

Adapting to climate change impacts when opportunity knocks

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A changing climate is causing impacts worldwide

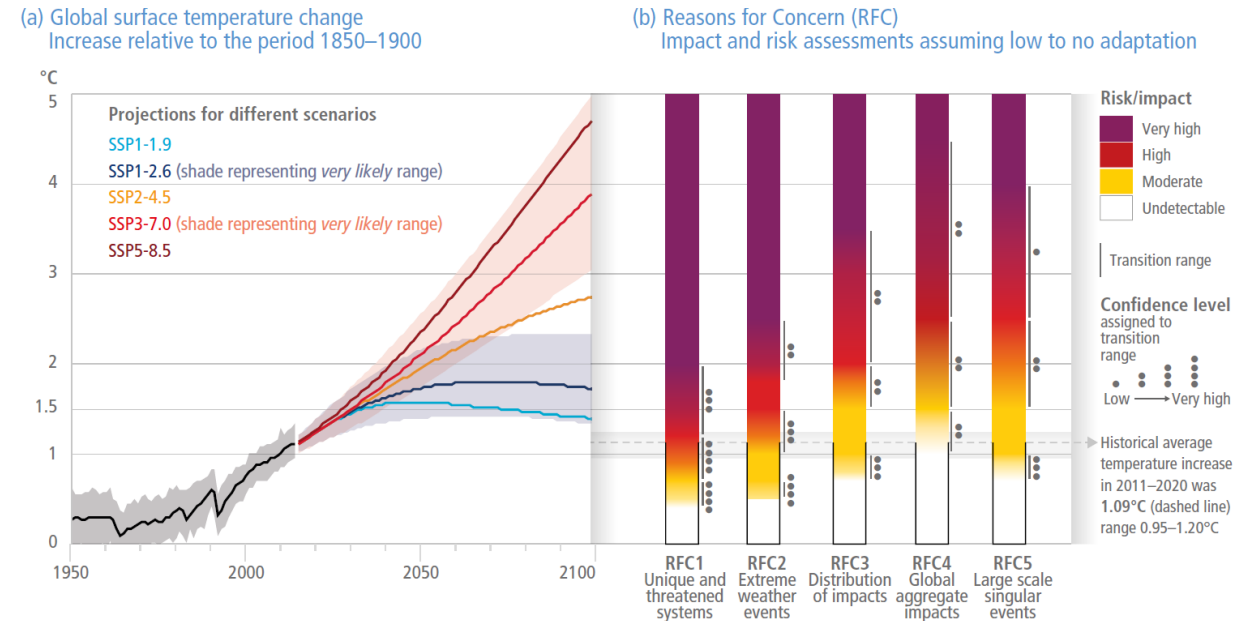
IPCC Sixth Assessment Report

- *Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damages to nature and people (high confidence).*
- *For any given future warming level, projected long-term impacts are up to multiple times higher than currently observed (high confidence). Risks and projected adverse impacts and related losses and damages from climate change escalate with every increment of global warming (very high confidence).*

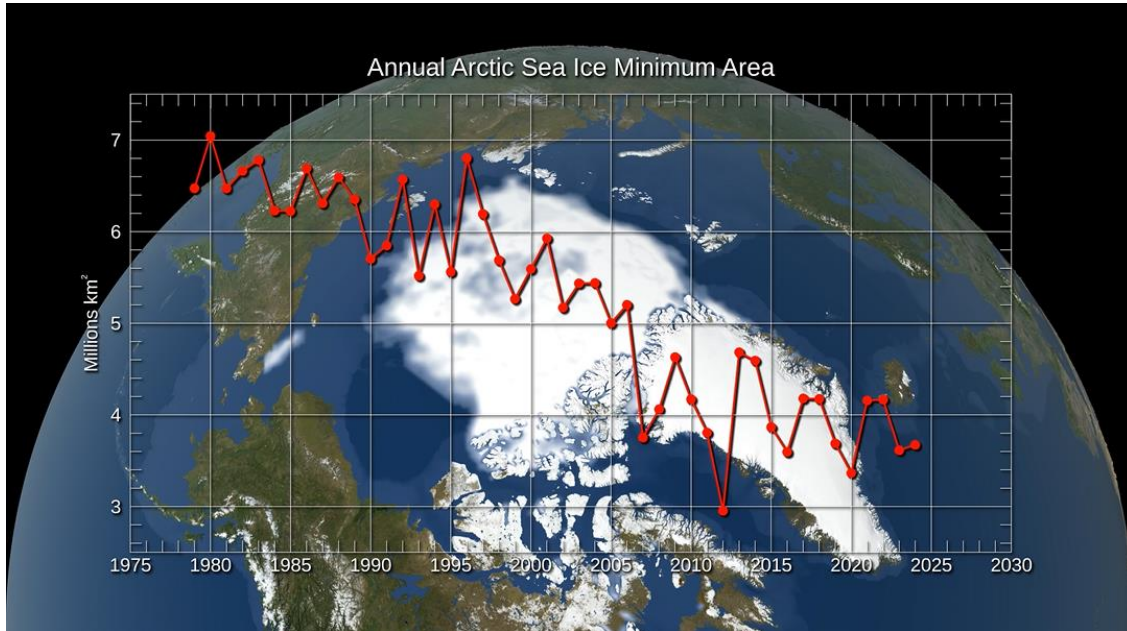
Source: IPCC (2023)

