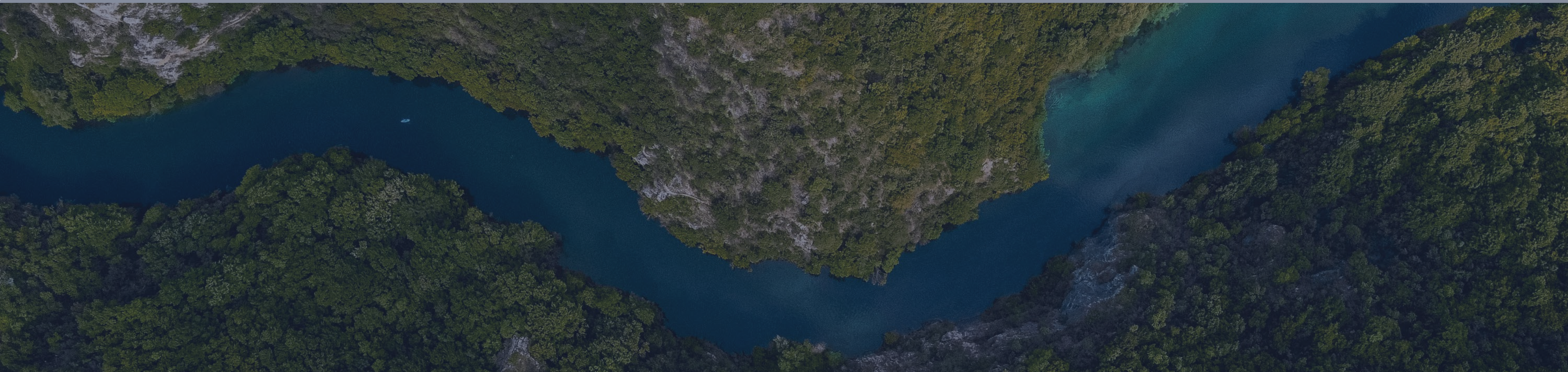
THANK YOU!

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