

Introduction

- The resource nexus can be defined as a set of critical interlinkages among natural resources used as inputs for essential services to human life, such as water, energy and food, and their value chains (Bleischwitz et al. 2018).
- However, being a novel framework, the nexus is not yet embedded in resource use and management literature, which tends to analyse each resource separately.
- The nexus framework is intrinsically context-specific, as each respective region will have their particularities in terms of critical interlinkages. Hence, nexus research should ideally be conducted downscaled to a country or region focus.
- Being a large emerging economy, which economic activities are based to a great extent in agriculture and renewable resources, Brazil has proven to be a textbook-case for such effort (Mercure et al. 2019).

Objective

The aim of this paper is to propose a research agenda for the resource nexus framework in Brazil, raising the most important interlinkages between two or more resources and their underlying research gaps.

Method: Systematic Review

Definition of Resource Use and Management Practices

- The concept of resource use and management practices used refers to practices regarding:
 - Clean water provision for households, agricultural water uses, water treatment, solid waste and effluents disposal, sewage collection and Treatment
 - energy generation technologies
 - agriculture and livestock activities and techniques which produce food goods for the population.
- Krueger et. al (1986) and the European Commission (2002) define natural resource management as a means to cope with resource scarcity and ensuring their sustainability across time .

Systematic Review

Key words: "water" or "waste" or "food" or "energy" and "Brazil"

Scopus and Web of Science searches in English and Portuguese

Titles and abstracts reviewed

Exclusion criteria: (i) case studies in Brazil (ii) Describing specific practices for one or more resources.

Results

141 papers reviewed
135 practices found
47 practices involving two or more resources – resource interlinkages