- **However, not all impacts are adverse**
- *Climate change also has positive implications (benefits and opportunities) for certain people and systems, although there are gaps in the literature on these positive effects*

Source: O'Neill et al. in IPCC (2022)



Retreat of Arctic Sea Ice & thawing ice on land



Source: NASA/Goddard Space Flight Center Scientific Visualization Studio

The Blue Marble data is courtesy of Reto Stockli (NASA/GSFC), <https://svs.gsfc.nasa.gov/5395/> (4 Oct 2024)

Human influence is *very likely* the main driver of the global retreat of glaciers since the 1990s and the decrease in Arctic sea ice area between 1979–1988 and 2010–2019 (decreases of about 40% in September and about 10% in March).

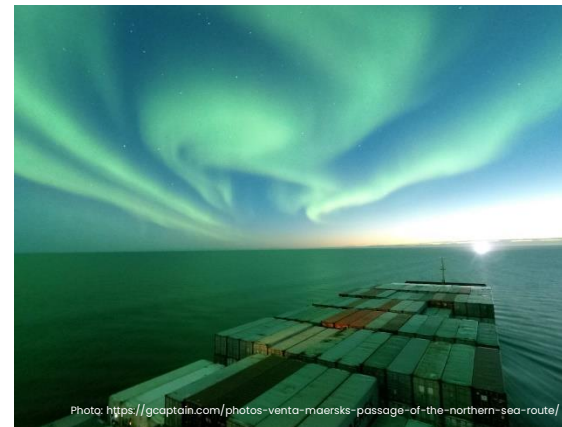
Source: IPCC (2021)

Potential opportunities










- New access to mineral resources
- Opening of shorter shipping routes for trade
- Northward shift of fish stocks
- Arctic tourism

Potential risks

- Geopolitical & security concerns
- Indigenous communities' livelihoods & displacement
- Pollution & loss of unique habitats & species
- Limited emergency response



Some examples of opportunities and associated risks

	Sectors	Examples of opportunities from potentially beneficial impacts of change change	Risks and barriers in adapting to realise opportunities
	Agriculture, forestry & fisheries	Increased productivity; novel species; multi-cropping, increased outdoor grazing, increased biomass for energy	Water scarcity; poor water quality; soil degradation; pests, pathogens & weeds
	Business	New products & services, e.g.: consultancy & advice; monitoring; engineering, manufacturing & construction; finance including insurance	Low returns due to adverse climate change impacts and/or unfavourable business conditions
	Cultural heritage	New discoveries of heritage sites exposed by changing climate	Simultaneous loss of other heritage sites due to climate change
	Energy supply & demand	Reduced winter heating demand; increased hydropower with increased river flow; increased photovoltaic & solar heat production with reduced snow cover	Higher air conditioning demand; adverse impacts of extreme low & high river flows
	Infrastructure	Reduced frost & snow damage to transport, buildings & water infrastructure; lower winter maintenance; decreased travel delays	Under-preparedness for disruptive severe cold events; concurrent risks from high summer temperatures
	International trade	Improved food exports with enhanced comparative advantage; new trade routes & tourism in the Arctic	Geopolitical, environmental & equity implications globally & in the Arctic
	Nature & biodiversity	Longer growing season & reduced cold damage to ecosystems; new species colonisation	Invasive species; limited soil suitability or habitat availability
	Public health & safety	Reduced cold-related mortality; increased use & benefit of outdoor space; less mould growth in homes; improved road safety for slipping accidents	Complacency towards cold events; moister conditions compromise building health
	Tourism	Enhanced summer tourism at previously cool beach, mountain & lake locations	Uncertain & variable seasonal demand for outdoor recreation

