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**Sustainability in interdisciplinary perspective:  
integration of economic and ecological knowledge**

**Textbook project  
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# Thematic perspectives

**(1) A short version of the theme of the book:** see keynote address KB, Inproforum 2018: **“The significance of economic knowledge in the environmental sustainability discourse”**:

- *In which phases of the sustainability process (that stretches from research to application of scientific knowledge in environmental governance practices) is economic knowledge required?*
- *How can economic knowledge be connected with knowledge about sustainability from other disciplines?*

**(2) The broader scientific context:** What the Gulbenkian Commission for the Social Sciences demanded in the 1990s: **“Opening the social sciences” for an interdisciplinary dialogue** and knowledge exchange - in similar form now happening with economics: **creating a dialogue between economics and other environmentally relevant disciplines/sciences that participate in the sustainability discourse**

**(3) Core theme of the book:** connecting economic and social-ecological knowledge to interpret sustainability and sustainable development

...

**(4) Different interpretations of sustainability are always found** in the economic and in the broader discourse – they need to be described and discussed – how do they differ, how to integrate them, apply them practically (sustainable development as example of “essentially contested concepts”)

**The approach – review, interpretation, knowledge synthesis:**

**(5) Economic and ecological knowledge and research on sustainable development:** is critically reviewed, integrated and synthesised (= the material for the core chapters of the book)

**(6) New practices of knowledge use in the sustainability discourse and process** – critically reviewed, especially:

- **“sustainability science”**
- **“social ecology”** (= an interdisciplinary science of nature-society-interaction: my working programme – three prior publications with the same publisher) – the **cognitive aim**: to understand and analyse the long transition to sustainability and its difficulties (arguing for “accompanying research”)

