Resource nexus for food security in the Anthropocene: A review

Huirong Yu, Pengfei Du

School of Environment, Tsinghua University

Introduction

Over the past decades, the human impacts on the natural environment have been so profound that a neologism “Anthropocene” (human-dominated geological epoch) was proposed. How to reconcile human food security with natural resource constraints has become a major challenge for sustainability worldwide in the Anthropocene.

Resource nexus refers to the interconnections between different natural resources or the linkage across resource sectors for provision services like food and water. The notion of resource nexus has now been widely adopted as a novel and promising way to address the food-natural resource challenge.

As far as we know, no review specifically explore to what extent resource nexus researches contribute to food security issue. Hence, this paper makes a systemic literature review on food-resource nexus, aiming to

i) have a comprehensive understanding of the interconnections between food and natural resources in the nexus,
ii) identify what kind of nexus approaches are available to ensure food security,
iii) discuss the challenges that pose to food security from a resource-nexus perspective and their further implications.

Methodology

A systemic review was conducted. The query terms “nexus” (or its synonyms like “linkage”, “link”, “interaction”, “interdependence”, “interconnection” and “interlinkage”) and “food security” were chosen for searching journal articles in both Web of Science and Scopus. And four rounds of screening were applied to carefully select useful literature (Fig.1).

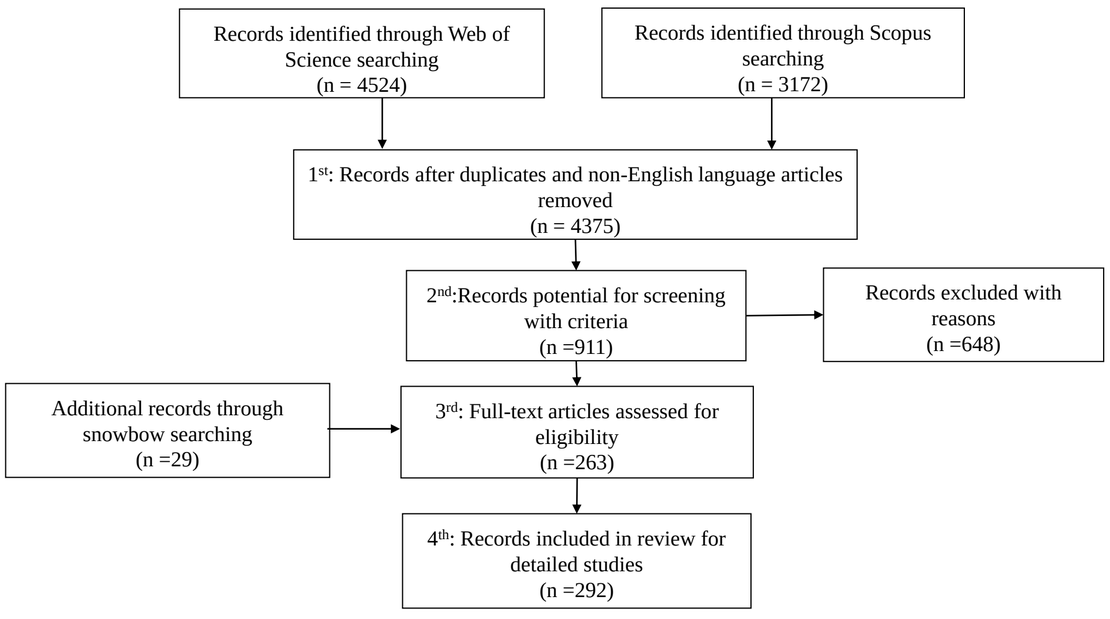

Fig.1 Flow diagram of data collection process

Food-natural resource interactions

The role of food in nexus

➢ Sink of resource use

Land, water, energy and fertilizer minerals are the main resource inputs for food production (Fig.2).

