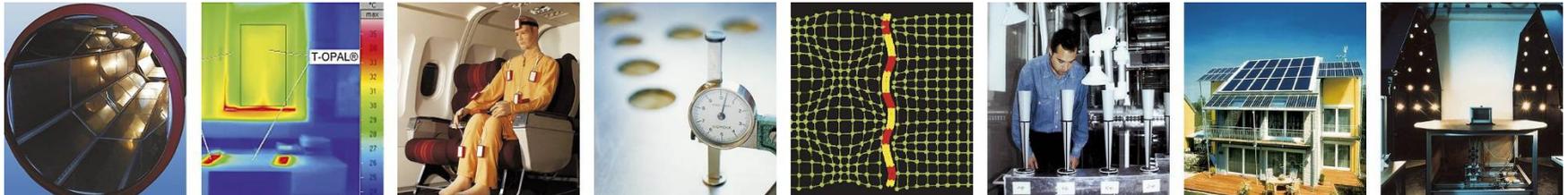

Biodiversity in the context of global value chains

Cairo Climate Talks

Cairo, Egypt, 12 March 2014



Ganzheitliche Bilanzierung

Overview

- Introduction to biodiversity
- Introduction to LCA
- Application of LCA
- Land Use in LCA
- Approaches for tackling biodiversity in LCA
- Outlook: What does biodiversity in LCA mean for companies, governments, NGOs?



Introduction to biodiversity: relevance

The loss of biological diversity due to habitat destruction has become a **pivotal topic of environmental action** in recent years. The motivation behind this political development, aside from the clear, scientific knowledge that for years the species and habitat loss has been proceeding at rates never recorded before (FAO 2010), is also the societal understanding that „functional“ ecosystems, with their respective diversities, form an irreplaceable foundation of life and supply valuable services to humans (TEEB D3 Report).



Introduction to biodiversity: policies

As a result of a long list of international conferences (e.g. World Summit for Sustainable Development (2002), Malahide Conference (2004), G8+5 Meeting Heiligendamm (2007), Potsdam Initiative – Biological Diversity 2010 (2007), Conference of Parties (2008 und 2010)) **the EU set as a goal to investigate the systematic interrelations of biodiversity and to stop its loss** (COM 2011). The European policy decisions were implemented in Germany in the form of the **national strategy for biodiversity** (Nationale Strategie zur biologischen Vielfalt, NBS) from 2007 und its derivative programs and research focus areas. To support the NBS, the Federal Agency for Nature Conservation (BfN) developed a joint concept with the Federal Ministry for the Environment (UBA) in June 2011, establishing research focus areas for biodiversity.



Introduction to biodiversity: international milestones

Convention on Biological Diversity (1992)

- Global consensus
- Broad definition: specimen, species, ecosystems

Millennium Ecosystem Assessment (2005)

- State of biodiversity worldwide, trends, causes
- Concept of Ecosystem Services

The Economics of Ecosystems & Biodiversity (since 2008)

- Monetization of biodiversity
- Principle: operationalization of valuation



Introduction to biodiversity: IPBES

Intergovernmental Platform on Biodiversity & Ecosystem Services

- Independent intergovernmental body, UN-based
- Science-policy interface for biodiversity and ecosystem services
 - Key scientific information for policymakers
 - Assessments of knowledge on biodiversity and ecosystem services
 - Policy formulation and implementation support
 - Capacity building



Intergovernmental Platform on
Biodiversity & Ecosystem Services



Introduction to biodiversity: BBOP

Business and Biodiversity Offsets Programme

- International partnership of conservation NGOs, companies, governments, financial institutions
- Design, testing, implementation of biodiversity offsets
- Publication of standards and guidelines

Business and Biodiversity Offsets Programme



Introduction to LCA: burden shifting



Avoid

solving a problem...



Introduction to LCA: burden shifting



Avoid

solving a problem...



... by creating

another one.



