

Transformations towards Sustainability: Reflections on action, knowledge, innovation and governance

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SPRU Friday seminar
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What this presentation is about

- An impressionist journey around the theme of transformations for Sustainability
- Including explorations and reflections on
 - Policy action (including precaution)
 - Knowledge
 - Innovation
 - Governance
 - (Science-policy interfaces)
- and some digressions on myths and asymmetries
 - Persistent myths underlying (dominant) visions of science, innovation and decision
 - Asymmetries not sufficiently reflected upon and accounted for in our ways of dealing with evidence in support of policies and actions
- My objective: trigger a discussion with you and learn from you!

Starting point

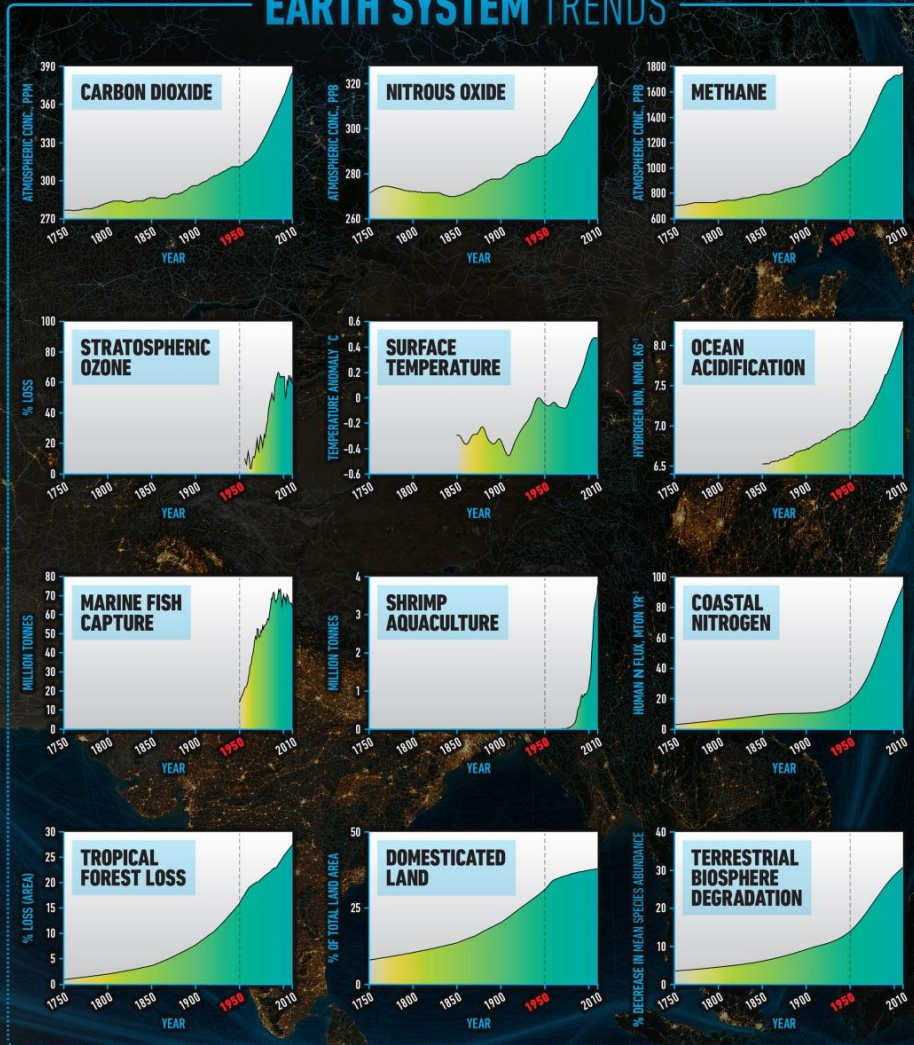
- Multiple and intertwined societal, environmental and economic crises
- Old ways ('more of the same') won't work
- Transition to a more sustainable world in ecological, social and economic terms requires radical transformations in ways of thinking, knowing, doing and being.

