Food-Energy-Water Security Considering Climate and Land Use Changes in the São Francisco River Basin

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Abstract

Brazil is one of the richest countries in water resources and is currently the second largest global supplier of food and agricultural products. Furthermore, more than 70% of Brazilian energy comes from hydropower. Therefore, to ensure water availability for future generations it is necessary to consider the Nexus thinking (water, food, energy, ecosystem service, and social aspects integrated) in the country. However, few studies have been developed considering the Nexus thinking in Brazil. Understanding the interconnected risks and vulnerability to these sectors under climatic change conditions is crucial for the development of sustainable resources management plans and for mitigating competition among them. Here, we assess the Food-Energy-Water Nexus considering climate and land cover and land use changes (LCLUC) scenarios in the São Francisco river basin. This basin is the third largest basin in Brazil and supplies water to approximately 14 million inhabitants, with the Metropolitan Region of Belo Horizonte being the most populous area. The São Francisco river has been used for water supply, irrigation, agriculture and transportation by waterways, but its preponderant use is for hydroelectric power generation. However, this basin has been suffering from LCLUC and drought that has plagued the region since 2012. In addition, part of the river flow has been diverted due to the transposition of the São Francisco river to supply water to the semi-arid region of Brazil. We will calibrate and evaluate the Soil and Water Assessment Tool (SWAT) using hydrometeorological data from 1972 to 2017. We will also use LCLUC scenarios from the OTIMIZAGRO model and regional climate change models (HadGEM2-ES and MIROC5, RCP 4.5 and 8.5). Then, we will compute the demands of water by different sectors and integrate water availability and demand to reach an optimal water use based on the Nexus thinking. Our results will provide decision-makers with information regarding the risks and trade-offs and will support water resources management decisions in order to allocate scarce water resources toward food or energy.

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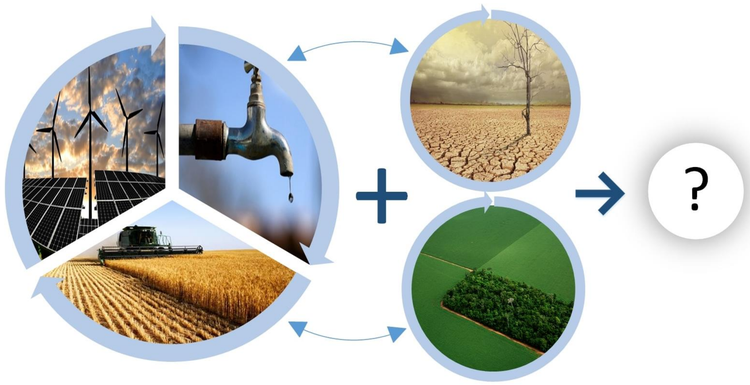
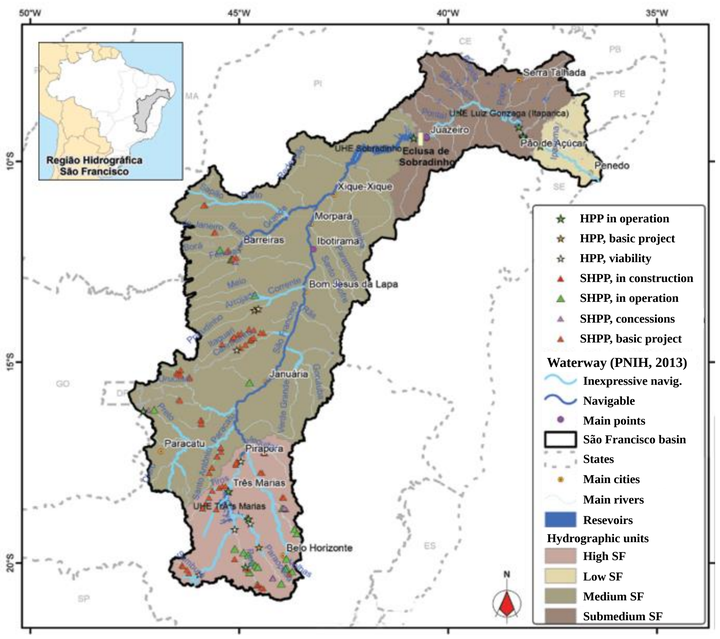
INTRODUCTION



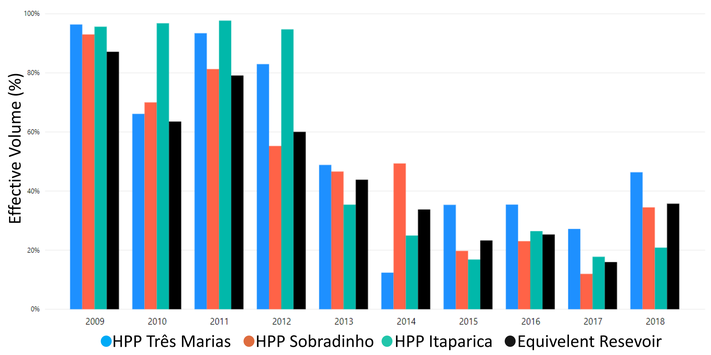
Brazil is one of the richest countries in water resources and is expected to become the largest exporter of agricultural and food products in the world (OECD-FAO, 2015). Furthermore, 62% of Brazil's energy is generated through hydropower plants (ANEEL, 2018). Therefore, to ensure water availability for future generations it is necessary to consider the Nexus thinking.

