

Introduction to the Circular Economy

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HENVI Science Day

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“Towards Circular Economy – Designing a
sustainable food cycle”.

Content of the introduction

- The sustainability challenge (the background)
- The circular economy challenge (the aim)
- The policy challenge (speeding up and directing the transition)
- The knowledge challenge (the need for and the nature of the knowledge required)

The starting point: The world is not sustainable

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FEATURE

A safe operating space for humanity

Identifying and quantifying planetary boundaries that must not be transgressed could help prevent human activities from causing unacceptable environmental change, argue **Johan Rockström** and colleagues.



SUMMARY

- New approach proposed for defining preconditions for human development
- Crossing certain biophysical thresholds could have disastrous consequences for humanity
- Three of nine interlinked planetary boundaries have already been overstepped

Although Earth has undergone many periods of significant environmental change, the planet's environment has been unusually stable for the past 10,000 years¹. This period of stability — known to geologists as the Holocene — has seen human civilizations arise, develop and thrive. Such stability may now be under threat. Since the Industrial Revolution, a new era has arisen, the Anthropocene, in which human activities have become the main driver of global environmental change². This could see human activities push the Earth system outside the environmental state of the Holocene, with consequences that are detrimental or even catastrophic for large parts of the world.

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industrialized forms of agriculture, human activities have reached a level that could damage the systems that keep Earth in the desirable Holocene state. The result could be irreversible and, in some cases, abrupt environmental change, leading to a state less conducive to human development³. Without pressure from humans, the Holocene is expected to continue for at least several thousands of years⁴.

boundaries define the safe operating space for humanity with respect to the Earth system and are associated with the planet's biophysical subsystems or processes. Although smoothly to changing pressures, it seems that this will prove to be the exception rather than the rule. Many subsystems of Earth react in a nonlinear, often abrupt way, and are particularly sensitive variables. If these thresholds are crossed, then important subsystems, often with deleterious or potentially disastrous consequences for humanity, could shift into a critical state for one or more of these subsystems, such as carbon dioxide. Not all processes or subsystems have well-defined thresholds. Some processes or subsystems, such as water degradation and water degradation, will cross thresholds as a result of processes, such as global warming.

We have tried to define a set of nine planetary boundaries that, if not crossed, could help ensure that the Earth system remains in a state similar to that of the Holocene, a period of relative environmental stability that has lasted for about 10,000 years.

Most of these thresholds are not yet quantified, but we have identified three that have already been exceeded: climate change, biodiversity loss and stratospheric ozone depletion.

Other boundaries that have not yet been quantified include chemical pollution, atmospheric aerosol loading, freshwater use, change in land use, global freshwater use, phosphorus cycle, nitrogen cycle, and stratospheric ozone depletion.