THE GREAT ACCELERATION

SOCIO-ECONOMIC TRENDS



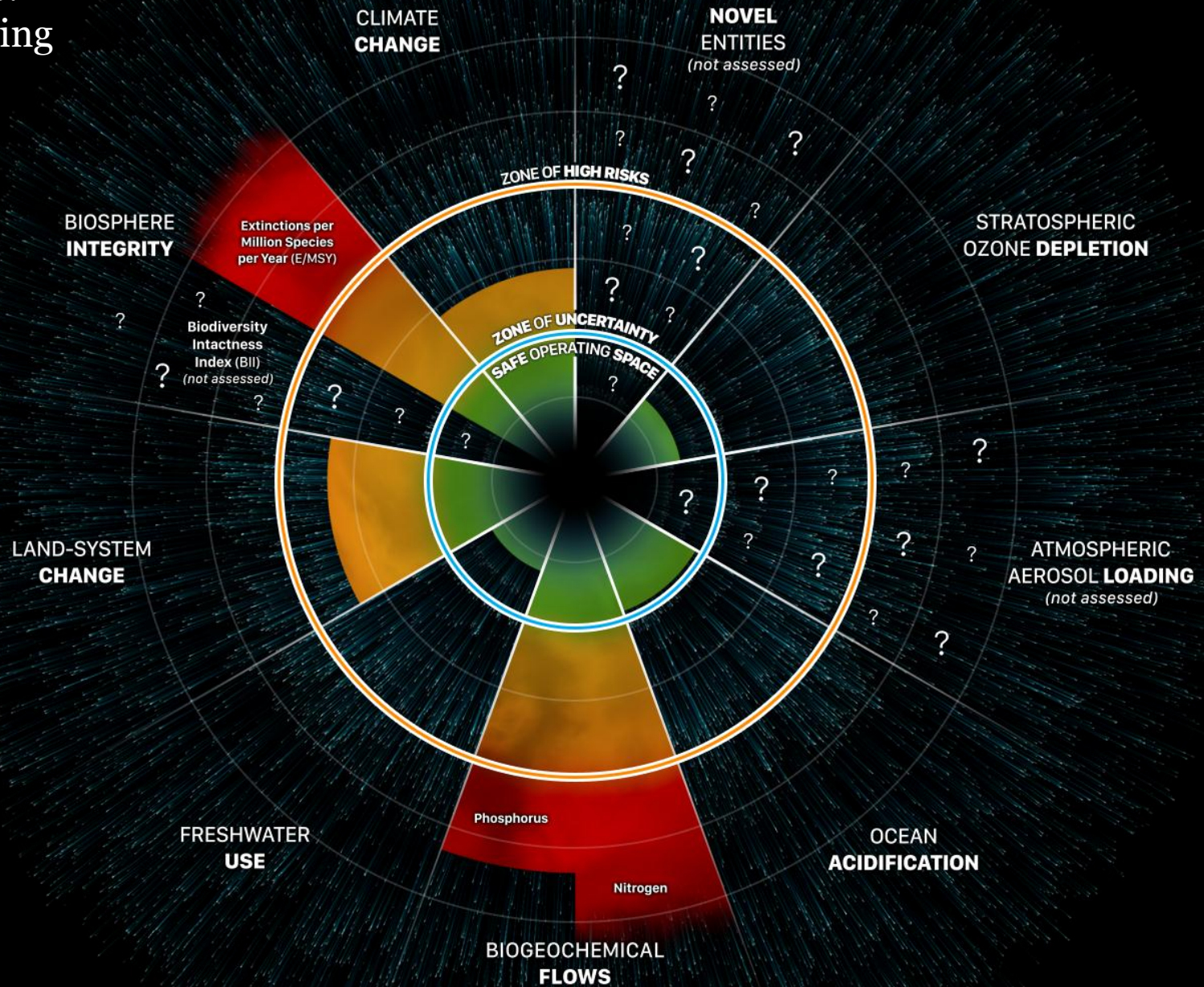
EARTH SYSTEM TRENDS



REFERENCE: Steffen, W., Broadgate, L., Deutsch, O., Gaffney and C. Ludwig (2015), The Trajectory of the Anthropocene: the Great Acceleration, Submitted to *The Anthropocene Review*.

MAP & DESIGN: Félix Pharand-Deschênes / Globaïa

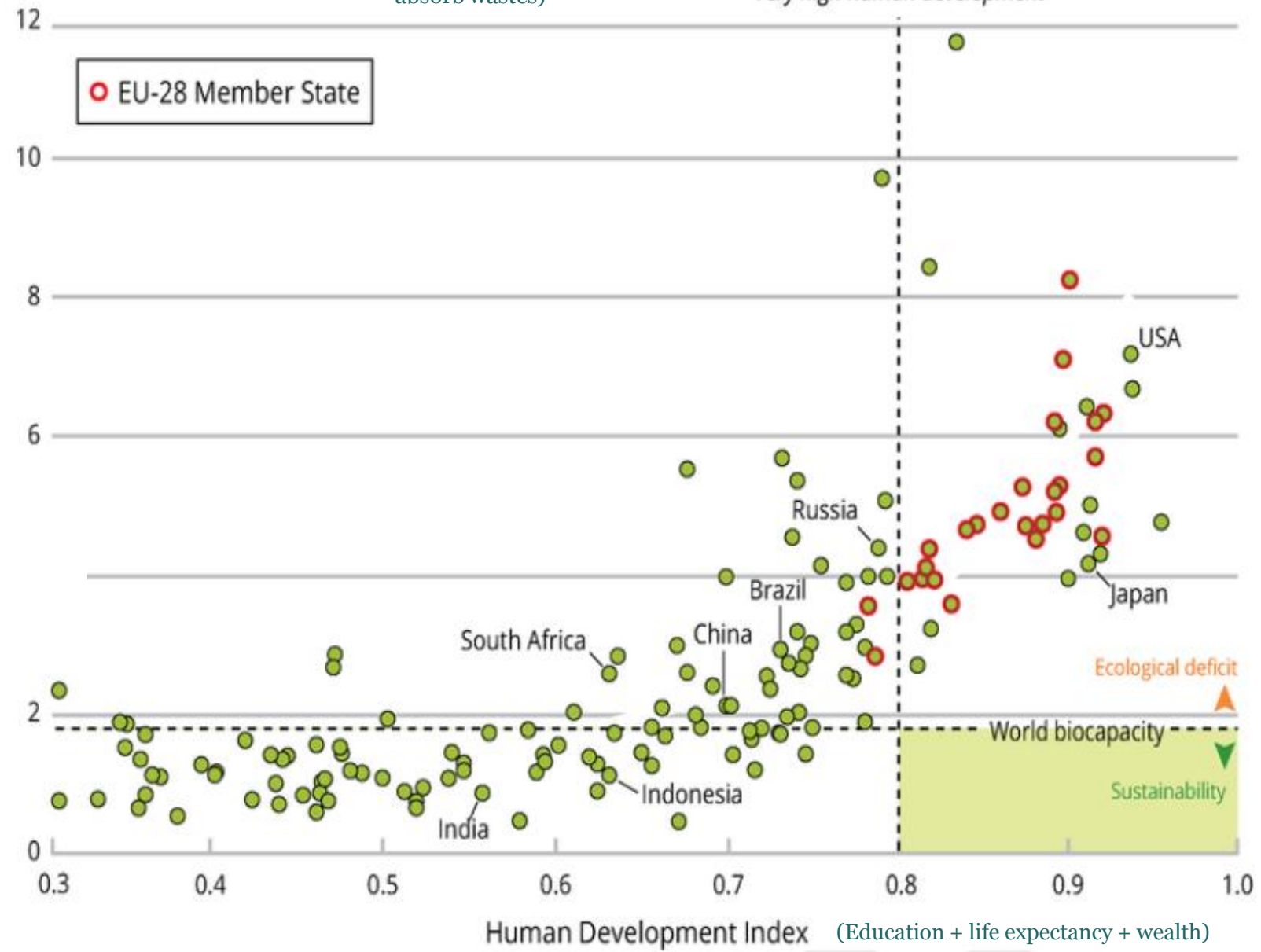
Planetary Boundaries: A safe operating space for humanity



Ecological footprint
(hectares per person per year)