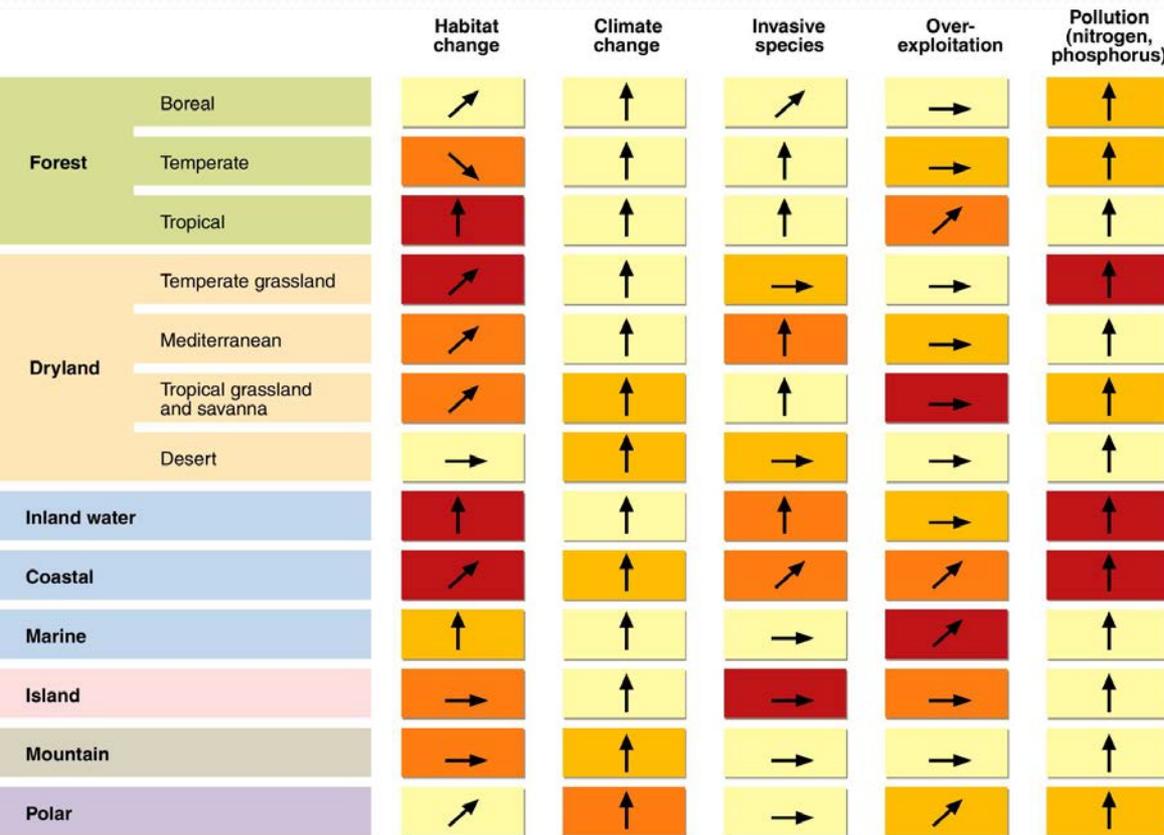
## Concepts to clarify

- **Sustainability and sustainable development** – working with “essentially contested concepts”, bridging concepts, policy concepts and scientific concepts
- **Guiding ideas, principles in the sustainability discourse (“efficiency” – “sufficiency”)** – the normative assumptions and how they influence the cognitive and knowledge practices in science and in the policy processes
- **Bioeconomy - circular economy - green economy - sharing economy** (all what is also intensively discussed and investigated in this faculty!)
- the inherent meaning of sustainable development as “re-distributive economy” (intra- and intergenerational solidarity)

# Target audience for the interdisciplinary textbook

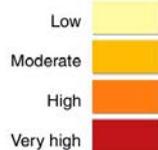
- Master and PhD-students, not only from **economics**, but from a broader range of **sustainability-related disciplines and teaching programmes**:
- **ecology, policy and management science, sociology, anthropology, geography**
- **interdisciplinary teaching programmes that take up sustainability: human, social, political ecology, sustainability science**
- **Pedagogical aim and approach:**
- supporting the teaching of interdisciplinary economics, non-dogmatic economics
- innovating and “interdisciplinising” the sustainability discourse- creating “a science for teaching and practice” – to support the sustainability process with new knowledge - why is this necessary?:

# Degradation of ecosystems has not improved since the beginning of the global sustainability discourse – see: Millennium Ecosystem Assessment 2005

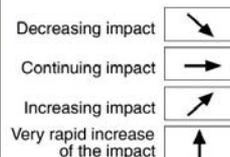


▶ Most direct drivers of degradation in ecosystem services remain constant or are growing in intensity in most ecosystems