OBJECTIVES

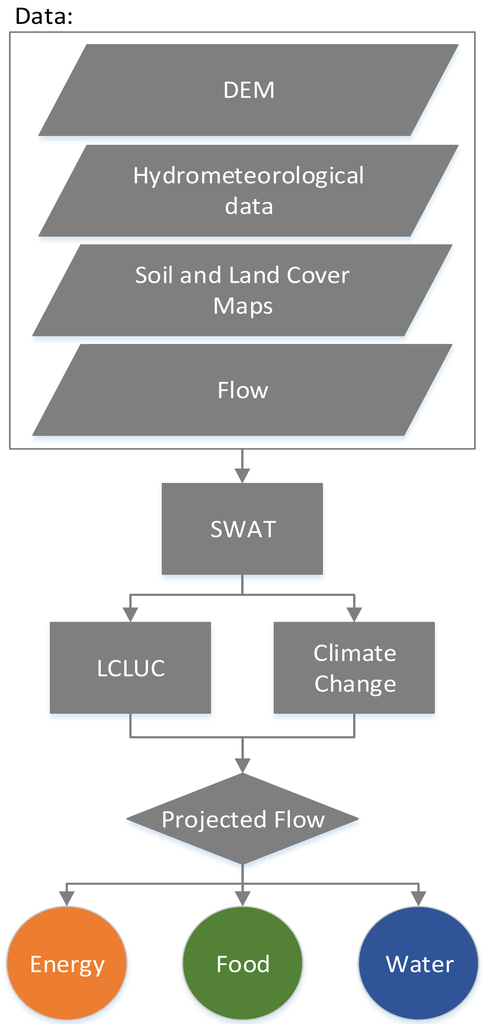
Here, we assess the Food-Energy-Water Nexus considering climate and land cover and land use changes (LCLUC) scenarios in the São Francisco river basin.

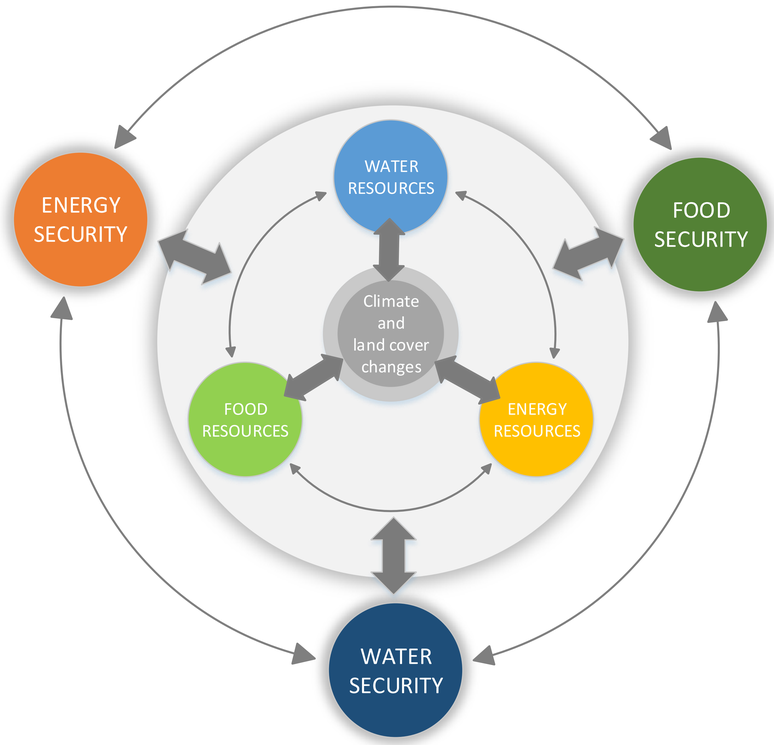


MATERIALS & METHODS



How to predict future water availability to meet the Food-Energy-Water demands in the São Francisco river basin?





CONCLUSIONS

Our results will provide decision-makers with information regarding the risks and trade-offs and will support water resources management decisions in order to allocate scarce water resources toward food and energy.

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