(Land and water area to produce
the resources consumed &
absorb wastes)

'Very high human development'



Source: EEA 2015 based on UNDP & Global Footprint Network

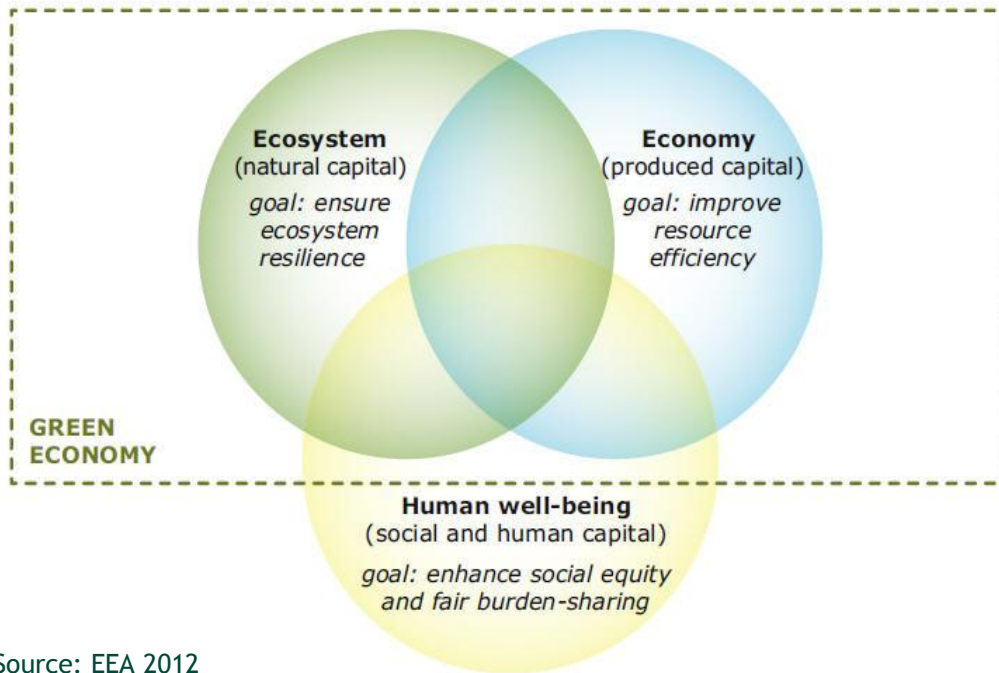
Where to?



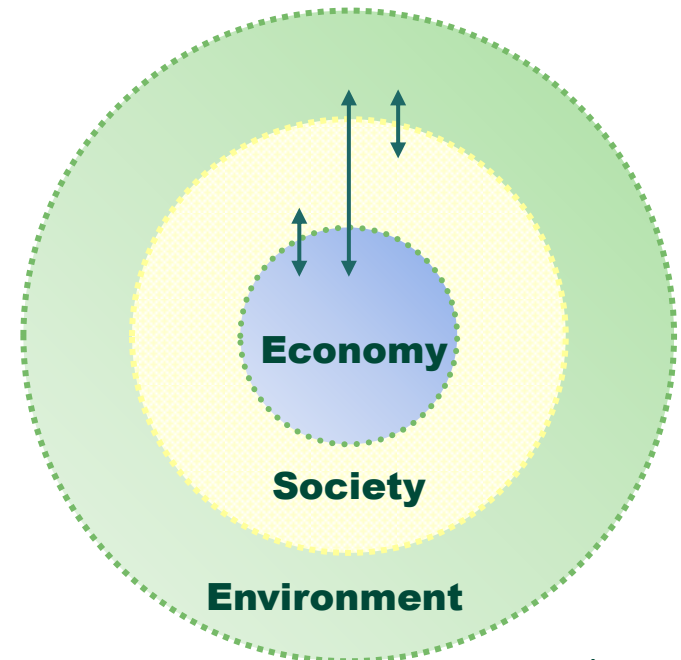
Sustainability

- An undefined state: what is sustainable?
- We have some key (physical and biological) constraints:
 - *"The laws of physics are non-negotiable"* (WMO Secretary-General, Michel Jarraud)
 - Ecosystems as our inescapable life-support
- And some framing values and principles, e.g.
 - Democracy, Diversity, Equity, Liberty, ...
- We know a lot more about what is unsustainable than about what sustainability is/could be
(→ a first asymmetry)
- Calls for a procedural approach: focusing on the journey and not just on the destination

A second asymmetry: between 3 dimensions of sustainability



Asymmetry stems from
physical and biological limits
and irreversibility



▲ Useful to highlight trade-offs,
yet reality is closer to ►

From 3 pillars to 3 embedded spheres

Confronting the complex

It is about how we transform the ways in which we operate in complex social-ecological systems
⇒ Trying to understand and operate those transformations

Transformation:

'trans-' → going across, going beyond

'forma-' → form, manner

⇒ Changing the substance and the process ...

Pervasive myths

(about systems, knowledge, technology, decision...)

Myths

Complex systems can be fully understood and described

Uncertainty is always reducible or quantifiable

Simple cause-effect relationships can always be established (deterministic science)

With enough effort and knowledge, complex systems are controllable

Messy life

Understanding of complex systems always partial

Irreducible uncertainties, ignorance, indeterminacies, surprises

Non-linear relationships, multiple and co-causalities

Absolute control and security is an illusion. Things do get out of control

About the myth of safety...