Introduction to LCA: burden shifting

Example: fuel economy and CO₂ emission improvement for car

Approach:

- 95% of energy used to push car
- Only 5% used to push driver

Make it lighter! Use aluminium, titanium, compound materials



Introduction to LCA: burden shifting

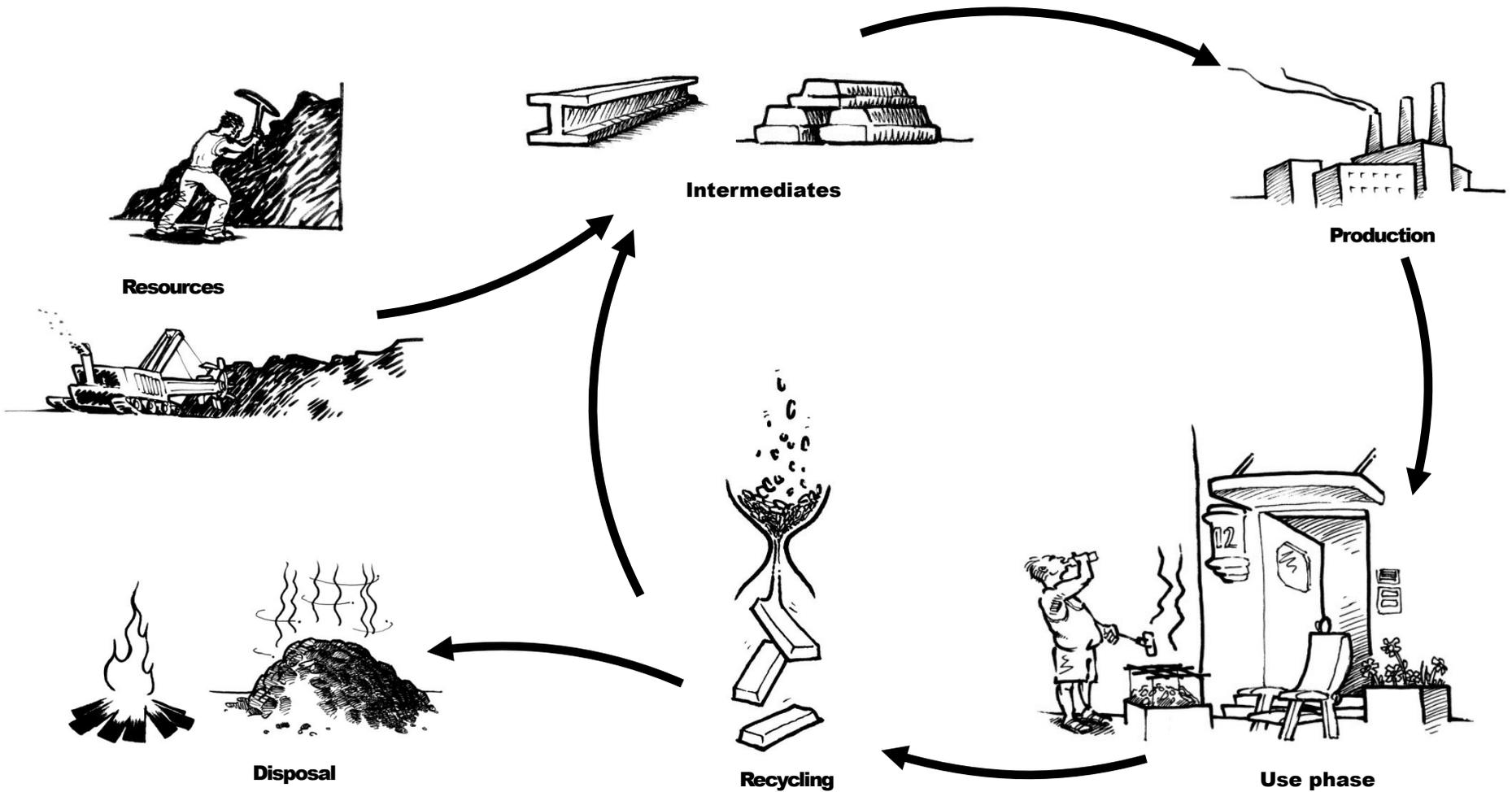
Problems associated with lightweight materials:

- Aluminium is energy-intensive to manufacture
 - CO₂ emissions from industry
- Titanium is energy-intensive and expensive
 - CO₂ emissions from industry
 - Watch price of product
- Compound materials are hard to recycle
 - Less substitution of new materials
 - Watch cost of recycling

Danger of problem shift rather than solution



Introduction to LCA: life cycle thinking



Introduction to LCA: demand for structured information

Take into account

- All relevant effects of the product
- Whole life cycle of the product (“cradle to grave”)

In certain cases: compare services rather than products

(e.g. mobility, storage, heating)