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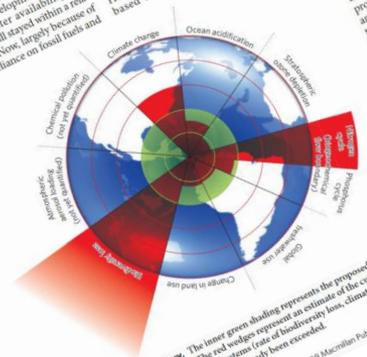
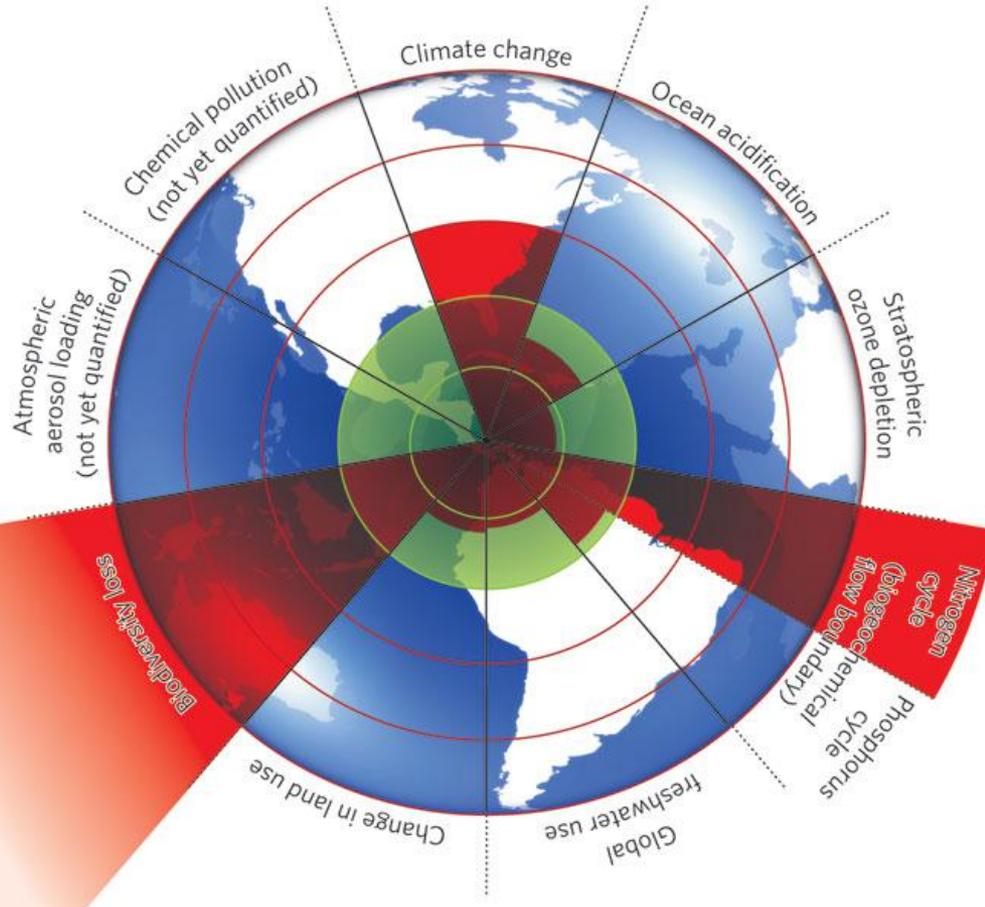


Figure 1 | Beyond the boundary. The inner green shading represents the safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change and human interference with the nitrogen cycle), have already been exceeded.

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The starting point: The world is not sustainable PB 2.0

RESEARCH CH

RESEARCH ARTICLE SUMMARY

SUSTAINABILITY

Planetary boundaries: Guiding human development on a changing planet

Will Steffen, Katherine Richardson, Johan Rockström, Sarah E. Cornell, Inga Fetzer, Elena M. Bennett, Redouane Biggs, Stephen R. Carpenter, Wim de Vries, Cynthia A. de Wit, Carl Folke, Dieter Gerten, Jens Heinke, Georgina M. Mace, Luan M. Persson, Veeharadhnan Ramasathan, Edinda Reyers, Sverker Sorlin

INTRODUCTION: There is an urgent need for a new paradigm that integrates the continued development of human societies and the maintenance of the Earth system (ES) in a resilient and accommodating state. The planetary boundary (PB) framework contributes to such a paradigm by providing a science-based analysis of the risk that human perturbations will destabilize the ES at the planetary scale. Here, the scientific underpinnings of the PB framework are updated and strengthened.

RATIONALE: The relatively stable, 11,700-year long Holocene epoch is the only state of the ES that we know for certain can support contemporary human societies. There is increasing evidence that human activities are affecting ES functioning to a degree that threatens the resilience of the ES—its ability to persist in a Holocene-like state in the face of increasing human pressures and shocks. The PB framework is based on critical processes that regulate ES functioning. By combining improved scientific understanding of ES functioning with the precautionary principle, the PB framework identifies levels of anthropogenic perturbations of the ES below which the risk of destabilization of the ES is likely to remain low—a “safe operating space” for global societal development. A zone of increasing risk for each PB highlights the area of anthropogenic impact on the ES, and thus the risk to the stability of the ES, is assessed by comparison with the proposed PB (see the figure).

RESULTS: Three of the PB (climate change, stratospheric ozone depletion, and ocean acidification) remain essentially unchanged by the earlier analysis. Regional-level PBs as well as globally aggregated PBs have been developed for biosphere integrity (biodiversity loss), freshwater system change, and phosphorus and nitrogen loading. Although we cannot yet establish a regional boundary for any one PB, we can establish a global boundary for only one: regional boundary for stratospheric ozone depletion. Although we cannot yet establish a regional boundary for any one PB, we can establish a global boundary for only one: regional boundary for stratospheric ozone depletion.

