Aiming for multiple goals with one shot
- the Paris Agreement and the SDGs

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Paris Agreement – a new North Star for research
Knowledge-Action Network: Water-Energy-Food Nexus

How can resource management help to deliver food AND water AND energy for all in sustainable ways?

Consider synergies and tradeoffs:

• Irrigating promotes food production but can reduce river flows and hydropower potential.
• Bioenergy crops can increase water withdrawal and jeopardize food security.
• High efficiency pressurized irrigation saves water but may result in higher energy use.

- New values and norms
- 2050: Sustainability transformation
- 2030: Achievement of SDGs

Legitimacy of BAU eroding
## GOALS SCORING

<table>
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<th>INDIVISIBLE</th>
<th>REINFORCING</th>
<th>ENABLING</th>
<th>CONSISTENT</th>
<th>CONSTRAINTING</th>
<th>COUNTERACTING</th>
<th>CANCELLING</th>
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<td>The strongest form of positive interaction in which one objective is exclusively linked to the achievement of another. Reducing air pollution (3.4) is inextricably linked to improved health and reducing non-com municable diseases (3.4).</td>
<td>One objective directly creates conditions that lead to the achievement of another objective. Increasing economic benefits from sustainable marine resources use (14.7) reinforces the creation of decent jobs and small enterprise in e.g. tourism (8.9) and 9.5.</td>
<td>The present of one objective enables the achievement of another objective. Developing infrastructure for transport (9.5) enables participation of women in the workforce and in political life (5.5).</td>
<td>A neutral relationship where one objective does not significantly interact with another or where interactions are deemed to be neither positive nor negative. By 2020, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution (14.4) is consistent with target 3.5. Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.</td>
<td>A mild form of negative interaction when the pursuit of one objective sets a condition or a constraint on the achievement of another. Conserving coastal areas (14.5) and development of safe affordable housing and basic services (11.1) may conflict with each other.</td>
<td>The pursuit of one objective constrains another objective. Ensuring access to safe, nutritious and sufficient food can counteract unsustainable water withdrawals (6.4) and reduction of chemicals release (12.4).</td>
<td>The most negative interaction is where progress in one goal makes it impossible to reach another goal and possibly leads to a deteriorating state of the second. A choice has to be made between the two. Developing infrastructure (11.1) could be cancelling the reduction of degradation of natural habitats in terrestrial ecosystems (15.1).</td>
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### OUTDOOR AND INDOR AIR POLLUTION

Outdoor and indoor air pollution is responsible for 7 million deaths annually, as well as respiratory and cardiovascular disease but also increases in preterm deaths. In 2012, ambient outdoor air pollution was responsible for 3 million deaths, representing 5.4% of the total deaths. Worldwide, ambient air pollution is estimated to cause about 25% of all lung cancer deaths. Major urban areas in low and middle-income countries are the most exposed to this burden. (WHO, 2016).

Sustainable and diversified strategies for using the marine resource base open up opportunities for small enterprises in fisheries or other harvesting and associated value-added activities, as well as activities related to tourism. Many SIDS and LDCs that are rich in these resources also have poor, vulnerable and marginalised coastal communities.

Affordable public transport promotes social inclusion, more equal access to different parts of the city, and enabling employment for marginalized groups. In many places, women do not have access to a car and depend on public transport, walking or bicycling to get around, to work places and to social or political activities (NCE, 2016; GSDR, 2018).

There is no significant interaction between the two targets.

Establishing protection areas in the coastal zone and promoting urbanization, infrastructure or transport route spatial competition especially in densely populated areas. Integrated coastal zone management and marine spatial planning tools are readily available to mitigate spatial competition.

Increasing productivity in agriculture is a necessary (but not sufficient) condition to improve food security. In many places, this might entail increased and/or better irrigation as well as increased use of agro-chemical inputs.

In underdeveloped regions, developing roads, dams, and power grids might be a high priority, although it will cause some irreversible fragmentation of habitats and compromising the integrity of the natural ecosystems, leading to risks to biodiversity as well as social risks.