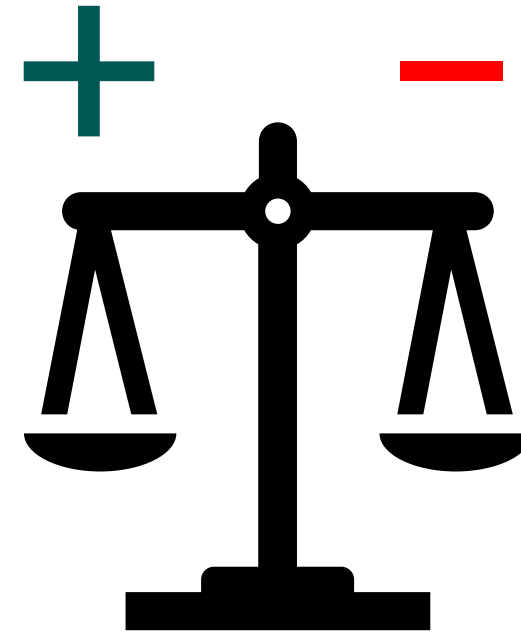
* Examples are from national risk assessments for New Zealand, Switzerland & UK

Source: Simplified from Carter (2026)

So why analyse opportunities alongside risks?

Research needs for informing adaptation

- Systematic analysis of beneficial impacts
- Cataloguing of past adaptation to realise opportunities
- Determining who stands to gain (or not)
- Broadening consideration of social justice in the design of adaptation policy
- Investigating dynamic interdependencies between risks and opportunities
- Identifying barriers for adapting to opportunities
- Examining potential enabling roles for stakeholders in aiding realisation of opportunities
- Scenario analysis for exploring trade-offs between risks and opportunities



Learning for practice

- Addressing beneficial impacts alongside risks may spur engagement, innovation & action

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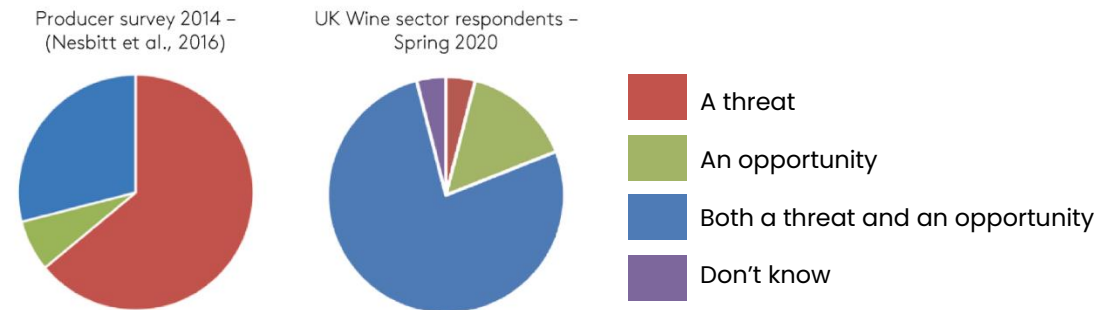
- Addressing beneficial impacts alongside risks may spur engagement, innovation & action

Climate change opportunities & risks: the case of UK wine



Changing perceptions of climate change in the UK wine sector based on interview & survey responses in 2014 & 2020

Panel B: Do you think climate change is a threat or an opportunity for wine production in the UK?



Based on Gannon et al., 2023

Ethical dimensions of climate change impacts

Impacts: Winners & losers:

- Gains for some can be losses for others
- Social justice: the most adverse impacts borne by the most vulnerable
- UNFCCC: Common but differentiated responsibilities (CBDR)
- What constitutes a fair distribution of gains?

