RADICAL INTERVENTIONS FOR CLIMATE-IMPACTED MARINE SYSTEMS

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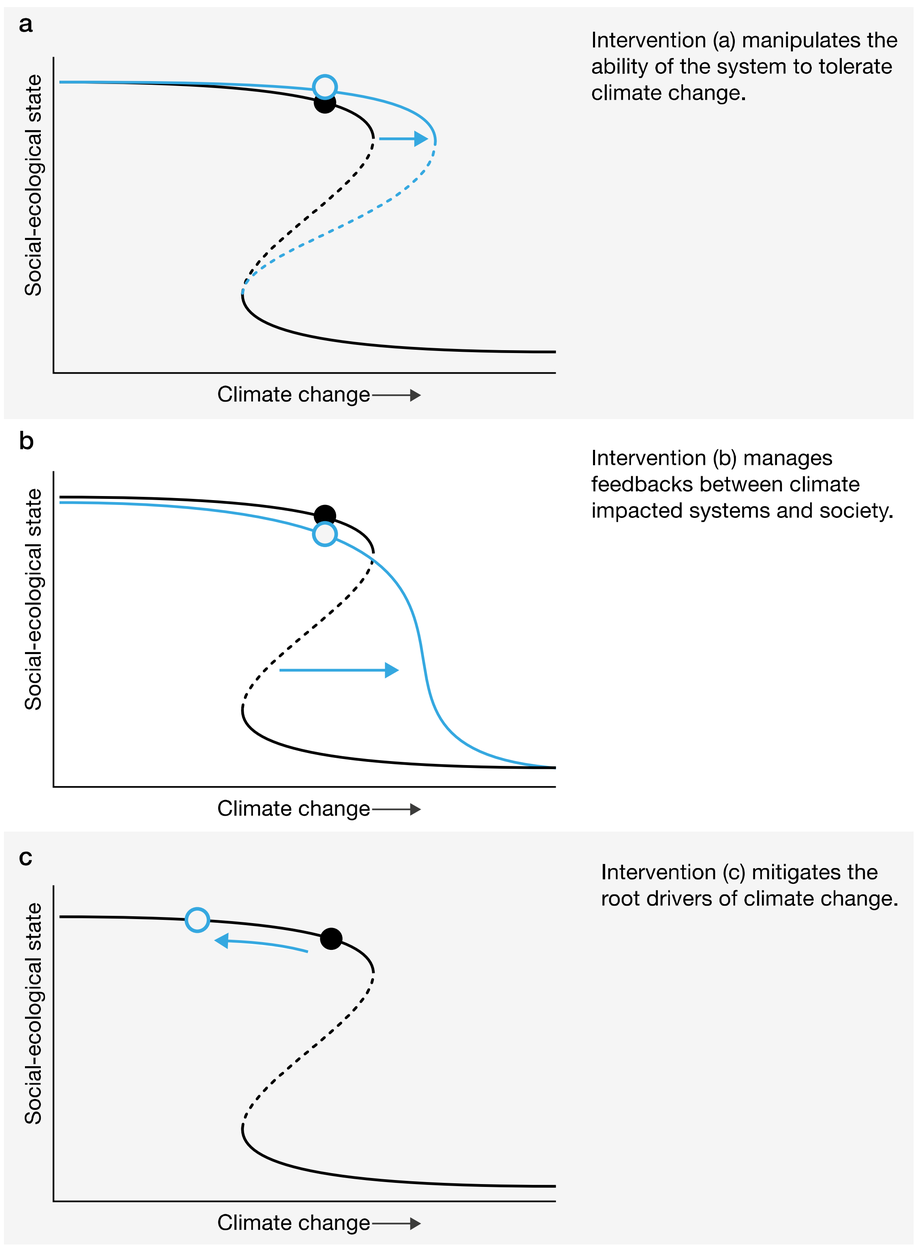
Summary

Standard solutions to the threat of >1.5 °C global average warming are not ambitious enough to prevent large-scale irreversible loss. Meaningful climate action requires interventions that are preventative, effective and systemic—interventions that are radical rather than conventional. New forms of radical intervention are already emerging, but they risk being waylaid by rhetorical or misleading claims.

Here, to encourage a more informed debate, we present a typology of radical intervention based on recent studies of resilience, transition and transformation. The typology, which is intended to be provocative, questions the extent that different interventions can disrupt the status quo to address the root drivers of climate change.

1 System effects of common modes of climate intervention



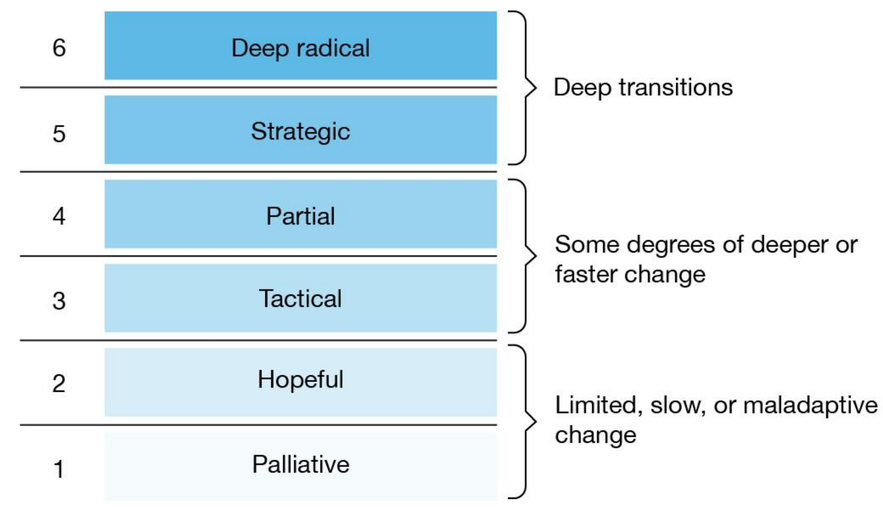
The nonlinear equilibrial response of a social–ecological system (y axis) is plotted as a function of the strength of multiple interacting climate drivers (x axis). The blue lines indicate an alternative response curve, modified by interventions, and the blue and black dots show the shift in the state of the system (for a given intensity of climate change) due to interventions.