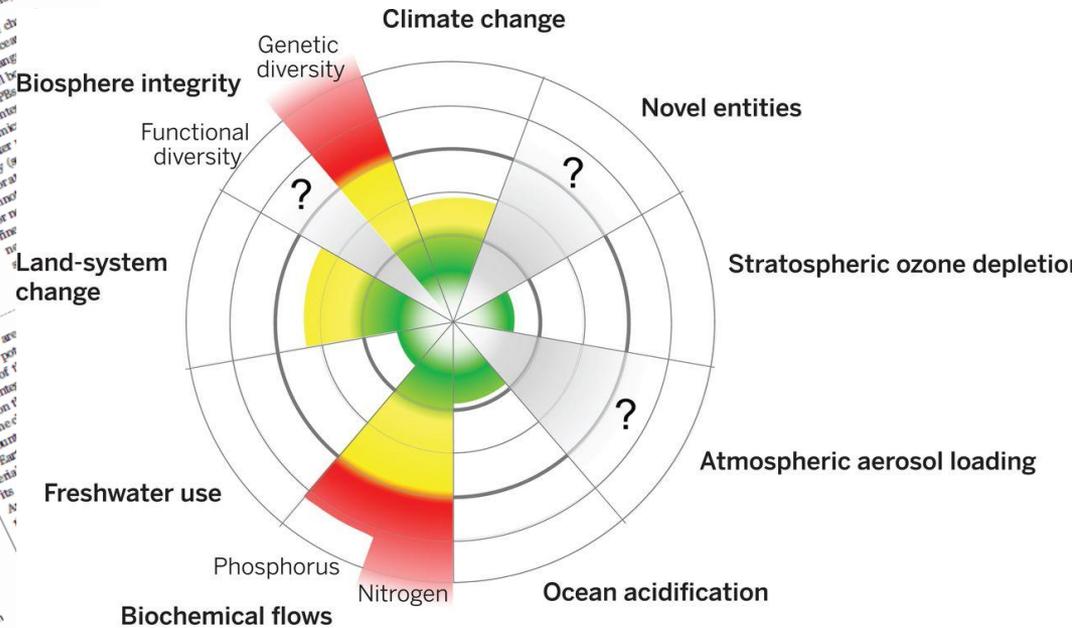
CONCLUSIONS: The PB framework provides a science-based analysis of the risk that human perturbations will destabilize the ES at the planetary scale. Here, the scientific underpinnings of the PB framework are updated and strengthened.

KEYWORDS: Planetary boundaries, Earth system, human development, sustainability, risk, resilience, Holocene epoch, anthropogenic perturbations, biosphere integrity, freshwater system change, phosphorus and nitrogen loading, stratospheric ozone depletion, ocean acidification.