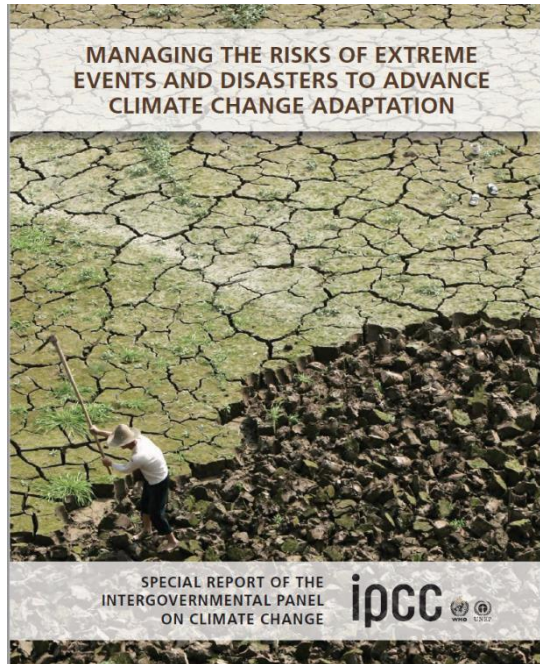


Photo: Dmitry Kokh, www.dmitrykokh.com

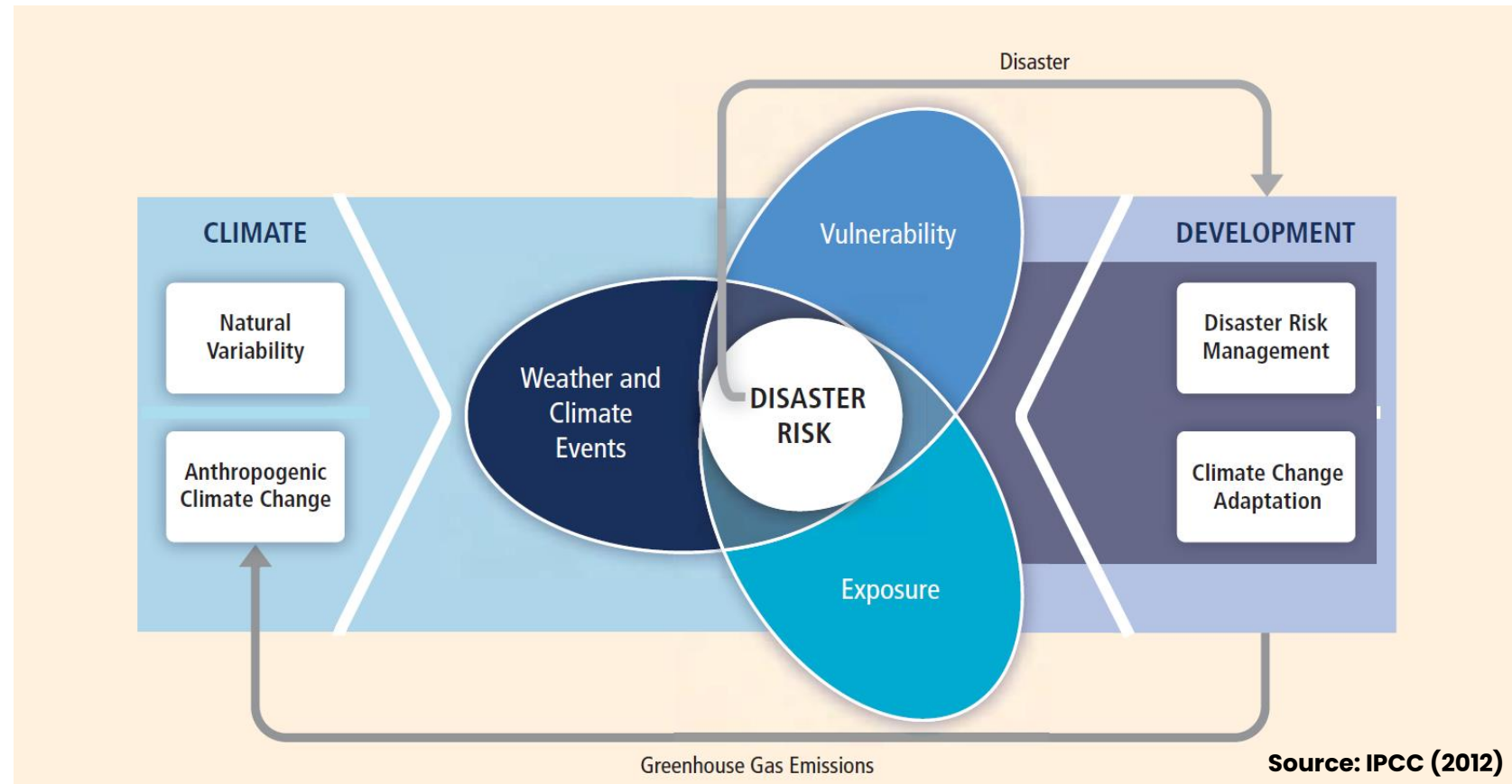


Are current analytical frameworks fit for purpose?

IPCC “Disaster Risk Framework”



2012