"It is safe"



"It is safe here"



"We will make it safe"



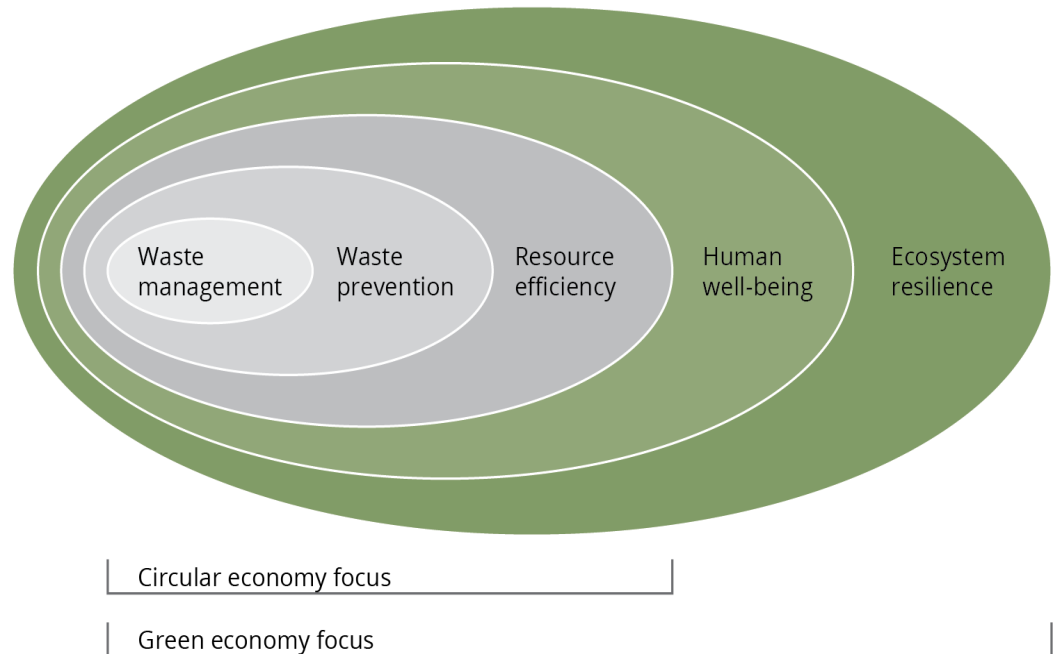
Pervasive myths (Cont'd)

Myths	Messy life
<i>Technology can 'solve it all' (aka technological optimism)</i>	History tells us otherwise Humility might be a more promising path...
<i>A socio-ecological system must be fully understood before making decisions that affect it</i>	In situations of irreversibility and high risks / stakes, precaution may be more appropriate
<i>Decisions result from linear reasoning processes including neutral weighting of pros and cons and optimisation</i>	Choices and non-choices, vested interests, power, lack of transparency,...

Revisiting these myths can help to better understand issues, and for transformative action

Policy action: Systemic challenges / Systemic solutions

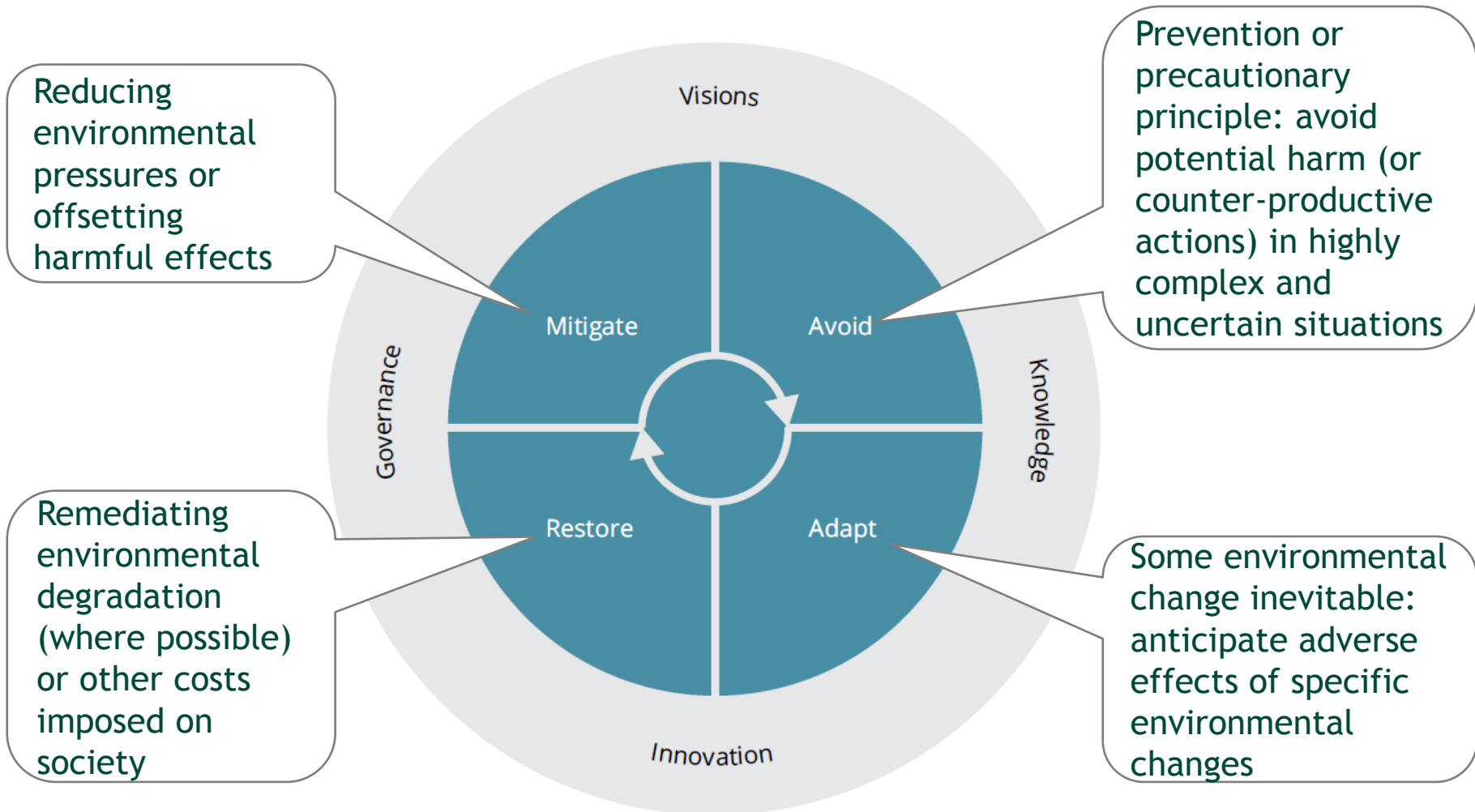
Example: Green economy as an integrating framework for a broad range of policies beyond environmental ones (employment, fiscal, transport, health, energy ...)



