

A Framework to Evaluate the Nexus Food-Water-Energy Security in an Urban Area in Southeast of Brazil

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INTRODUCTION

This study aims to present a methodology for nexus food-water-energy assessment using as case study an urban area located in Angra dos Reis, Southern Coast of Rio de Janeiro State, Brazil (Figure 1). Currently the community lacks public services and equipment and is still exposed to all kinds of urban and environmental risks.

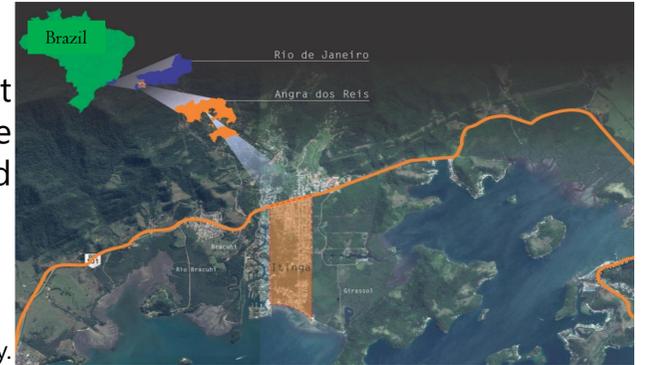


Figure 1 - Location of the area of study.

METHODOLOGY

From a pilot interviews in community carried out in 2018 (Figure 2), research in bibliography and official bases, twelve participatory indicators of food, water and energy security were proposed. The indicators was based on residents' perception and official bases availability at different scales (federal, state and municipal) and considered access and availability dimensions, related to the household level.

The reference values were established using the average of the official time series available in 10 years period. Afterwards, the thresholds were established for each indicator, according to national and international policies and organisms. The steps of the methodology are summarized in Figure 3.



Figure 2 - Interviews in community.

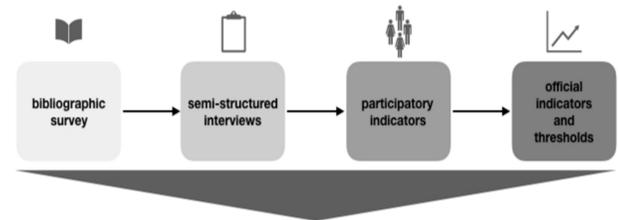


Figure 3 - Steps of methodology.

RESULTS

Partial results show the framework as shown in Figure 4. Irregular urban expansion in the study area contributes to contamination of water resources and the occurrence of floods. The electricity supply is precarious and the use of biogas and solar energy has been considered as an energy alternative for the neighborhood. The consumption of fresh food is below the recommended, even with the presence of local crops (Figure 5). All participatory indicators were organized in the Table 1. Future steps of the project consist in the establishment of all indicator scores and nexus evaluation.

Table 1 – Summary of participatory indicators, reference values and thresholds.

FOOD			
Indicator	Calculation	Reference Value	Threshold
1F – Consumption of FV	% of individuals who consume fruits, vegetables and vegetables five or more times/day, five or more days/week (including consumption of natural juices). Number max. for juices = 1. Satisfactory 3 or more daily portions of fruit and 2 or more daily portions of vegetables (lunch and dinner).	40,4% (IBGE – National Survey of Health)	43% (National Plan for Food and Nutrition Security, 2019)
2F – Consumption of fish/seafood	% of individuals who consume fish at least 1 time/week.	69,2% (IBGE – National Survey of Health)	100% (World Health Organization, 2004)
3F – Consumption of beans	% of individuals who claim to consume beans on five or more days a week	79,0% (IBGE – National Survey of Health)	100% (Food Guide for Brazilian Population, 2014)
4F - Local Acquisition of FV	% of respondents who claim to purchase fruits, vegetables and vegetables in local establishments (in the neighborhood).	13,9% (IBGE – Consumer Expenditure Survey)	100% (National Plan for Food and Nutrition Security, 2019)
ENERGY			
Indicator	Calculation	Reference Value	Threshold
1E - Access to electricity	% of residents interviewed who claim to have a regular electricity access.	100,0% (IBGE – Continuous National Household Sample Survey)	100% (UN – Sustainable Energy for All, 2012)
2E - LPG consumption	% of respondents who reported using LPG in food preparation not concomitantly with biomass sources.	99,5% (IBGE - Continuous National Household Sample Survey)	100% (UN – Sustainable Energy for All, 2012)
3E – Equivalent Frequency of Interruption	Weighted average frequency indicated by the interviewed residents.	13,16 (Brazilian National Agency of Electricity)	9 (Brazilian National Agency of Electricity, 2018)
4E – Equivalent Duration of Interruption	Weighted average duration of interruptions reported by the interviewed residents (hours).	25,92h (Brazilian National Agency of Electricity)	11h (Brazilian National Agency of Electricity, 2018)
WATER			
Indicator	Calculation	Reference Value	Threshold
1W - Water Supply	% of individuals claiming to have piped water (either from the grid or other alternative source).	92,9% (National Sanitation Information System)	100% (2030 Agenda, 2015)
2W - Water Availability of the Public Service	% of individuals who claims lack of water in the community (without considering periodicity).	60,9% (National Sanitation Information System)	73,3% (National Sanitation Plan, 2019)
3W - Water Quality of the Public Service	% of individuals who classify water as suitable for consumption.	35,0% (Water Quality Surveillance Information System fo Human Consumption)	100% (2030 Agenda, 2015)
4W – Sewage Treatment	% of individuals who claim to have sewage connected to the public collection system, including septic tank connected to the network.	41,9% (National Sanitation Information System)	100% (National Sanitation Plan, 2019)

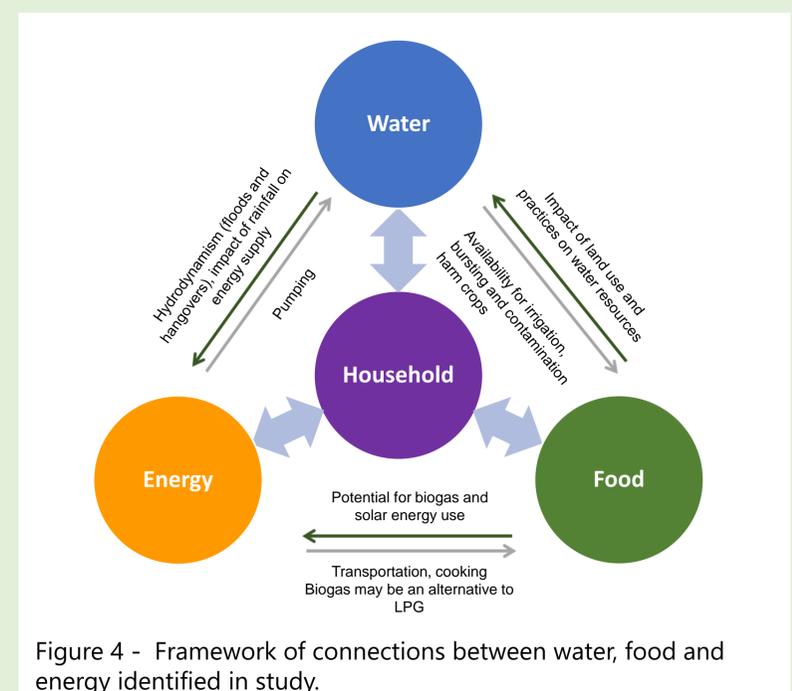


Figure 4 - Framework of connections between water, food and energy identified in study.



Figure 5 - House crops in community gardens.