Are current analytical frameworks fit for purpose?

Definitions (IPCC, 2022)

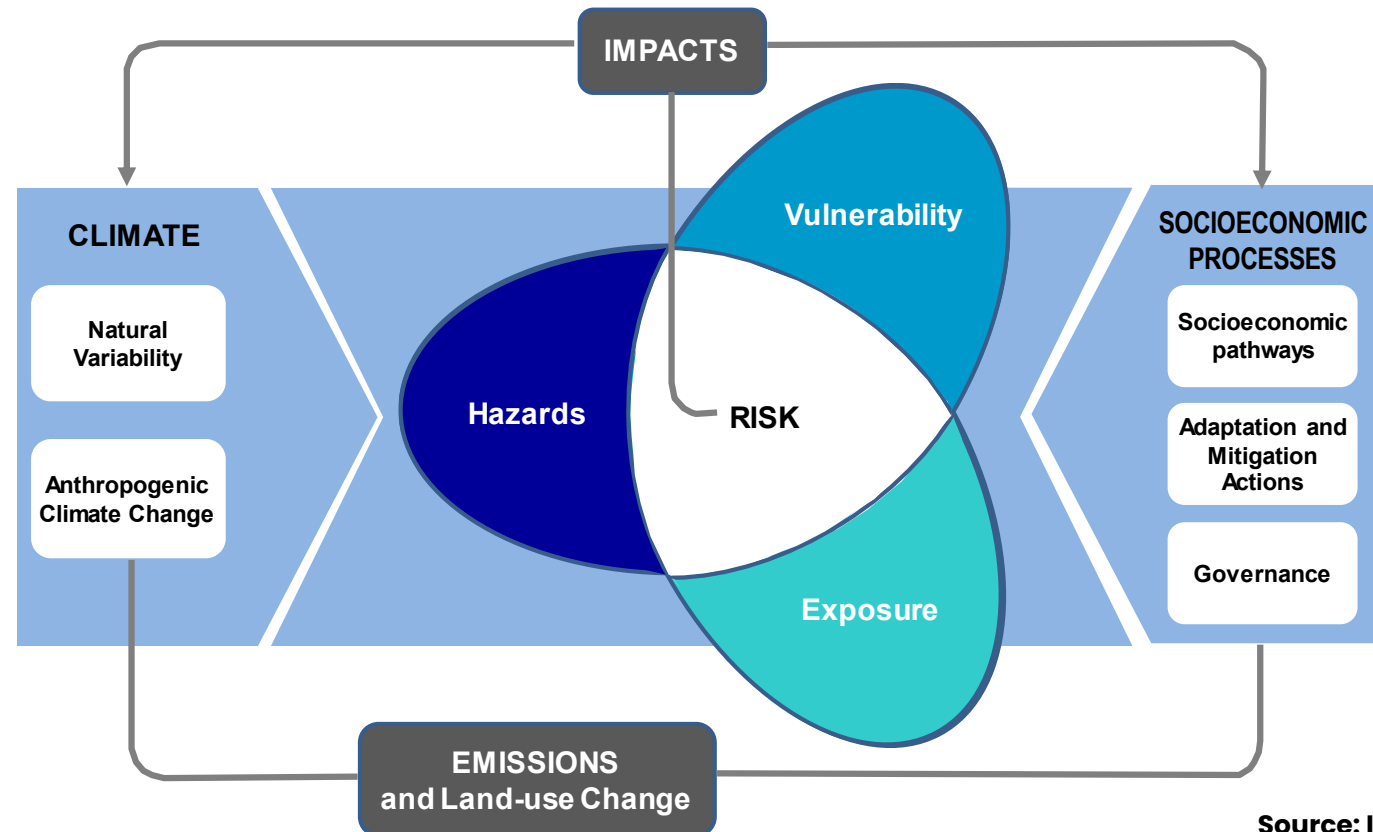
Risk: The potential for **adverse** consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems.