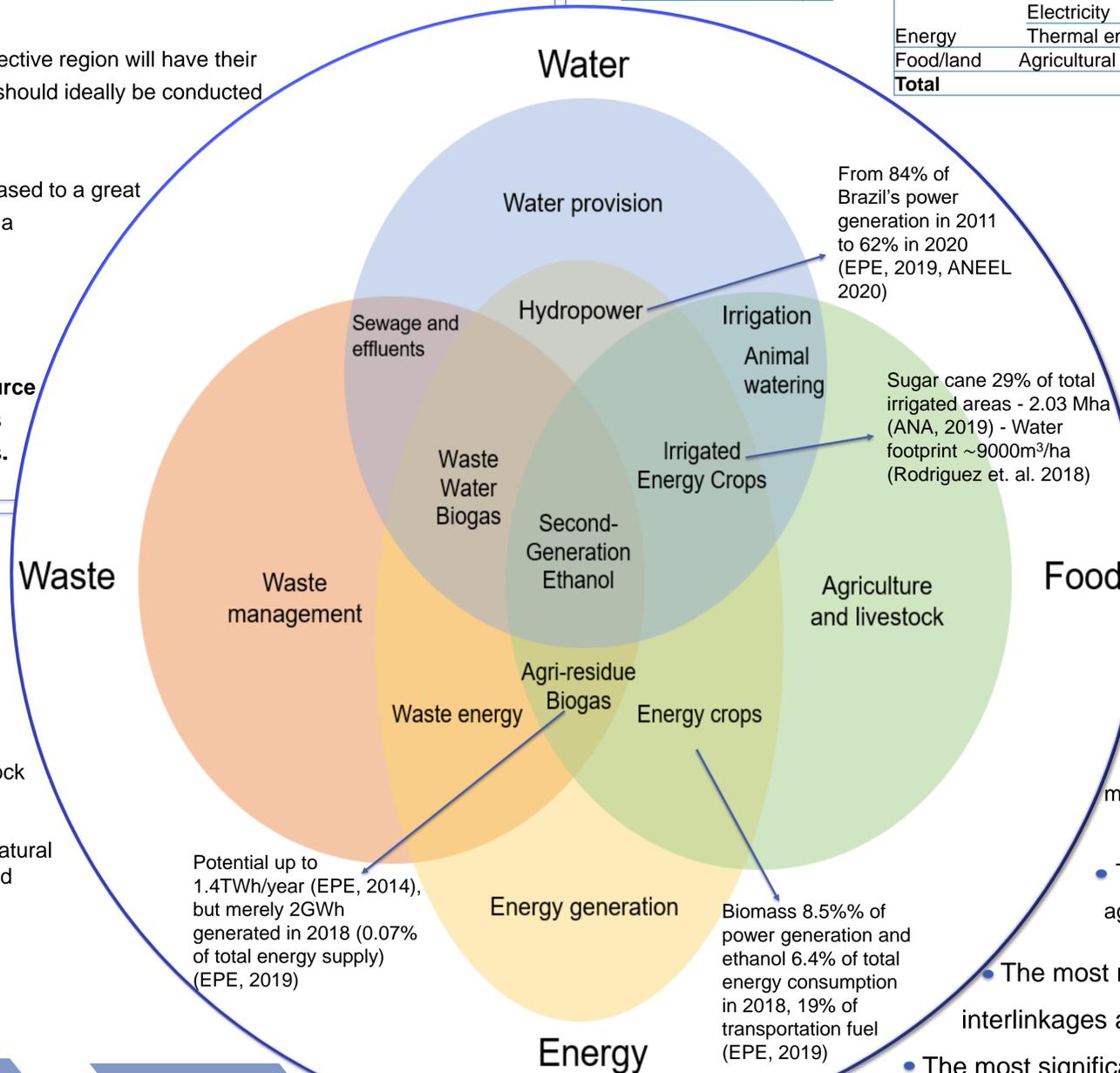
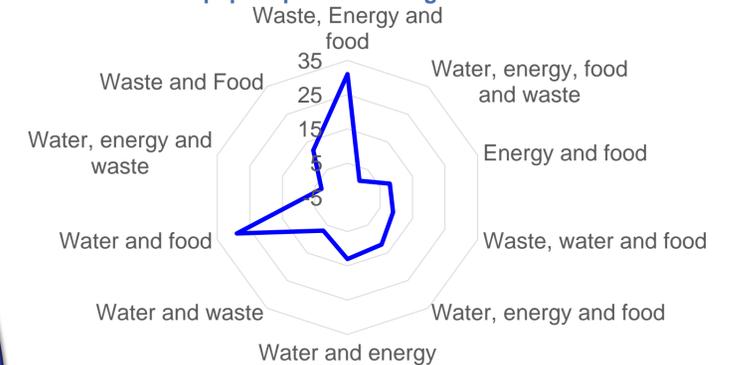
Number of Practices per resource analysed in each paper

Resource	Type of Practice	Σ Practices
Water	Agricultural water use	21
	Household water use	8
	Water treatment	5
	Solid Waste disposal	9
Waste	Effluents/sewage	15
	Agricultural waste disposal	9
	Electricity	21
Energy	Thermal energy	9
Food/land	Agricultural practices	38
Total		135

Finding interlinkages:

- Group papers per practice they describe;
- identify how many resources the described practices involve;
- Analyse how each of the resources is impacted
- Select critical interlinkages according to: incidence in the literature, number of resources impacted scale of use in the national context.

Number of papers per interlinkage identified



Main findings

- Although the reviewed literature is focused in one resource at a time, 35% of practices analysed involve two of more resources.
- Biogas technologies are seen by the literature as a potentially relevant synergy mostly between waste, energy and food for the medium to long term (31 papers).
- The water-food interlinkage is highly relevant due to the expansion of agriculture to areas where irrigation is necessary (29 papers).
- The most relevant **nexus research agenda** for Brazil lies in the resource interlinkages around **bioenergy and hydropower**.
- The most significant **trade-offs** in terms of **scale** are the **water-energy-food** interlinkage of **bioenergy** and the **water-energy** interlinkage of **hydropower**.
- Solar and wind** sources are the most prominent alternatives to tackle such trade-offs.

Paper under review: Renewable and Sustainable Energy Reviews Journal