



May 2018

## Cross-scale challenges of the Anthropocene



PHOTO: S. STACEY/WORLDFISH

### Brief abstract/summary

As the world becomes more interconnected, resilience depends on maintaining diverse response capacities to global changes. Interventions for sustainable development are affected by processes taking place over both larger and smaller space- and time-frames than the interventions themselves.

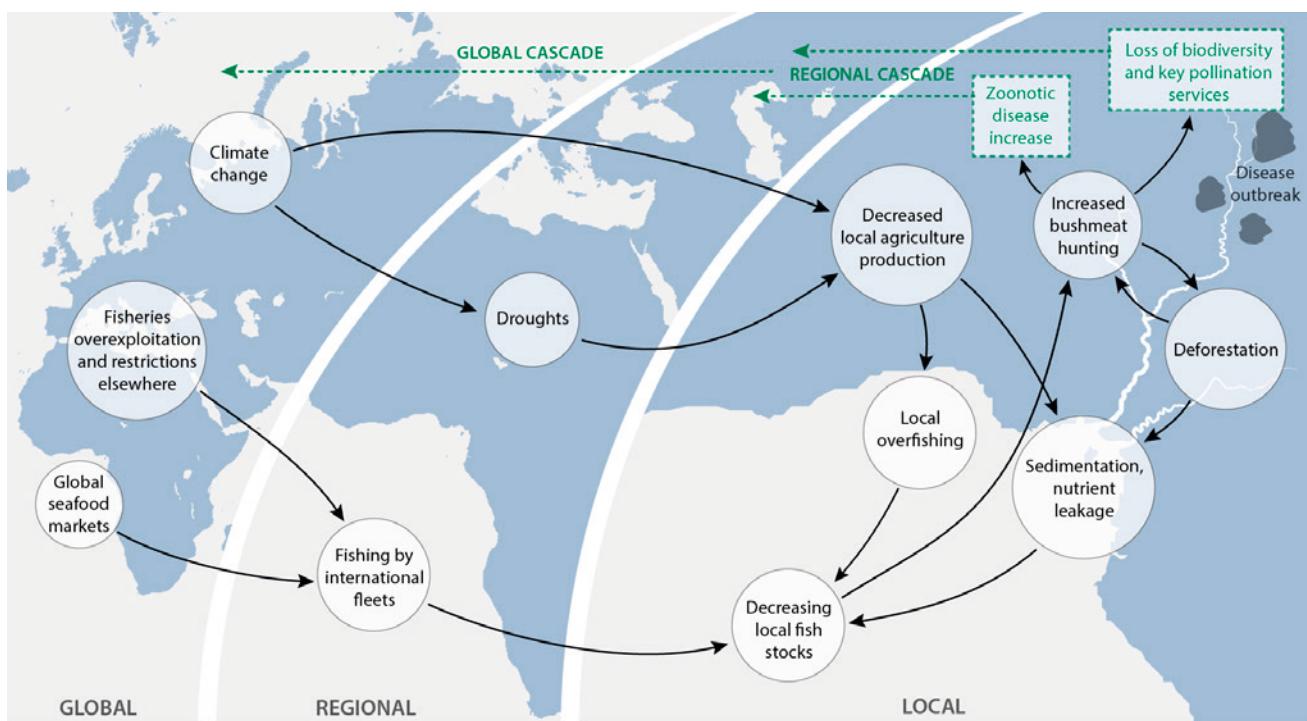
### Key messages

- The world is increasingly connected: the local influences the global and vice-versa, often in new and unpredictable ways, creating risks and opportunities.
- Mapping out cross-scale connections can help identify solutions that may lie beyond problems' perceived borders
- Impacts of development interventions will be felt – and should be accounted for – beyond local/national borders.

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At Stockholm Resilience Centre

A programme funded by the  
Swedish International Development Cooperation Agency (Sida)



Societies and ecosystems at local, regional and global scales are interconnected. Processes at global and regional scales (climate change and international fishing fleets) impact on local processes around Gulf of Guinea, and how events such as local disease outbreaks can 'cascade' up to affect larger systems (adapted from Galaz et al 2011). Illustration: J. Lokrantz/Azote

## The interconnected Anthropocene:

Societies, economies and ecosystems are increasingly interconnected in the human-dominated conditions of the Anthropocene. Development interventions and needs at local scales are impacted by global processes such as climate change, migration, international trade, spread of invasive species, and technology diffusion. Meanwhile, events in local places can spread outwards and upwards to affect regional or even global scales.