Hazard: The potential occurrence of a natural or human-induced physical event or trend that may **cause loss of life, injury** or other health impacts, as well as **damage and loss** to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Vulnerability: The propensity or predisposition to be **adversely affected**.

Exposure: The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be **adversely affected**.

IPCC Risk Framework



Source: IPCC (2014)

Towards an inclusive framework for analysis

Definitions (for research)

Impact (potential or observed): Consequence of climate change for human or ecological systems (**adverse, beneficial or neutral**)

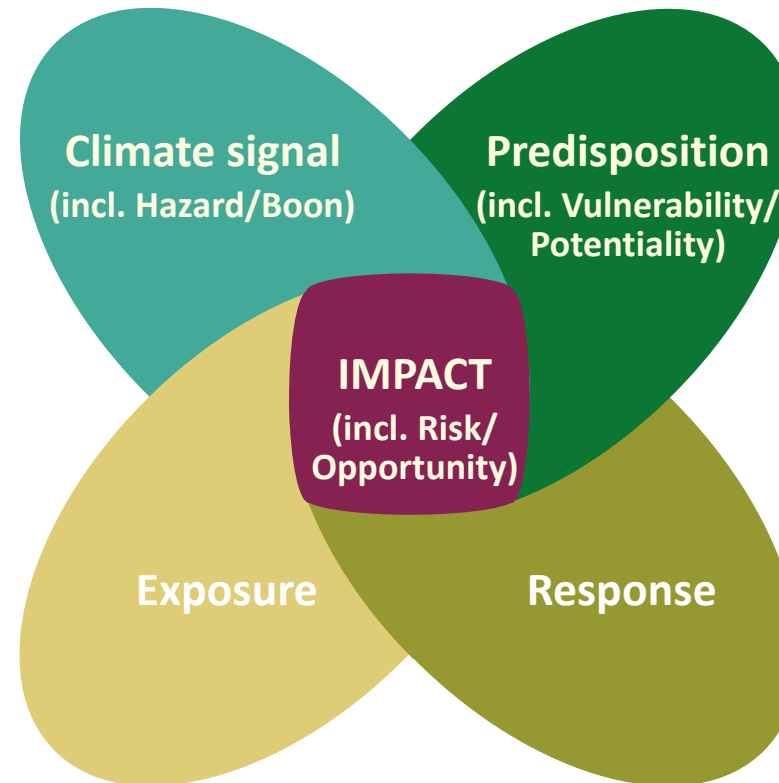
Climate signal: Physical climate system conditions (e.g., means, events, extremes) that affect an element of society or ecosystems. Characterised by climatic impact-drivers (CIDs), their changes can be **detrimental, beneficial, neutral, or a mixture** of each.

Predisposition: Inclination of an affected system to respond in a certain way to a stimulus, which can be **positive or negative**. Described by non-climate impact-drivers (NCIDs). Alternatively referred to as sensitivity.

Exposure: The presence of people; livelihoods; species or ecosystems; environmental functions, services, & resources; infrastructure; or economic, social, or cultural assets in places & settings that could be affected by a climate signal. Also described by NCIDs.