### A GUIDE TO SDG INTERACTIONS: FROM SCIENCE TO IMPLEMENTATION

Reducing SDGs-complexity by qualitative scoring:
The ICSU-Guide approach

Interactions of SDG7 “Affordable and clean energy”
with poverty, food, health, water, economy, & climate

Interactions of SDG2 “Zero hunger”
with poverty, health, equality, water, energy, climate & land

**Interaction matrix** of selected Sustainable Development Goals

Synergies outweigh trade-offs

Weitz et al. 2017, *Sustainability Science*
The climate / decarbonisation challenge
Earth is approaching TIPPING POINTS due to human pressures

Global average surface temperatures during the last 10,000 years have been remarkably stable. The tipping elements at risk within the Paris range of 1.5-2 °C global warming are shown within the inset.

In 2020, the remaining global carbon budget for greater than 66% of remaining below 2°C...

The world emits about 41 GtCO₂ every year (all sources).

At these rates, in 2020, the world will have 16 years carbon budget for humanity's remaining time on Earth.
The world needs to act faster: deeper cuts are needed to reduce risk of global average temperature rising 2 °C above pre-industrial levels. A pathway of halving global emissions every decade is consistent with this goal.

A representative pathway to stabilise global average temperature at around 1.5 °C with 50% probability. Such pathways assume large-scale "negative emissions" to achieve this goal, which have been untried at scale.

Global emissions from fossil fuel and industry: 36.2 ± 2 GtCO₂ in 2016, 62% over 1990
Projection for 2017: 36.8 ± 2 GtCO₂, 2.0% higher than 2016

Estimates for 2015 and 2016 are preliminary. Growth rate is adjusted for the leap year in 2016.
Source: CDIAC; Le Quéré et al 2017; Global Carbon Budget 2017
In recent years, CO₂ emissions have been almost flat despite continued economic growth

Source: Jackson et al 2017; Global Carbon Budget 2017
22 countries have decoupled GDP growth from CO2 emissions.

Emissions decreased significantly in the presence of a growing GDP in 22 countries (representing 20% of global emissions) in the last decade (2007-2016). Other notable changes are also shown.

- China: Emissions declined for the past 3 years but are up again.
- Brazil: Emissions declining but probably due to economic crisis.
- Japan: Emissions declined recently.
- India: Emissions grew 6% in the past decade but slowed in 2017.
The world needs to act faster: deeper cuts are needed to reduce risk of global average temperature rising 2 °C above pre-industrial levels.

*Renewable energy's share of primary energy is growing exponentially – doubling around every 5-6 years, albeit from a very low baseline.*

Examples for smart and scalable solution ideas

Taken from *Anthropocene*, Future Earth’s digital, print and live magazine.
Construction

Building with wood instead of cement

turning cities into Carbon sinks

From *Anthropocene*, Vol 2, 2017
Energy:
Instead of Trump’s Wall, let’s build a border of solar panels

- Carbon emission-free energy
- Civilising effect in a dangerous area
- High-tech construction and technology jobs along the border
- Potential to connect to desalination to have agriculture instead of desert

From Anthropocene, Vol 2, 2017
Food production: in-vitro meat

Compared to livestock:
• 82-96% lower water use
• 7-45% lower energy use
• 78-96% lower emissions

From Anthropocene, Vol 2, 2017
Mobility:
Small changes to flight routes could deliver big climate savings

Reduction of climate impact (by ~10%) at low costs (~1%)


From Anthropocene, Vol 2, 2017
Future Earth’s digital, print and live magazine.

Featuring top science journalists from around the world.

Asking how do we build a sustainable human age we actually want to live in?
High-level challenges (and ways to approach them)

- Analyse interlinkages between sustainability targets and measures
  - amplifying synergetic measures, while avoiding major trade-offs

- Work on exponential growth of transitional actions
  - such as expanding the renewable energy sector

- Turn ideas of sustainability and decarbonisation into a movement
  - scale up the good seeds of innovative ideas
  - stimulate the left side of the people’s brain (e.g. through art)