Source: EEA 2015

- Goes further than circular economy, beyond waste and material resources to how the use of water, energy, land and biodiversity should be managed towards more human well-being and ecosystem resilience.
- Also addresses wider economic and social aspects, such as prosperity, competitiveness or social inequalities.

Action: Strategic approaches to transformation

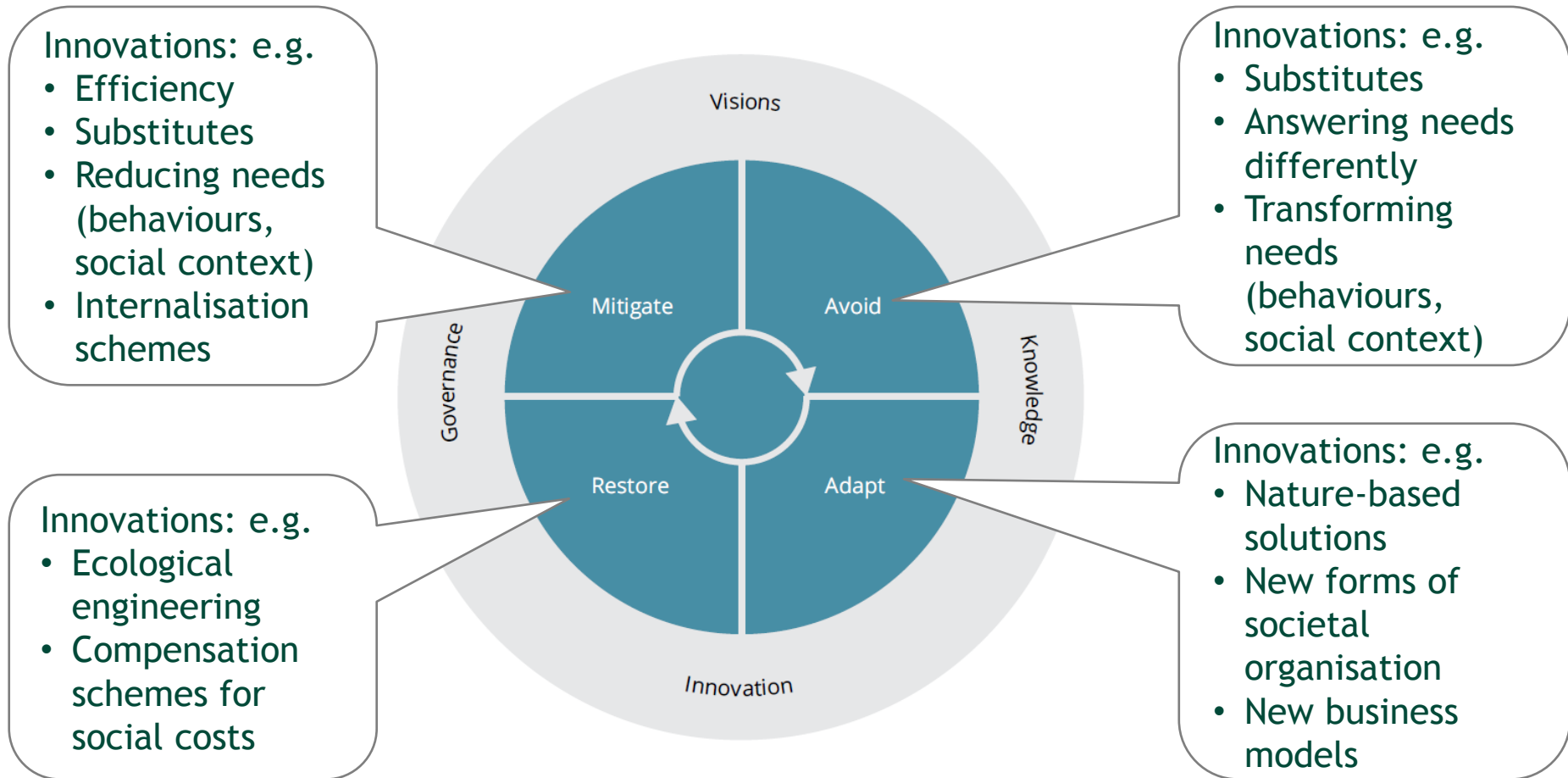


Avoid - Mitigate - Adapt - Restore

- Complementary, interrelated and porous approaches
- Each approach depends on different types of knowledge and governance arrangements and creates different innovation needs
- There can be a transformative potential in all four approaches and in their combinations
 - ⇒ ***Question: On which values, which knowledge and which science-policy interfaces do we base actions under those four approaches?***
- Time to consider these four approaches together in terms of existing policy implementation and future policy design
 - ⇒ ***Question: What do we need to transform to support such joint consideration? How can we innovate here?***



Innovating in the four approaches...



...and across them

Asymmetries

A series of asymmetries often not accounted for in our way of dealing with evidence in support of (policy) action:

- More knowledge about unsustainability than about sustainability
- Between the three 'pillars' of sustainability
- Between false positives and false negatives
- In the weighing of pros and cons
- In the levels of evidence demanded
- Between resources aiming at maintaining business as usual and efforts towards transformation
- Power asymmetries
- Between high tech systems and low tech solutions to deal with consequences of associated disasters
- ...

Asymmetry in error types

Type I error False positive	Accept a false hypothesis <i>(H= there is an effect)</i>	Excessive credulity	In science: avoid them because you want to provide explanations of the world
Type II error False negative	Reject a true hypothesis <i>(H= there is an effect)</i>	Excessive scepticism	Maybe these should be avoided when stakes are high and damages irreversible and/or exposure widespread

- ❑ Asymmetry between competing policy and scientific options of avoiding false negatives and avoiding false positives
 - ❑ Stems from irreversibility and high stakes
 - ❑ Calls for precautionary approaches
- ⇒ Reflect on pros and cons of being wrong

Weighing pros and cons

- Asymmetries in how we account for the pros and cons, costs and benefits of an action /a technology
 - Emphasis on the short term one-dimensional (vested) benefits & risks vs. long-term and systemic risks & benefits
 - More emphasis on costs of preventative or precautionary action than on benefits (and co-benefits, spillover effects)
 - Negative externalisation goes one way: from private interests to society &/or environment
- Public R&D funding for development of new technologies >> than for research on potential risks of these technologies
 - Environmental Health and Safety (EHS) research funding for information and communication technologies, nanotechnologies and biotechnologies : resp. 0.09%, 2.3% & 4% of total EU funding since 1996 (Foss Hanssen & Gee 2014)



Pros and cons...