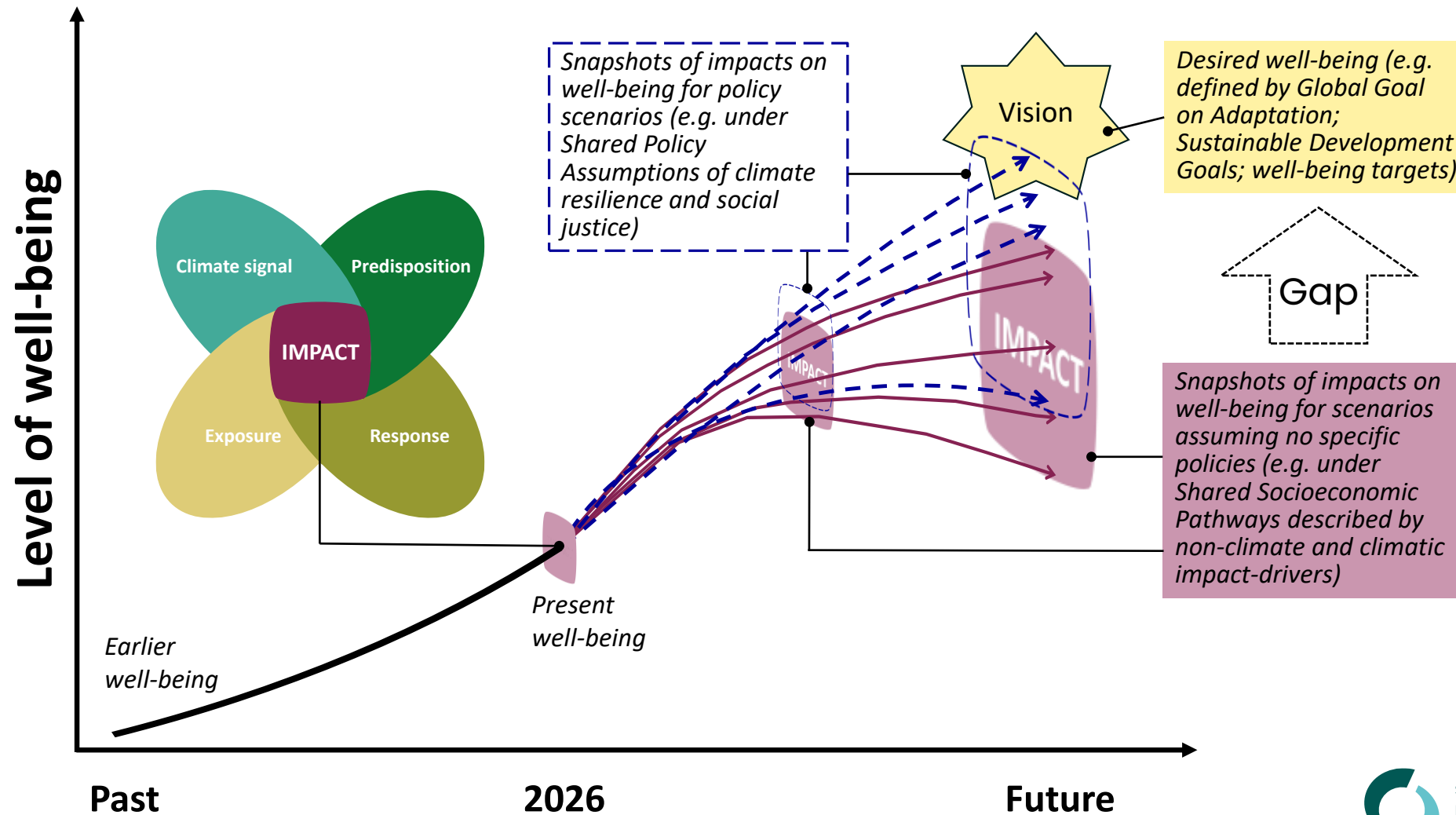
Response: Effects of interventions to modify impacts, intended or unintended, such as through adaptation or mitigation.

Determinants of climate change impacts



Source: Modification of Simpson et al. (2021)

Towards an inclusive framework for analysis



Incentivising action

Overall framework

- Allows for more positive messaging of climate change impacts and adaptation

Hence, it may:

- Incentivise constructive engagement
- Offer hope



So, when opportunity knocks

- Risk frameworks commonly adopted to formulate climate change adaptation policy, may inadvertently be constraining important research on adapting to potentially beneficial impacts of climate change.
- Opportunities presented by a changing climate are known to exist across different sectors, but are poorly documented and rarely analysed systematically
- This knowledge gap poses a challenge for planning adaptation to accommodate opportunities alongside risks
- Research into opportunities is no more or less challenging than that focused on risks
- However, is such research being pursued or even contemplated by the research community?
- Does such research feature prominently in the sights of funding agencies?
- Should this inclusive approach to impact and adaptation research be represented in AR7 IPCC Technical Guidelines for Assessing Climate Change Impacts & Adaptation?

Read more at:

nature climate change

<https://doi.org/10.1038/s41558-026-02626-9>



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