DOI: 10.1038/s41562-015-0021-4

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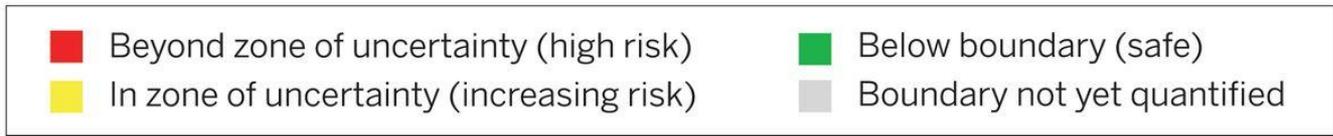
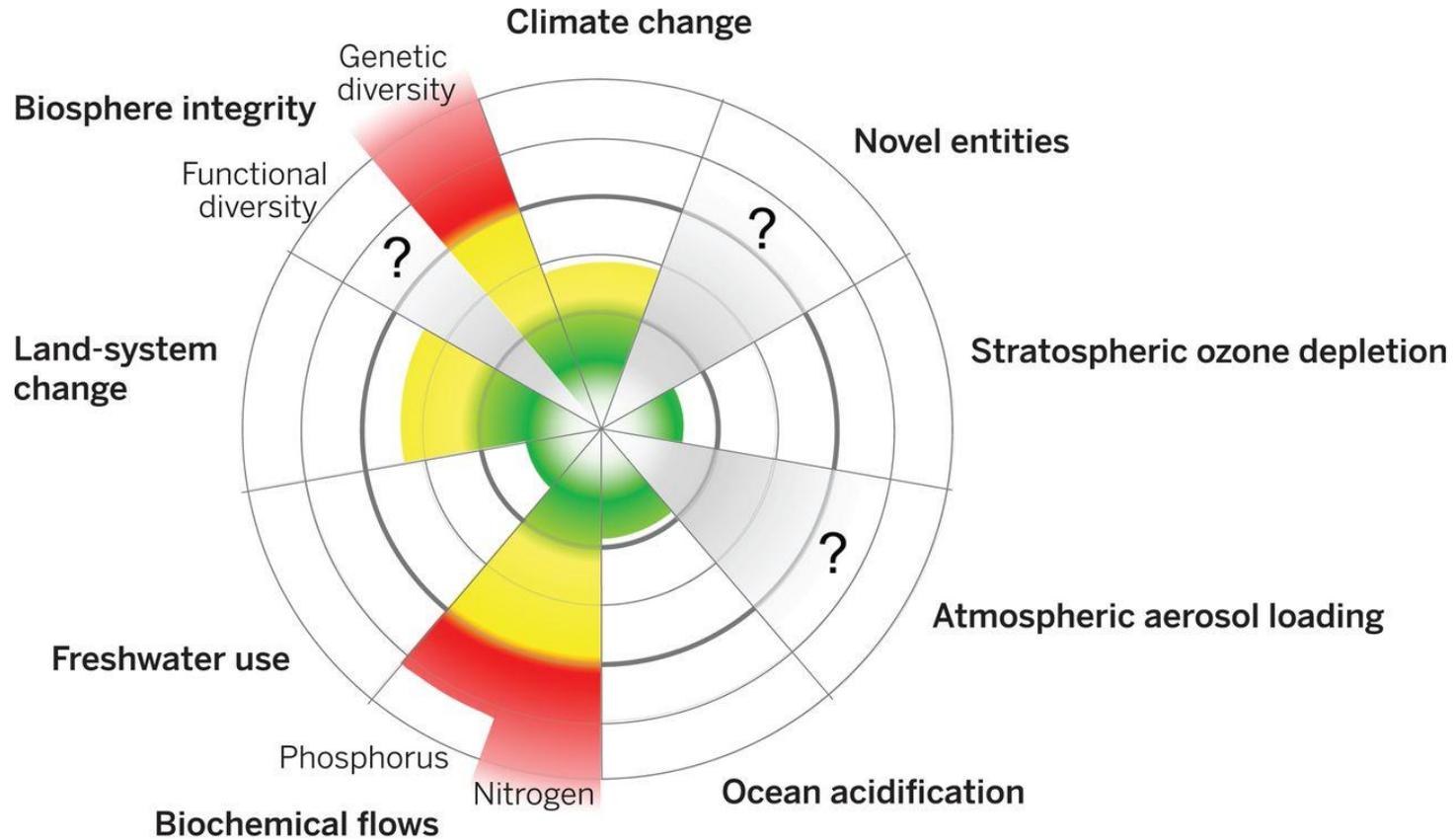
Read the full article at <http://dx.doi.org/10.1038/s41562-015-0021-4>



■ Beyond zone of uncertainty (high risk)
 ■ Below boundary (safe)

■ In zone of uncertainty (increasing risk)
 ■ Boundary not yet quantified

Current status of the control variables for seven of the planetary boundaries. The green zone is the safe operating space, the yellow represents the zone of uncertainty (increasing risk), and the red is a high-risk zone.



Will Steffen et al. Science 2015;347:1259855

Current status of the control variables for seven of the planetary boundaries. The green zone is the safe operating space, the yellow represents the zone of uncertainty (increasing risk), and the red is a high-risk zone.