Driver's impact on biodiversity over the last century



Driver's current trends



Source: Millennium Ecosystem Assessment

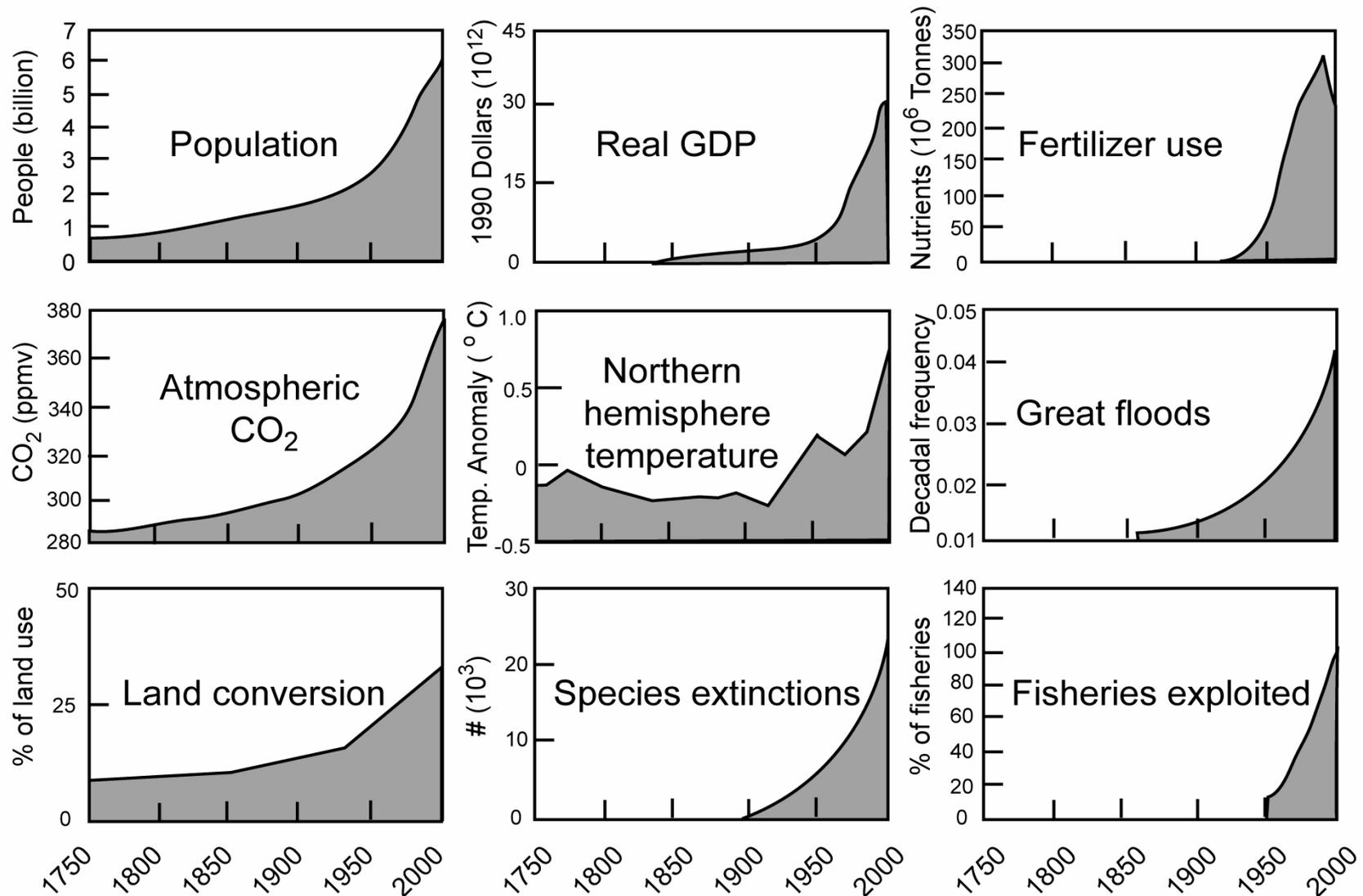
## The practical purpose of a textbook

- Much of the knowledge created in interdisciplinary environmental and sustainability research is **documented in specialised scientific journals and books** (many journals now with the concept of sustainability in the title), discussed by specialised researchers
- but it is **not accessible for the broader sustainability discourse** and process and for the participants – knowledge needs to be communicated and brought to application, teaching is part of this:
- A textbook is a form of broader distribution and communication of the knowledge about sustainability

# Important books since the beginning of the sustainability discourse – critically reviewed

1. **Herman Daly**'s classical book "Beyond Growth: The Economics of Sustainable Development" (Boston 1996);
2. David Pearce, Anil Markandya and Edward B. Barbier, "Blueprint for a Green Economy" (1989, and later updates);
3. Ian Goldin and Alan Winters, eds., "The economics of sustainable development" (Cambridge University Press, 1995);
4. Joseph Stiglitz "Globalization and its Discontents" (2002);
5. Nicholas Stern, "The Economics of Climate Change" (The Stern Review, 2007);
6. Gil Friend "The Truth about Green Business" (FT Press Indianapolis, 2009):
7. **Peter Bartelmus** "Sustainability Economics" (Routledge, 2013);
8. **Jack Reardon et al** "Introducing a New Economics: Pluralist, Sustainable and Progressive" (Pluto Press, 2017);
9. J. Mao et al 2018, "Circular Economy and Sustainable Development Enterprises" (Springer, 2018);
10. Jonathan Harris & Brian Roach, "Environmental and Natural Resource Economics: A Contemporary Approach" (Routledge, 4. Ed, 2018);
11. J. Hall & K. Klitgaard, "Energy and the Wealth of Nations" (Springer, 2018)

# A core question to discuss in the textbook: consequences of global exponential growth



Year

Steffen et al. 2004

## The questions of growth

- ... connect the theme of sustainable development to a broader discourse reaching back in the intellectual history of economics as “dismal science”:
- the “Malthusian discourse” about population growth and subsistence and
- the Neo-Malthusian discourse” about “Limits to growth” (Club of Rome, 1972) – social and ecological limits to growth



...