“Although the science of climate change is uncertain, there’s no doubt about the considerable economic harm to society that would result from reducing fuel availability to consumers by adopting the Kyoto Protocol or other mandatory measures that would significantly increase the cost of energy. Most economists tell us that such a step would damage our economy and almost certainly require large increases in taxes on gas and oil. It could also entail enormous transfers of wealth to other countries.”

Former ExxonMobil CEO and Chairman, Lee Raymond, 2001

Levels of evidence demanded

High levels of proof of harm (or risk) demanded by proponents of a technology to justify remedial or preventive action



Much lower level of evidence the same proponent deem sufficient to claim that their products / processes are 'safe'



More asymmetries

- Between resources aiming at maintaining business as usual and efforts towards transformation
 - (e.g. amount of subsidies going to nuclear or fossil fuels vs. greener energy technologies & energy efficiency)
- Power asymmetries:
 - who gets a say?
 - whose "rationality" counts?
 - who manipulates?
- Between high tech systems and low tech solutions to deal with negative side-effects / consequences of associated disasters





High tech systems

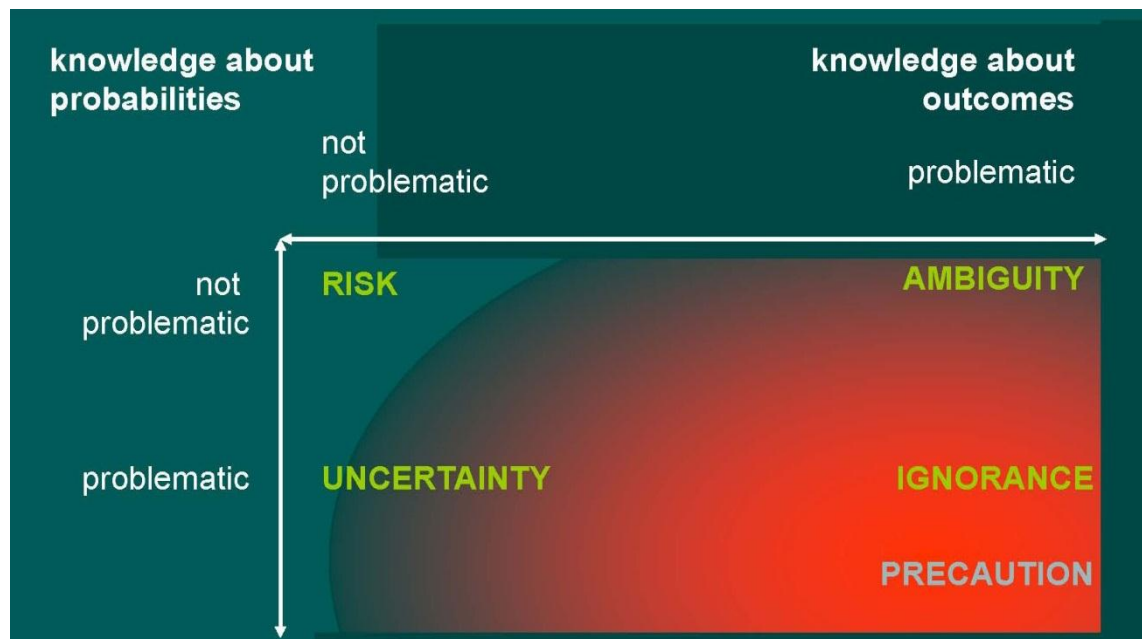


Low tech 'solutions' to their 'side-effects'



Back to action: Precaution

- Situations characterised by scientific (but also technological and social) complexity; high uncertainty and ignorance; high economic, social and environmental stakes; and/or irreversibility
- Knowledge about consequences and about their probabilities is problematic (non-existent, or at best limited)

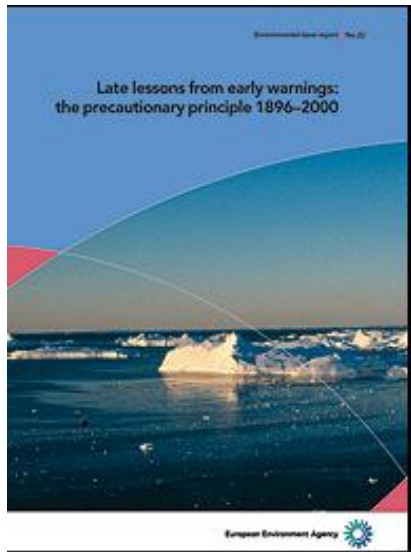


(Source:
A. Stirling & EEA 2001)

- Yet we still act based on values: values which we know or which we presume

The precautionary principle

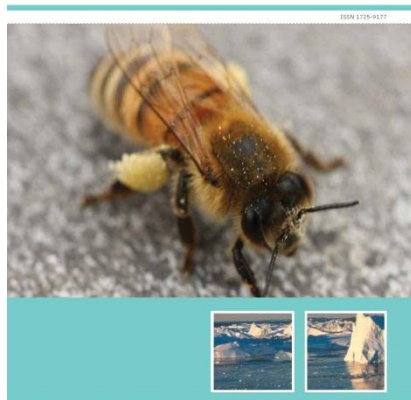
'The precautionary principle provides justification for public policy and other actions in situations of scientific complexity, uncertainty and ignorance, where there may be a need to act in order to avoid, or reduce, potentially serious or irreversible threats to health and/or the environment, using an appropriate strength of scientific evidence, and taking into account the pros and cons of action and inaction and their distribution.'



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Late lessons from early warnings:
science, precaution, innovation

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European Environment Agency



Uncertainty and ignorance

'All scientific work is liable to be upset or modified by advancing knowledge. That does not confer on us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time'.