Recent food price spikes provide an illustration of the global-scale of energy prices, aggregate food production, and financial markets triggered shocks to societies and places around the globe<sup>1</sup>. Meanwhile the global epidemic of avian influenza illustrates a local-to-global effect, where increased densities of humans and domestic animals and loss of natural wetlands in one part of the world, rapidly spread through the connectivity of the international trade in poultry and wild birds<sup>2</sup>.

Globalisation contributes to specialisation and homogenisation, whereby systems, practices, processes and technologies become more similar in different places across the

globe. Such homogenisation can provide increased economic efficiency in the short term, but can reduce resilience by increasing connectivity and exposure to cross-scale shocks, and by reducing the diversity of responses and sensitivities that people have to change.

## How do cross-scale dynamics influence development in the Anthropocene?

In the Anthropocene, action to mitigate stressors at global or regional scales (for example reducing carbon emissions) are critical, but local interventions are also needed to build resilience to global stressors, while addressing local stressors<sup>3</sup>. Local resilience requires a diversity of responses and processes, so that connected systems with different sensitivities and responses can help each other regenerate after local shocks or stresses<sup>4</sup>. This is particularly relevant in the context of the Sustainable Development Goals (SDGs), which were defined at a global scale for local application: here interventions should be designed to specific development needs of particular contexts, rather than being blanket interventions applied across systems.

However, the connectivity between places and scales requires that local interventions need to be understood in

1 Tadasse, G. et al. 2016. Drivers and Triggers of International Food Price Spikes and Volatility. In: *Food Price Volatility and Its Implications for Food Security and Policy*, 59–82. Springer, Cham. [https://doi.org/10.1007/978-3-319-28201-5\\_3](https://doi.org/10.1007/978-3-319-28201-5_3)

2 Galaz, V., Moberg, F., Olsson, E.-K., Paglia, E. & Parker, C. Institutional and Political Leadership Dimensions of Cascading Ecological Crises. *Public Adm.* 89, 361–380 (2011).

3 Scheffer, B. M. et al. Creating a safe operating space for iconic ecosystems. *Science* (80-. ). 347, 1317–1319 (2015).

4 Homer-Dixon, T. et al. Synchronous failure: The emerging causal architecture of global crisis. *Ecol. Soc.* 20, (2015).

## Case study: Western Indian Ocean Octopus Fisheries: Subject to top-down global market forces, but also benefitting from bottom-up emergence of new management practices

Octopus harvested by small-scale fishers around the shores of the Western Indian Ocean increasingly enter international seafood market chains. As local fisheries become connected, demand, supply and price of Octopus in importing countries can lead to local price increases, overexploitation and competition for resource access that can harm marginalised groups such as women.<sup>8</sup>

However, cross-scale dynamics can also allow management innovations to spread and scale out. A pilot-study including a six-week octopus fishery closure in Madagascar in 2004 has since been replicated over 200 times, now also including other types of fisheries. Local fishery closures have led to the buy-in and co-management of locally managed marine areas (LMMAs) by fisheries and conservation authorities.

The octopus fishery initiative was successful as it addressed the root problem local fishers' incentives, and targeted monitoring and communication to demonstrate how the benefits of the fishery closure outweighed short-term losses. Further communication and exchange facilitated buy-in to the initiative across the region, and cooperation between fishery and conservation authorities and commercial traders. Fishery closures are managed differently in the different areas, fitting the overarching benefits to local situations and needs<sup>9</sup>. Local and regional success is driving further innovations in management that connect with other global developments, for example the development of eco-certification for fishery products.

<sup>8</sup> Porter, M., R. Mwaipopo, R. Faustine, and M. Mzuma. 2008. Globalization and Women in Coastal Communities in Tanzania. *Development* 51(2):193–198.

<sup>9</sup> Roccliffe, S. & Harris, A. Scaling success in octopus fisheries management in the Western Indian Ocean. *Proceedings of the workshop*, 3–5 December 2014, Stone Town, Zanzibar. 44, (2015).

terms of how they are connected to a larger context and longer timescale. For example, national reforestation programmes that do not address the demand and use of wood resources, may have no impact on global carbon budgets if it stimulates deforestation beyond national borders<sup>5</sup>. The problem can also spill over from forests to affect political, or food systems. Similarly, local management of marine resources can fall victim to 'roving bandit' effects, as seafood and trading operations repeatedly divert from one stock to the next as each is overexploited. Such pressures can overwhelm local institutions and require an adaptive and cross-scale approach that addresses multiple and sometimes distant causes<sup>6</sup>.