- Other topics:
- **Global environmental change**, especially anthropogenic climate change and the (social, economic, environmental) consequences
- **Sustainable development in practice**: the “sustainable city” – the “eco-city” – the “smart city” – urbanisation as global social change – sustainable urbanisation (“cities as parasites on the countryside”/E. Odum vs. cities as “sustainable multipliers”/W. Rees) – sustainable urban food systems
- Economic and ecological distribution conflicts (J. Martinez-Alier)
- Ethics of sustainable development, environmental ethics

# The idea of the sustainable city: compromises of social and environmental sustainability

## Two sustainability transformations in modern cities and societies:

- **The first social-ecological transformation of cities – in the past, during industrialisation** - the hygienic revolution: clean drinking water, waste and wastewater treatment, hygienic living conditions in cities – improving health and quality of life in European cities significantly since the mid of the 19<sup>th</sup> century – mainly with the help of (medical) science and technology
- Improving of social sustainability, less environmental sustainability, although the urban technologies included environmental components: with industrialisation came simultaneously new forms of environmental pollution
- **The second social-ecological transformation towards sustainability – present and future strategies:**
- practices of sustainable urbanisation under conditions of modernised cities - reduction of ecological footprints and of material and energy flows, sustainable urbanization through nature based solutions, urban and peri-urban agriculture, strengthening urban-rural interaction, urbanization of the countryside

# The thematic outline of the book

- ... is described in the text handed out to you – for further discussion
- Part I: Economic knowledge in the broader context of the sustainability discourse
- Part II: Economics of sustainability in disciplinary and thematic specialisation
- Chapter 4 Economics outright - natural resource management
- Chapter 5 Environmental economics
- Chapter 6 Ecological economics – critical perspectives of natural resource use
- Chapter 7 Neglected problems – crises and conflicts between economy and ecology
- Part III: The future – new themes to take up in the interdisciplinary and economic sustainability discourse: transition processes towards global sustainability

# The discussion after the presentation

## (1) Is a new paradigm of sustainability developing with the interdisciplinary discourse on this subject?:

- With the recent renewing and discussion of sustainability come significant changes of the old and inexact term of “sustainable development” – it is not only a process in terms of solidarity and justice (intra and intergenerational solidarity); it is not only a policy concept and process, but crosses the boundaries between different spheres of modern society – politics, economy, natural resource management, culture, education; it is a process that stretches in the indefinite future (long time perspective), it is a process of transforming the economy and together with that the society. For the transformation process the concept of “great transformation” by Polanyi has been adopted – another “great transformation”, a social-ecological transformation: and for the new society to come the widespread term is “post-industrial society”. The core concept and problem with sustainability is that of time, the temporality and its dynamics: what does a “long-term perspective” imply, what are the time-horizons of sustainability as transformation process?:

...

- As the process stretches into the more distant and unknown future of several generations, it is “beyond planning”. Sustainability cannot be planned (although planning processes are necessary in all phases of the process, for short term action and changes to achieve in shorter time).
- The biggest difficulty is not “can we deal with processes that stretch way beyond our lifetimes?” - we always and only live in the presence, in the human and social lifeworld. The aversions against long-term thinking, projecting, futurising (Keynes: “in the long run we are all dead”; Popper: “the future is unknown, that´s why it is called the future”) do not help, but ignore foreseeable disasters in “our common future” (Brundtland-report) on this planet.
- In the sustainability process, long-term projections and envisioning of the future are required and possible, as the global scenario analyses show. The real difficulties in thinking the future are (1) that of thinking it in meaningful and realistic form, not only as wishful thinking or utopia; (2) the many and different time perspectives and views of time that need to be connected and integrated in the distant time-horizon of sustainability. To deal with both difficulties, such differentiations and combinations of the time concepts and perspectives are useful as practiced in the “annals”-school in the historical sciences (Braudel), e.g., the term of “longue durée”.