(B. Hill 1965, Environment and disease: association or causation?)

'Today's knowledge is often seen as static, with just a few troublesome gaps in knowledge that further research will remove. Such 'further research' can then become an excuse to postpone precautionary, or even preventative, actions.'

(D. Gee 2008, Establishing Evidence for Early Action)

⇒ There is no contradiction between aiming at improving the knowledge basis to inform decisions (towards more evidence-based decisions) and applying a precautionary approach in situations of uncertainty, ignorance, high and irreversible risks, ...

Precaution, engagement and evidence

The precautionary principle also brings opportunities for broader societal engagement on future policy actions and development pathways, including debate on questions such as the nature and strength of evidence for action, the burden of proof and the trade-offs that society is willing to make against other objectives and priorities.



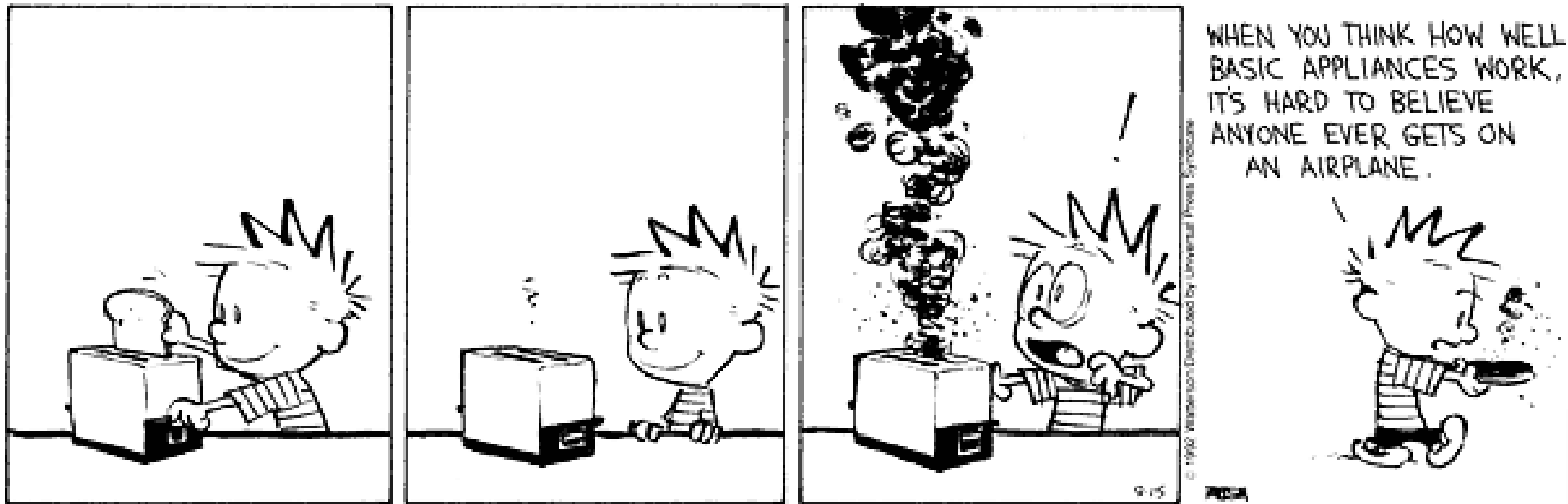
(cf. EEA 2013 & EEA 2015)

Innovation

- Dominance of a narrow concept of innovation
 - Beyond mere technological innovation there are also social, institutional, organisational and behavioural innovations
 - New ways of thinking, knowing, doing, being
 - Need to re-visit the political discourses on innovation and target innovation towards delivering societal objectives (e.g. better health, quality of life, well-being, sustainability, etc)
- ⇒ Innovation with a soul (socially meaningful innovation)... to support "*une économie à finalité humaine*" (an economy with a human purpose) (R. Passet)
- Innovation can also be about re-inventing (revisiting and adapting old ways of doing) → 're-innovation' ?

Technological optimism

- Builds on myth of controllability of complex systems...
- Reliance on 'technofixes' provides a false sense of security \Rightarrow wait and see attitudes
- Yet solving one problem often creates another one (e.g. bioenergy to mitigate climate change vs. food security and biodiversity)
- Technological optimism not a tenable ethical position when confronted with irreversible and severe consequences



Narrow focuses and lock-ins

- Narrow focus on technological innovation (in part. for economic growth) leads to unintended health, societal and environment side-effects.
- Can locks us onto a dominant and unrealistic path of material growth, based on unsustainable use of finite resources and overburdening the sink capacity of the biosphere.
- Beyond technological lock-ins, there are also institutional, intellectual (paradigmatic) and ideological lock-ins:
 - Technological lock-ins: e.g. nuclear energy
 - Ideological lock-ins: e.g. more consumption \Rightarrow more happiness
- Some lock-ins stem from legacy: e.g. in nuclear energy, necessity of maintaining technological know-how and competencies for managing the end of life (waste and decommissioning) and impacts of whole life cycle and accidents.



Governance of innovation

Decision processes around technology development and deployment need to :

- Be transparent and dynamic (there are unknowns, knowledge evolves)
- Build on plural and conditional assessments
- Apply the precautionary principle when stakes are high, uncertainty and ignorance prevail
- Consider irreversibility of potential negative consequences
- Cherish diversity of solutions to build resilience
- Acknowledge the possibility of surprises
- Be adaptive, allow to revisit decisions and choices
- Keep options open, yet accept to close down inappropriate paths...
- Gauge innovations against societal goals

Governance of innovation

- Transform governance of innovation, allowing ourselves to think outside the box, with openness, transparency and humility, acknowledging choices and non-choices and the ethical dimensions, taking stock of lessons from the past.