<sup>5</sup> Liu, J. Forest Sustainability in China and Implications for a Telecoupled World. *Asia Pacific Policy Stud.* 1, 230–250 (2014).

<sup>6</sup> Berkes, F. et al. Globalization, Roving Bandits, and Marine Resources. *Science* (80-. ). 311, 1557–1558 (2006).



An octopus fisherman with his catch in Kenya. Global markets for Octopus are increasingly spreading through the driving higher prices, competition that can displace women from the fishery and overfishing. However, a participatory management innovation of temporary closures are also spreading with the potential to improve the sustainability and benefits of the fishery. Photo: O. Henriksson/Azote Images

Mapping out these cross-scale connections can identify risks but also opportunities for finding synergies between solutions to local problems may and development in geographically distant areas. For example, rain-fed agriculture in Pakistan and India – while vulnerable to changes in local water-cycling – could benefit from reforestation in Europe through the recycling of moisture released from the vegetation<sup>7</sup>. Meanwhile, connectivity can also allow successful interventions to rapidly scale out and be reproduced (see Box).

<sup>7</sup> Keys, P. W. et al. Analyzing precipitationsheds to understand the vulnerability of rainfall dependent regions. *Biogeosciences* 9, 733–746 (2012).

## Further reading:

### Global gambles in the Age of Humans

People's activities have changed the whole planet so much that they are triggering entirely new types of risks. Cutting-edge research looks at improving the odds for our gambles with the Earth, both now and into the future

Rethink article, February 2018

[www.rethink.earth/global-gambles-in-the-age-of-humans/](http://www.rethink.earth/global-gambles-in-the-age-of-humans/)

### Women hunters in the octopuses' gardens

Octopus represents both food and profit for small-scale fishers who live along the shores of the western Indian Ocean.

Changes in the region have implications for fisherwomen that need to be addressed by fisheries policy and management to become more gender equitable

Rethink article, June 2017

[www.rethink.earth/women-hunters-in-the-octopuses-gardens/](http://www.rethink.earth/women-hunters-in-the-octopuses-gardens/)

### Amazon on the edge

Combined pressures on the Amazon are pushing it towards a tipping point, which may be much closer than scientists previously thought. Can a new economic paradigm emerge to prevent it?

Rethink article, May 2017

[www.rethink.earth/amazon-on-the-edge/](http://www.rethink.earth/amazon-on-the-edge/)

These two scientific papers highlight cross-scale and cross-system connections from three different perspectives, while using clear definitions and structures:

Pascual, U., Palomo, I., Adams, W. M., Chan, K. M. A., Daw, T., M, Gómez-baggethun E., de Groot, R., S. and Mace, G., M. 2017. Off-stage ecosystem service burdens: A blind spot for global sustainability. *Environmental Research Letters*. 12 075001. <https://doi.org/10.1088/1748-9326/aa7392>

Liu, J., V. Hull, M. Batistella, R. DeFries, T. Dietz, F. Fu, T. W. Hertel, R. C. Izaurralde, E. F. Lambin, S. Li, L. A. Martinelli, W. J. McConnell, E. F. Moran, R. Naylor, Z. Ouyang, K. R. Polenske, A. Reenberg, G. de Miranda Rocha, C. S. Simmons, P. H. Verburg, P. M. Vitousek, F. Zhang, and C. Zhu. 2013. Framing sustainability in a telecoupled world. *Ecology and Society* 18(2): 26.

<http://dx.doi.org/10.5751/ES-05873-180226>

The following article brings the concept of response diversity into social-ecological systems thinking:

Leslie, P. and McCabe, J.T. 2013. Response diversity and resilience in social-ecological systems. *Current Anthropology* 54, no. 2 (April 2013): 114–143.

<https://doi.org/10.1086/669563>

## GRAID insight briefs

This brief is part of a series which introduce key insights from social-ecological resilience research, and how they relate to challenges of development in the Anthropocene.

Human actions increasingly dominate the biosphere, the thin living surface of the earth on which people depend. The complex feedbacks between social and ecological processes and interconnections and between different places can lead

to surprising sudden changes, as well as inertia in undesirable states. Awareness of the Anthropocene challenge and the complex behaviours of social-ecological systems highlights the need to embrace uncertainty, explore how stewardship can be supported at different scales, and for transformational change for a sustainable and just development.

For the full text of all briefs in this series visit [www.graid.earth](http://www.graid.earth)



### For further information, please contact:

GRAID

Stockholm Resilience Centre,  
Stockholm University, SE – 106 91 Stockholm  
[graid/src@su.se](mailto:graid.src@su.se)

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