## **(2) The interdisciplinary process – common language, motivation, dissolution of interdisciplinary cooperation:**

- For interdisciplinary communication a common language of (natural- and social) scientists is necessary – but what does it mean? It is not necessary to develop a new scientific terminology and to educate all scientists in interdisciplinary programmes. The communication problem is rather a practical pedagogical, known from teaching and political discourses: one needs to make one's knowledge and reasoning understandable to others that are non-specialists in the theme, be it other scientists or lay people. The transboundary communication processes follow a pragmatic logic, no ideal language is required and no ideal power-free communication as in the assumptions of Habermas' ideas of scientific, political and ethical communication ("discourse ethics"). The motivation problems should also not be imagined in misleading ways - as if it would be necessary to motivate scientists with the help of experts to communicate or participate in interdisciplinary research: environmental research or research on climate change in the past decades show, that it is possible without additional "transaction costs". As in all forms of science, disciplinary and interdisciplinary, there is never consensus; also within disciplines compete paradigms, theories, concepts. It is possible, that interdisciplinary cooperation does not succeed and scientists return to traditional forms of disciplinary specialisation – limiting the knowledge horizons, reducing science to the forms of academic teaching in specialised disciplines and subdisciplines, but this not help to deal with the problems addressed in environmental research and is no sustainable argument against interdisciplinarity which is already established.

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### **(3) The resource concept – different interpretations in ecology and economics, and in the sustainability discourse?**

- The concept of “resource” is an “overgeneralised” and abstract, de-contextualised term, and it creates misunderstanding, when economists and ecologists think they use the same term when they speak about resources. In interdisciplinary environmental research in human ecology the search for a clearer concept was not successful – talking about resource functions does not dissolve from the concept.
- Clarification is possible: to specify and classify the types of resources that are included in the abstract term, to work with specified forms - resources being only a common name for different resource types, social and natural, material and immaterial resources. Differentiations are also required for the scarcity concepts connecting with that of resources - there are different forms of natural and social scarcity. In the sustainability discourse one is always in the situation to specify the concepts, including that of sustainability.

#### **(4) The methodological problems and unsafe knowledge in interdisciplinary sustainability research?**

The knowledge about complex systems and processes (such as processes of global social and environmental change) is always in some regards insufficient, inexact, including possibilities, probabilities, sometimes informed guesses. This is meanwhile widely accepted – otherwise environmental and sustainability governance would not be possible. The knowledge improves through continuous research – as especially the research about climate change shows, that has come within a relatively short time from inexact models and insufficient data to refined, locally specific models and calculations, but still not exact knowledge. The epistemological discussion (e.g., about complex adaptive systems, coupled social-ecological systems, post-normal science, sustainability science, etc) is also advancing, and has resulted in some methodological innovations and developments, for example in sustainability science: away from the predominance of quantitative methods, working for example with semi-quantitative models, giving up models of linear change, developing new forms of knowledge synthesis (beyond synthesis of statistical data through meta-analysis). The main methodological problems in the sustainability discourse and process exist with the badly developed forms and methods of knowledge synthesis and of future research – for these new and additional methods are to be developed.

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## **(5) The participation forms and motivation problems in the sustainability process - who needs to be motivated in the sustainability process and how?**

- Participation of stakeholders that are non-scientists (resource users, citizen, political decision-makers) is for different reasons seen as necessary in environmental and sustainability policies and processes. The difficulties with practicing participatory research and resource management are not so much that of knowledge or different knowledge that the stakeholder have, but the power relations in the governance processes and the close connections between power and knowledge – knowledge becomes power when it is applied in political decisions and programmes.
- The development of participatory resource management regimes in European policies (agriculture, fisheries) goes slowly, with many difficulties (established power structures, some stakeholders can influence decisions more than others, vested interests of powerful actors).