Climate change

*“Two of the PBs—**climate change** and **biosphere integrity**—are recognized as “**core**” PBs based on their fundamental importance for the ES.*

The climate system is a manifestation of the amount, distribution, and net balance of energy at Earth’s surface; the biosphere regulates material and energy flows in the ES and increases its resilience to abrupt and gradual change.”

Biochemical flows

- | | |
|--|---|
|  Beyond zone of uncertainty (high risk) |  Below boundary (safe) |
|  In zone of uncertainty (increasing risk) |  Boundary not yet quantified |

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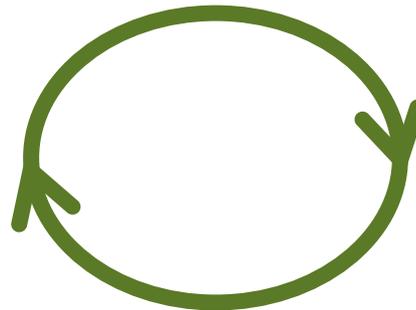


The aim

The use of natural resources is increasing

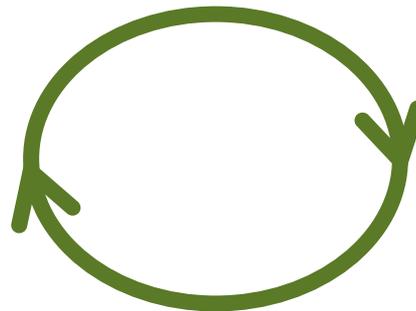
Greenhouse gas emissions are increasing

The amount of waste and emissions are increasing

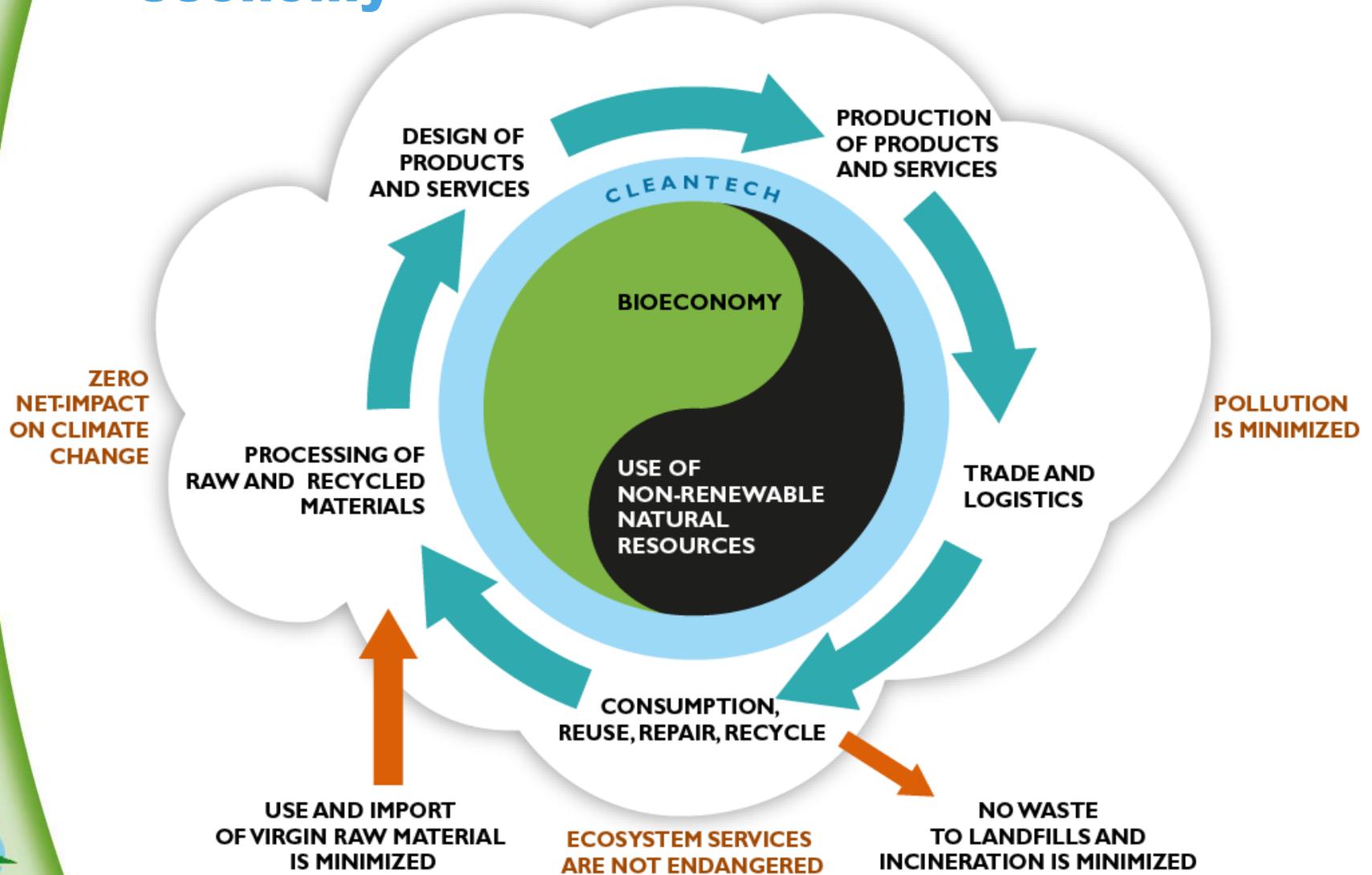


The aim

Safeguarding



The aim: A carbon neutral circular economy



“The way and the rate we are using up natural resources today risk undermining our well-being along with nature’s ability to provide for us. We need to fundamentally transform the way we produce, consume and live. We need to green our economy and the transition needs to start today.”



Hans Bruyninckx
Executive Director
The European
Environment
Agency (EEA)

Euroopan ympäristökeskuksen (EEA) State of the Environment report 2015

- The policies in place are delivering results, many of the 2020 targets will be achieved
- The long-term aim “*to ensure that ‘Living well, within the limits of our planet’*” will not be achieved with just current policies



Systems change: policy to speed up and direct the transition