Late lessons from early warnings:
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Humans can learn, change and transform and there is enormous potential in human creativity and its capacity to inspire cultural, social, political, institutional, organisational and behavioural innovation, beyond 'mere' technological innovation. If, as Plato said, necessity is the mother of invention, then the crises we are facing create a level of necessity that will hopefully engender the needed innovations. (EEA, 2013)

Elements for innovations in governance

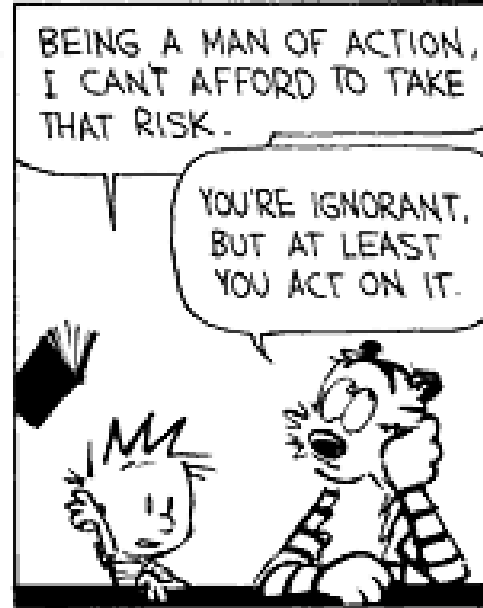
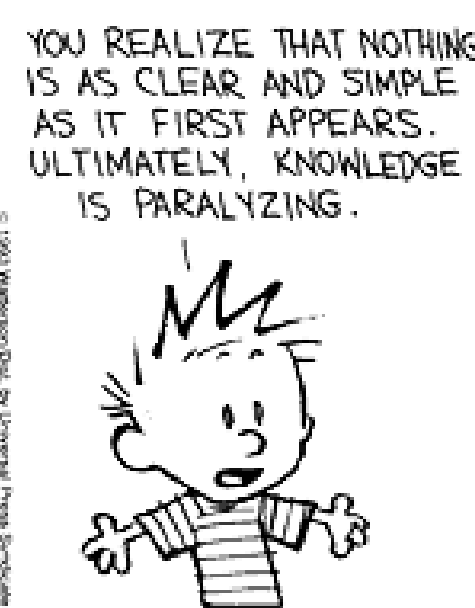
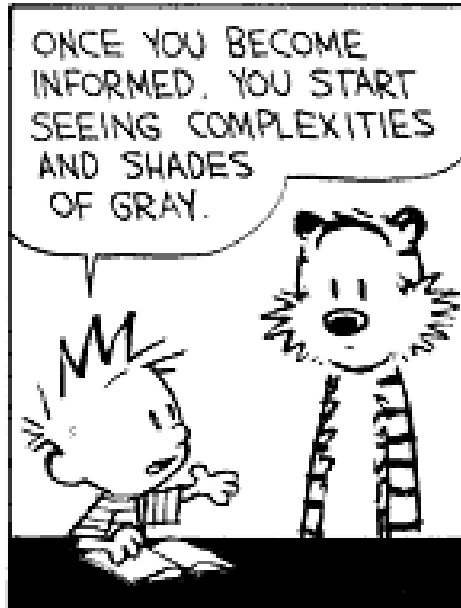
- Developing long-term visions in accordance with societal values, acknowledging irreducible diversity of values
- Breaking down silos, addressing interconnectedness of issues
- Learning to live with uncertainty, ignorance, imperfect (or absent) evidence, high risks and irreversibility
- Building on more systemic concepts such as resilience, the ecosystem approach, integrated management, natural & social capital, the precautionary principle, adaptive management, transformative capacity, green economy ...

Elements for innovations in governance (2)

- Implementing dynamic processes aiming at innovative, flexible and adjustable answers (not all eggs in one basket, leave options open, learn as you go)...
 - Allowing for progressive integration of new information
 - Allowing for integration of different value judgement and logics
 - Avoiding lock-ins: technological, institutional, ideological
- Building on multiple interfaces between policy, science and society
- Considering the four main (environmental) policy approaches together: Avoid - Mitigate - Adapt - Restore

In conclusion

- Still a lot of theoretical and practical research to be done around governance of innovation and innovations in governance for transformation towards sustainability
- Colossal epistemological, methodological and practical challenges of inter- and trans-disciplinary sustainability research remain
- Working at the science-policy interface is crucial
- Key ingredients for transformation: imagination, visions, motivation, resources, flexibility, adaptability, diversity, creativity, openness (to other's worldviews, values and constraints), thinking outside the box, accepting the messiness of life, humility, and sense of humour.



Thank you!

Also for inspiration many thanks to David Gee, Andy Stirling, Mike Depledge, Rob Tinch, Jacquie McGlade, EEA team, Calvin & Hobbes, and many others...
(Any mistake or absurdity remains my sole responsibility)

References

- EEA 2001. Late lessons from early warnings: the precautionary principle 1896-2000. European Environment Agency report 22/2001.
- EEA 2013. Late lessons from early warnings: science, precaution, innovation. European Environment Agency [report 1/2013](#).
- EEA 2015. SOER 2015: The European Environment - State and Outlook 2015. Synthesis. European Environment Agency.
- Foss Hansen, S., Gee, D. 2014 Adequate and anticipatory research on the potential hazards of emerging technologies: a case of myopia and inertia? Journal of epidemiology and community health.
- Bradford Hill, A., 1965, 'The environment and disease: association or causation?', Proceedings of the Royal Society of Medicine.
- Gee, D., 2008, 'Establishing evidence for early action: the prevention of reproductive and developmental harm', Basic and Clinical Pharmacology and Toxicology, (102/2) 257-266.
- Stirling, A., 2010. Keep it complex. Nature 468, 1029-1031. (and many other papers!)
- van den Hove, S., McGlade, J., Mottet, P., Depledge, M.H. (2012) The Innovation Union: A perfect means to confused ends? Environmental Science and Policy, 12:1, 73-80.

Multi-, Inter-, Trans-?

- **Multidisciplinary research** collates completed pieces of disciplinary work
- **Interdisciplinary research** integrates various discipline-based contributions in the course of problem formulation, method development and application, and analysis of results
- **Transdisciplinary research** moves beyond the domain of disciplinarity, generating new approaches to scientific knowledge production that either transcend the formalism of a discipline altogether and/or operationalize integrative collaborations between academics and non-academics, such as local communities and/or policy-makers, as a core part of the scientific work.

Farrell, van den Hove & Luzzati (2013)