RISKKAN
Knowledge Action Network

Metabolic Risk on Islands (MRI)

A RISK-KAN Working Group

Working Group Lead & Risk KAN Development Team contact:

Simron J. Singh, Faculty of Environment, University of Waterloo, Canada; simron.singh@uwaterloo.ca

Core team:
Tailin Huang, National Cheng Kung University, Taiwan; tailinhuang@mail.ncku.edu.tw
David Bristow, University of Victoria, Canada; dbristow@uvic.ca
Nidhi Nagabhatla, UN University & McMaster University, Canada; Nidhi.Nagabhatla@unu.edu
Pia-Johanna Schweizer, Institute of Advanced Sustainability Studies, Potsdam, Germany; Pia-Johanna.Schweizer@iass-potsdam.de

We welcome colleagues to join as WG members to participate or remain informed by subscribing to MRI mailing list here: https://www.risk-kan.org/

RATIONALE

Islands are sites of compounding events and multiple risk exposures. They suffer disproportionally from the effects of climate change such as sea-level rise, more frequent and intense hurricanes, increased flooding, droughts and water-stress. Islands are also characterized by sustainability problems such as limited resources and waste absorption capacity, isolation from markets, and heavy reliance on imports to meet basic needs such as food, energy and construction materials [1]. Disruptions from hurricanes or pandemics result in abrupt breakdown of supplies and reveal the vulnerability of such systems.

The ability for small island economies to withstand shocks is limited, and losses tend to be disparate relative to the size of the island economy [2]. Infrastructure damage from extreme weather events not only result in accumulation of a large volume of debris, but also the immediate loss of societal services such as shelter, sanitation, transport, food and energy. Restoring infrastructure comes with large fiscal and material requirements for reconstruction and causes environmental pressures at different scales.

AIM

The aim of the MRI working-group is to analyse the material basis of island economies and their impact on social well-being. An important goal is to offer policy-relevant insights for greater resource security and self-reliance. Island cases offer evidence on the linkages between societal resource use, metabolic risks, system vulnerability, and prospects for a sustainability transformation. This working-group also fulfills a recognized need for statistical capacity of island states and island jurisdictions to monitor progress towards sustainability.

Some of the questions we ask are: What is the aggregate material flow, stock, circularity, and vulnerability dynamics of each island? What are the spatially explicit end-uses of material stocks for each island? What are the associated metabolic risks with respect to distinct resource-use patterns? What are possible strategies, and their effects, to increase resource security and social wellbeing that achieves a high quality of life at a low environmental cost? How can material resources most effectively be used to limit losses and to recover services in the aftermath of climate-change induced disasters?

APPROACH AND CONCEPTS

Island socio-ecological systems are the unit of analysis. **Socio-metabolic research** (SMR) offers a compelling interdisciplinary framework to analyze the material basis of socio-economic systems [2]. SMR is a research tradition within *Industrial Ecology* (IE) for systematically studying the biophysical stocks and flows of material and energy associated with societal production and consumption. SMR offers crucial insights to develop strategies to reconfigure and reduce societies' use of natural resources that is compatible with ecological boundaries, while also providing essential services to reach social thresholds.

As economies develop, they stimulate the demand for **essential services** provided by the built environment (also referred to as **in-use stocks of materials** or simply "stocks"), and hence viewed as the material basis of societal well-being. The growth and maintenance of these material stocks occur by mobilizing **material and energy flows**, either from domestic sources or through imports from other societies. The larger the stocks, the greater the flows required to maintain and reproduce these stocks, creating a feedback loop, referred to as the **material stock-flow-service** (SFS) nexus [3].

This process of organizing and reproducing material stocks and flows by society has been referred to as **social metabolism** (Figure 1). The size and composition of resource throughput in a socioeconomic system characterises its **metabolic profile** and is indicative of the pressure an economy exerts on the environment [4]. Specific combinations of material stocks and flows can become a **metabolic trap** and contributes to the system's exposure to risk, referred to as the **metabolic risk** [5]. Systems that exhibit high metabolic risks are vulnerable to shocks and disruptions such as from hurricanes or pandemics. A **metabolic collapse** occurs when external influences guide the system into a **complex disaster**, where the system's ability to organise its **social metabolism** is severely compromised, by interfering with its cultural, economic, and political regulation [6], [7].

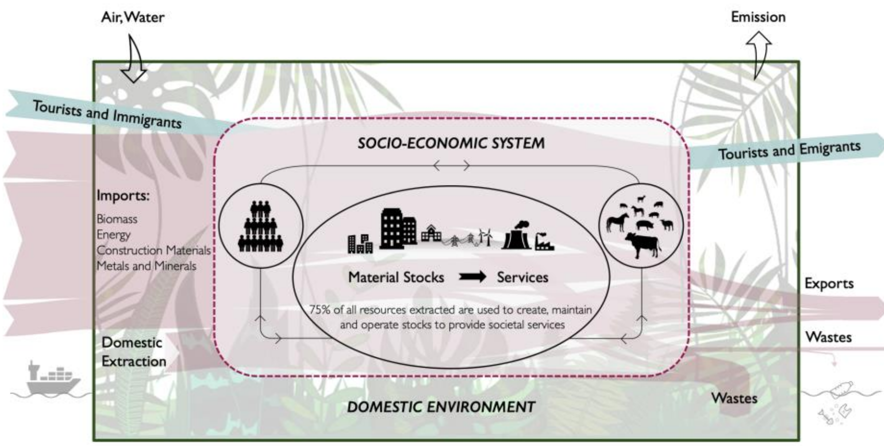

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Figure 1: Specific combinations of material stocks and flows contribute to the systems exposure to risk (metabolic risk), and its ability to provide essential services.

This working-group invites scholars from various disciplines such as industrial ecology, social and human ecology, disaster studies, political ecology, ecological economics, human geography, and engineering to analyze intrinsic and extrinsic systemic risks on islands with respect to their resource-use patterns. We invite colleagues interested in research that empirically examines and further develops concepts as metabolic risk, metabolic collapse, tipping points, and complex disasters with respect to islands. Fostering a transformation to sustainability through policy-relevant insights that are just, inclusive and equitable will be a core concern of such enquiries. The working-group encourages collaborative efforts with respect to joint research projects, publications, graduate supervision, and events.

Cited Literature

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Special journal issue of interest:

S. J. Singh, M. Fischer-Kowalski, and M. Chertow, Eds., *The Metabolism of Islands*. Sustainability. MDPI, 2020.
https://www.mdpi.com/journal/sustainability/special_issues/metabolism_islands