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## **(6) The problems with changing ecosystems and social systems**

Ecosystems and social systems change continually, through manifold and connected social and ecological reasons and causes. In modern society develop “novel ecosystems” that are heavily modified and manipulated by humans: urban ecosystems, agro-ecosystems and marine ecosystems. Whereas the ecosystem change processes in earlier human history were slow, limited, with environmental damages mainly at local levels, changes happen now fast and globally, with unforeseeable risks, e.g., through genetically modified organisms or anthropogenic climate change. Much of environmental policy is still dealing with older pollution forms of air, water soils that result from the industrialisation process. The new forms of global environmental change require internationally coordinated action: even when success at local levels and improvements of local ecosystems are possible (as through environmental policies in Europe), the global deterioration process continues, and the new biotechnologies or geo-engineering bring uncontrollable risks - maladaptive changes may not be reversible.

## **(7) Ethic in the sustainability process, forms of ethical communication**

Ethics are an important component of the sustainability discourse, however, it is difficult to find a form and approach of ethical reasoning adequate for the broad sustainability theme and problems connected. It is not possible simply to choose on the basis of a worldview as in environmental movements (e.g., accepting the ethical views of deep ecology), a globally accepted environmental ethic does not exist - there are various cultures and competing approaches. A possibility would be to refer to the classical environmental ethics from North American naturalism – the land ethic of Aldo Leopold and the ethic of the sea of Rachel Carson. But these are thematically limited and may not reflect the present environmental situation under the influence of global change that drives the sustainability discourse. Ethic must be connected with the political and scientific discourses and research which influence action, behaviour, consumption, ways of life. The perspective to develop ethical reflection of sustainability can be similar to professional ethics (example: professional ethics of medical doctors). Practically: formulating ethical problems and questions that connect to sustainability, then specifying forms and criteria of ethical reasoning to answer them: Do we have responsibility for present and future generations and why? Can sustainable development be ethically justified in an anthropocentric ethic or does it require bio- and ecocentric ethics? Regarding sustainability ethics in economic thinking we can refer to Daly, for whom ethical criteria for sustainability can be derived from the idea that the economy is a subset of the ecosphere and its limits to growth, therefore differentiating between “development” and “growth”.



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## **(8) Case studies as study material in the textbook**

Examples of case studies (summaries of studies and short information) are part of all chapters. But in dealing with the complex subject of sustainable development where empirical data are changing quickly, and empirical research alone cannot answer all important questions, more innovative and interactive forms of using empirical data and further material are required:

References and recommendations for deepening research and up-to-date research, for using material from the internet, formulating questions and suggestions for working with studies and texts - individually and in groups or class (joint work and discussion are more effective than short illustrations in the book). To make the work with the book, with case studies, and with further knowledge effective, it is necessary to develop a whole set of suggestions for exercising and working individually and collectively with the book – that is not mainly for individual reading, but for application in courses where the information in the book is always communicated and discussed in different forms.

# Appendices

- Further information

# Eco-cities as guiding models for urban development

## Principles of the eco-city idea (Simon et al 2013):

- A self-sufficient economy that obtains resources locally
- Is carbon neutral, e.g., through renewable energy
- Well-planned city for walking, biking and public transport
- Maximizing water and energy efficiency, ecologically beneficial waste management, recycling, building zero-waste systems
- Restoring damaged urban areas and ecosystems
- Decent and affordable housing for all socio-economic and ethnic groups, improving job opportunities for disadvantaged groups
- Local agriculture and production
- Supports future progress, expansion, innovation
  
- The idea of the eco-city - a model for sustainable urbanisation, competing with other models; technologies tend to become important and the eco-city strategy tends to technocratic concepts of urban development (ideas of self-administration, civil society action, participation of citizen seem less important)

## Rees made the dilemma with sustainable development of cities clear – in a few sentences

- Cities as “most concentrated forms of human settlement constitute only a small part of the ecological space actually appropriated by their human residents” (p.72):
- “Every city and urban region depends for its existence and growth on a globally diffuse hinterland up to 200 times the size of the city itself. Cities are therefore increasingly vulnerable to global ecological change and geopolitical instability.”(p. 63)
- **No urban population can live from the land area of the city** – only some living species (autotrophs, heterotrophs and decomposers) can “survive on material and energy flows generated within the city itself” (p. 72)
- **Sustainable development**, of cities and globally, implies, therefore: turning from quantitative (economic growth) to qualitative development – **restricting “trade to the exchange of true ecological surpluses within an overall framework of increasing regional self-reliance”** (p. 74)