1. Landscape pressure

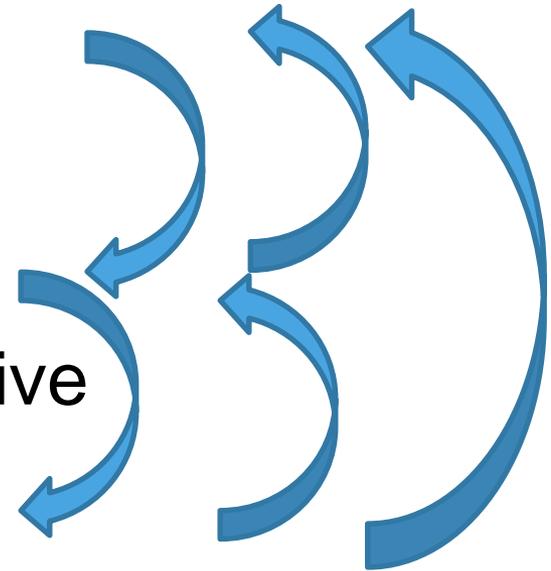
2. Destabilization of dominant system

3. Variation, maturing niches & selection



The aim to promote transitions has consequences,

- Normative perspective
- Ontological & epistemological perspective
- Methodological approach



“All researchers should be cognizant of the philosophical assumptions that guide their work.”
Donna Mertens (2007)

The aim to promote transitions has consequences

- Natural scientists often pay too little attention to the framing they contribute to – lack of constructivism
- Social scientists often too little attention to environmental challenges – lack of realism
 - *“If global change is seen as primarily a social construction rather than an objective (albeit imperfectly understood) condition, then it poses little threat to the future of our species.”* (Dunlap and Catton 1994)

The aim to promote transitions has consequences and we will have to focus more on these in the future

- Natural scientists often pay too little attention to the framing they contribute to – lack of constructivism
- Social scientists often too little attention to environmental challenges – lack of realism
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To which degree can research approaches and methods developed for marginal change be used to produce knowledge for radical transformations?

*“Evaluation is part of an ongoing **incremental** [emphasis in the original text] process of improvements and adjustments of a policy or an activity.” (Furubo 2013)*

4 challenges of the circular economy

- The sustainability challenge
- The policy challenge
- The knowledge challenge
- The circular economy challenge