Different climate interventions can shift thresholds to avoid (or trigger) transitions **(a)**, manipulate feedbacks to change the shape of the equilibrial relationship between drivers and system state **(b)**, or reduce climate change drivers to avoid transgressing thresholds **(c)**. Importantly, modifying thresholds and feedbacks (**a** and **b**) to tackle proximate impacts and causes will rarely have lasting or meaningful system effects unless the root drivers of climate change are also addressed **(c)**.

2 Types of climate intervention

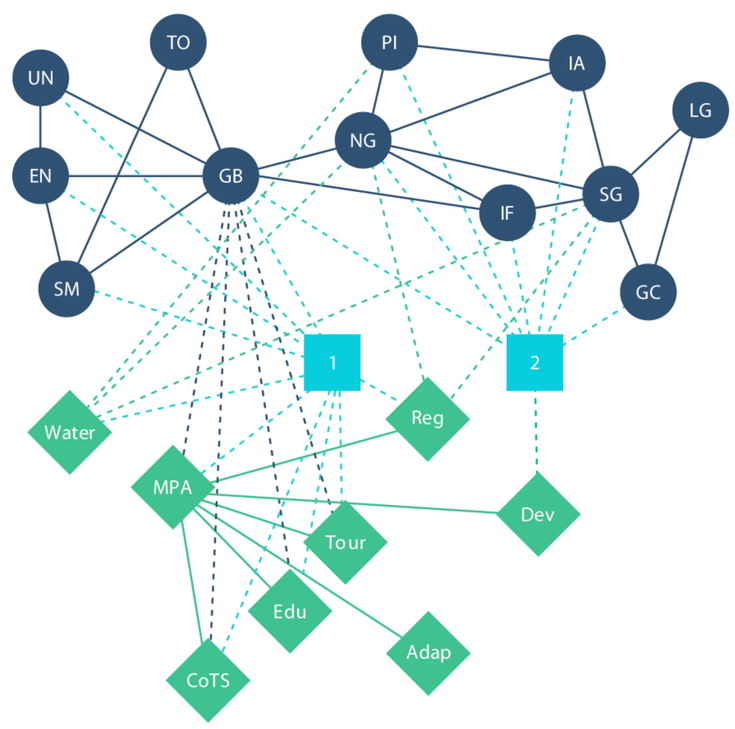
Debates about radical intervention invoke at least six different interpretations of 'radical'.

These interpretations can be viewed as a typology, with each type reflecting the extent to which the intervention disrupts the *status quo* to address the root drivers of climate change.



3 Polycentric governance of marine climate interventions

New ways to think about governance of radical marine interventions could include adding or removing links in a polycentric network to improve synergies and legitimacy of more radical interventions.



GOVERNANCE ACTORS:
EN = Environmental NGOs
GB = Marine Park Authority
GC = Government-owned Corporations
IA = Industry Associations
IF = Intergovernmental Forum
LG = Local Government
NG = National Government
OA = Other Actors
PI = Private Industries
SG = State Government
SM = Science and Media
TO = Traditional Owners
UN = UNESCO

DECISION-MAKING VENUES:
1 = Ministerial Forum
2 = UNESCO World Heritage Committee

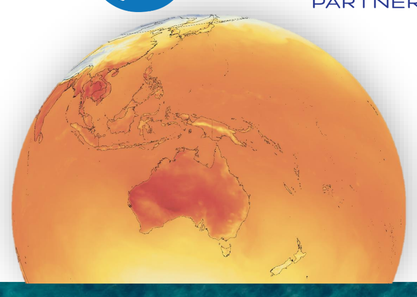
INTERVENTIONS:
Adap = Climate Adaptation Planning
CoTs = Pest Control
Dev = Development Control
Edu = Community Education
MPA = Biodiversity Protection
Reg = Fishing Regulation
Tour = Sustainable Tourism
Water = Water Quality

Future Directions

Climate impacts are creating novel marine ecosystems, stimulating new interventions to conserve oceans and communities. Novel interventions include blue economy, blue carbon, and blue conservation approaches that mitigate climate change (e.g. offshore renewable energy development, seaweed restoration, carbon trading) and promote conservation and adaptation (e.g. assisted marine animal and plant migration, marine climate refuge protection, solar-radiation control).

Novel interventions require transitions in governance to realise new opportunities, meet escalating demand for marine resources, and manage risks and unintended consequences. Achievement of these multiple outcomes is limited by a lack of understanding of which governance arrangements are enabling deep transitions for nature and people.

Our new **ARC** and **SNAPP** funded working group works directly with governments, NGOs, and donors to co-create practical guidance on how to govern new marine interventions in a changing climate. Chief Investigators include: Tiffany Morrison, Gretta Pecl, Pip Cohen, Emily Ogier and Terry Hughes (see: **https://snappartnership.net/teams/governing-changing-oceans/**)



Left: Global surface temperature average, March 23, 2023, 08:00

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