(W. Rees 1997. Urban ecosystems – the human dimension. Urban Ecosystems, 1: 63-75)

# Sustainable urbanisation and climate adaptation through ecosystem- and nature-based solutions

**Ecosystem-based resource management and nature-based solutions copy functions and services of ecosystems (regulating, provisioning, supporting, cultural services)** - also for reasons to make cities fit for climate change, and for cities at the coast to live longer with sea level rise:

- **Urban forests, parks**, green corridors, gardens, cemeteries - effective for the maintenance of biodiversity in the city
- **Urban and peri-urban agriculture** (and agrarian parks) with different methods to produce/supply food to urban dwellers, also strengthening urban-rural connections and networks
- **Regulating the urban water cycle**: blue infrastructures like rain gardens, control of storm surges to increase local infiltration
- **Greening walls and roofs** through plants
- **Green infrastructures**: trees along streets, replanting of hedges and forests
- Enhancing ecosystem resilience and adaptive capacity and different service types in urban and peri-urban areas: **reforestation, protected areas, flood regulation, recreation of wild habitats** (Geneletti & Zardo 2016)

# "Post normal science/PNS"

- The PNS-hypothesis formulated by Silvio Funtowicz and Jerome Ravetz describes knowledge situations like these of environmental problems or global environmental change - where **risks are high, values disputed, decisions urgently required, but knowledge insufficient**
- The **problems resulting from PNS:**
  - No single discipline or specialised research can provide the knowledge required (interdisciplinarity, transdisciplinarity)
  - Scientific knowledge/expertise (with abstract, general and universal knowledge) come under pressure and critique (other knowledge forms upgraded)

# Transdisciplinarity

- "First, transdisciplinarity tackles complexity in science and it challenges knowledge fragmentation ...
- Second transdisciplinary research accepts local contexts and uncertainty; it is a context-specific negotiation of knowledge...
- Third, transdisciplinarity implies intercommunicative action... includes the practical reasoning of individuals with the constraining and affording nature of social, organisational and material contexts ...
- Fourth, transdisciplinary research is often action-oriented ... deal with real world-topics and generate knowledge that not only address societal problems but also contribute to their solution"

(Roderick Lawrence & Carole Després, "Futures" XX, 2003)

# Interdisciplinary research in environmental history – influential works

Sociological, anthropological, economic, ecological approaches - **1st half of 20th century:**



**Karl A. Wittfogel**, Historical analysis of natural resource use: "oriental despotism" and "hydraulic societies" in several works, since the 1930s



**Lewis Mumford**, historical analysis of urban and technological development in several works, e.g., "Technics and Civilization", 1934

- **Karl Polanyi**, 1944: "The Great Transformation" (+ K. Polanyi, K. Arensberg, Pearson, 1957: "Trade and Markets in the Early Empires")



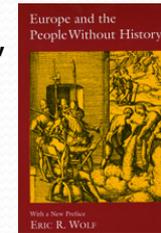
**Fernand Braudel**, European economic history, many works, e.g. "La Méditerranée et le monde méditerranéen à l'époque de Philippe II", 1949

## ... 2nd half of 20th century



**Marshall Sahlins**, stone age economy, e.g. "The Original Affluent Society", 1968

- **Eric Wolf**, 1982: "Europe and the People Without History" (cultural anthropology and world system theory)



**Alfred Crosby**, 1986: "Ecological Imperialism"



- **Jean-Claude Debeir, Jean-Paul Deléage, Daniel Hémerly**, "In the servitude of power" (Les servitudes de la puissance) 1986, 1991 – history of energy systems
- **Alf Hornborg, J.R. McNeill, Joan Martinez-Alier**, eds., 2007: "Rethinking Environmental History – World-System History and Global Environmental Change"
- **Marina Fischer-Kowalski & Helmut Haberl**, eds., 2007: "Socioecological Transitions and Global Change"
- Names that could be mentioned too: **Stephen Boyden** (biohistory), **Emilio Moran** (anthropology)