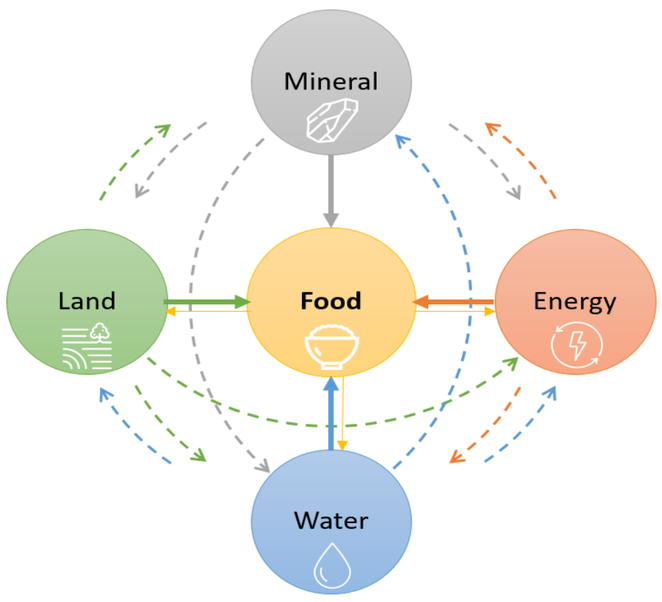

Fig.2 The role of food in nexus

➢ Catalyst of resource reallocation

Embodied land, water, energy and fertilizer minerals in food are reallocated via trade.
Inappropriate reallocation may cause environmental pollution and resource insecurity.

Physical interactions

Food has complex physical interactions with land /water /energy /mineral along its supply chain (Fig.3).

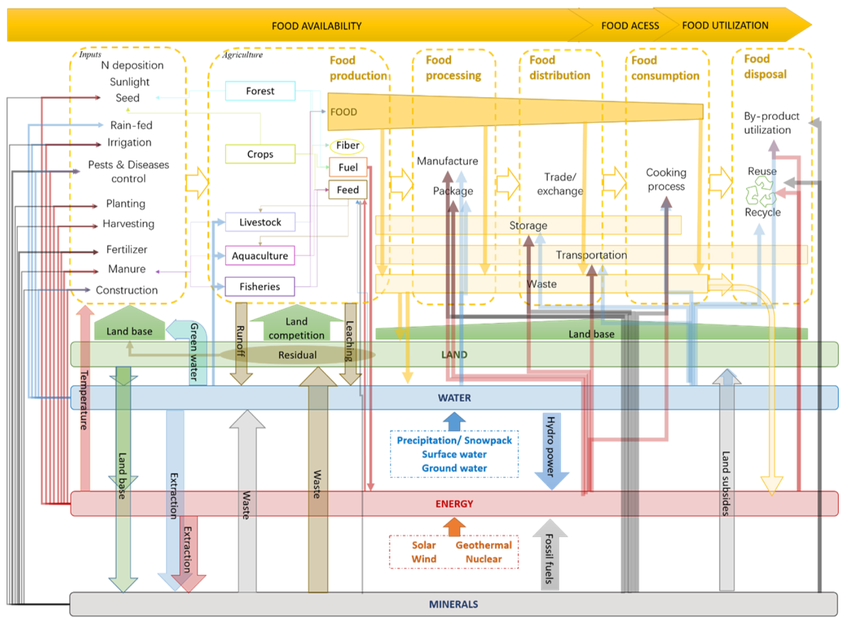

Fig.3 Interlinkages of food and natural resources

Nexus approaches for physical interactions:
Substance/Material flow analysis; Life cycle assessment; Production model; Dynamic system model; Biogeophysical model; Probabilistic modelling; Envrionmental footprint analysis, etc.

Non-physical interactions

Non-physical interactions refer to all the socio-economic interactions among stakeholders in resource use for food security (Tab.1).

Tab.1 Main nexus stakeholders for food security

Resource nexus	Food security		
	Stable food availability	Stable food access	Stable food utilization
Water Land Energy Mineral	Resource owner; Miner; Fertilizer factory; Food producer (farmer, processor) ; Government; Academic institute Food Enterprise; etc.	Food retailer; Market; Supermarket; Transporter; Logistics; Government; Trader; Food consumer; NGOs; etc.	All stakeholders

Nexus approaches for non-physical interactions:
(Multi-regional) environmental-extened Input-output model; Agent-based model; scenario analysis; social network analysis; etc.

Challenges

- Overlooked mechinsm and theoretical foundations of resource nexus for food security
- Further integration of physical and non-physical nexus studies
- Exploration of regional differences in resource nexus
- Multi-scale and cross-scale issues
- Gap between research and policy-making

Conclusion

- Resource security is the key prerequisite for food security.
- Food is both the sink of resource use and catalyst of resource reallocation.
- Great progresses have been made in the nexus approaches, but there are still several challenges.
- Nexus research calls for broader collaboration among interdisciplinary scholars and multi-stakeholders.

Email: hyu@tsinghua.edu.cn
School of Environment
Tsinghua University
Beijing 10084, China