Holistic view desired

→ Life Cycle Assessment / Life Cycle Engineering

LCA = Ökobilanz = “eco-balance”

LCE = Ganzheitliche Bilanzierung = “holistic balance”



Introduction to LCA: basic methodology

Life Cycle Phases:

- Production phase
- Use phase
- End-of-life

Procedure:

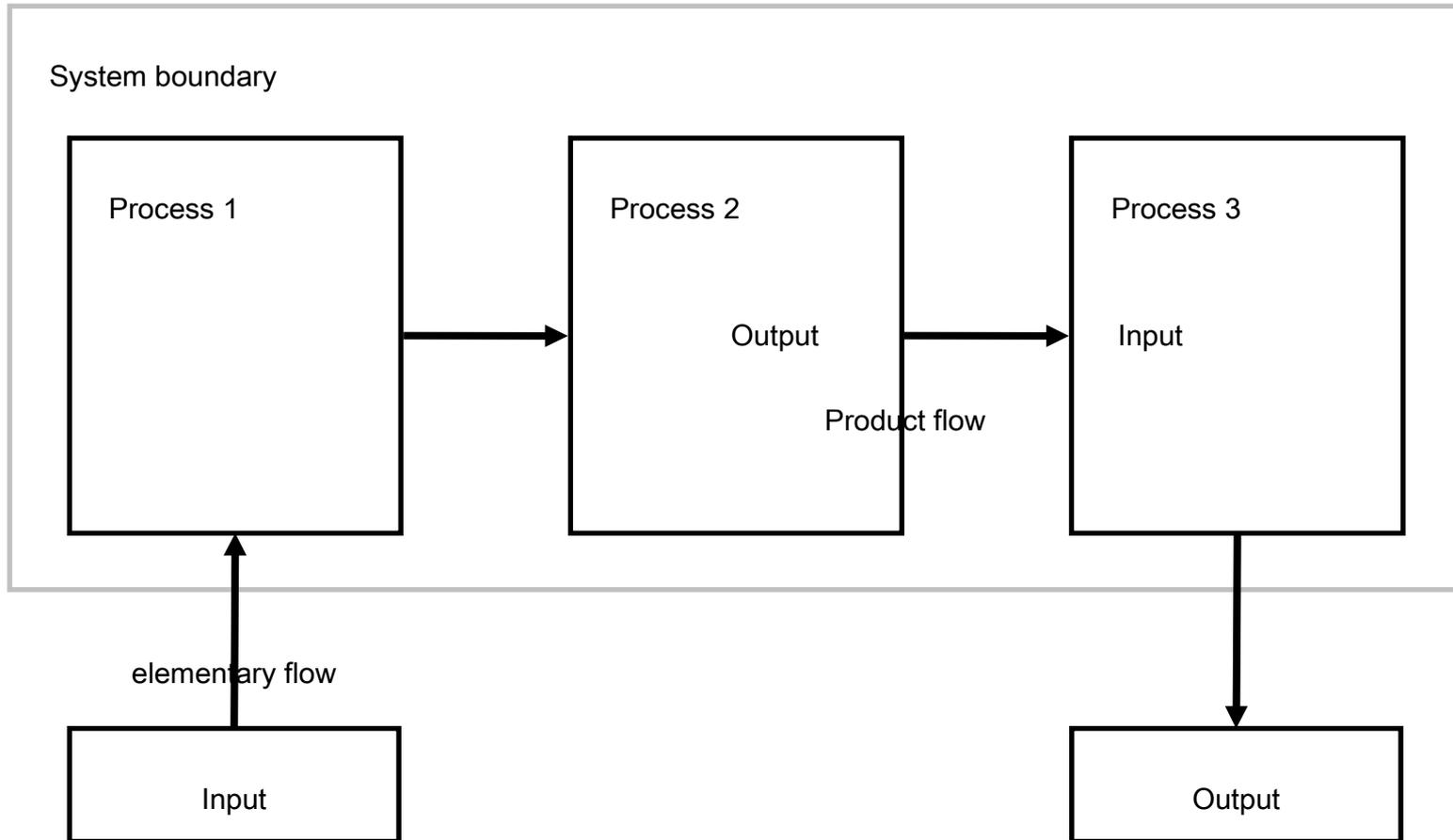
- Goal & scope: system boundary, functional unit
- Inventory modelling
- Impact assessment
- Interpretation

Back in the day: “handmade” LCA on spreadsheets

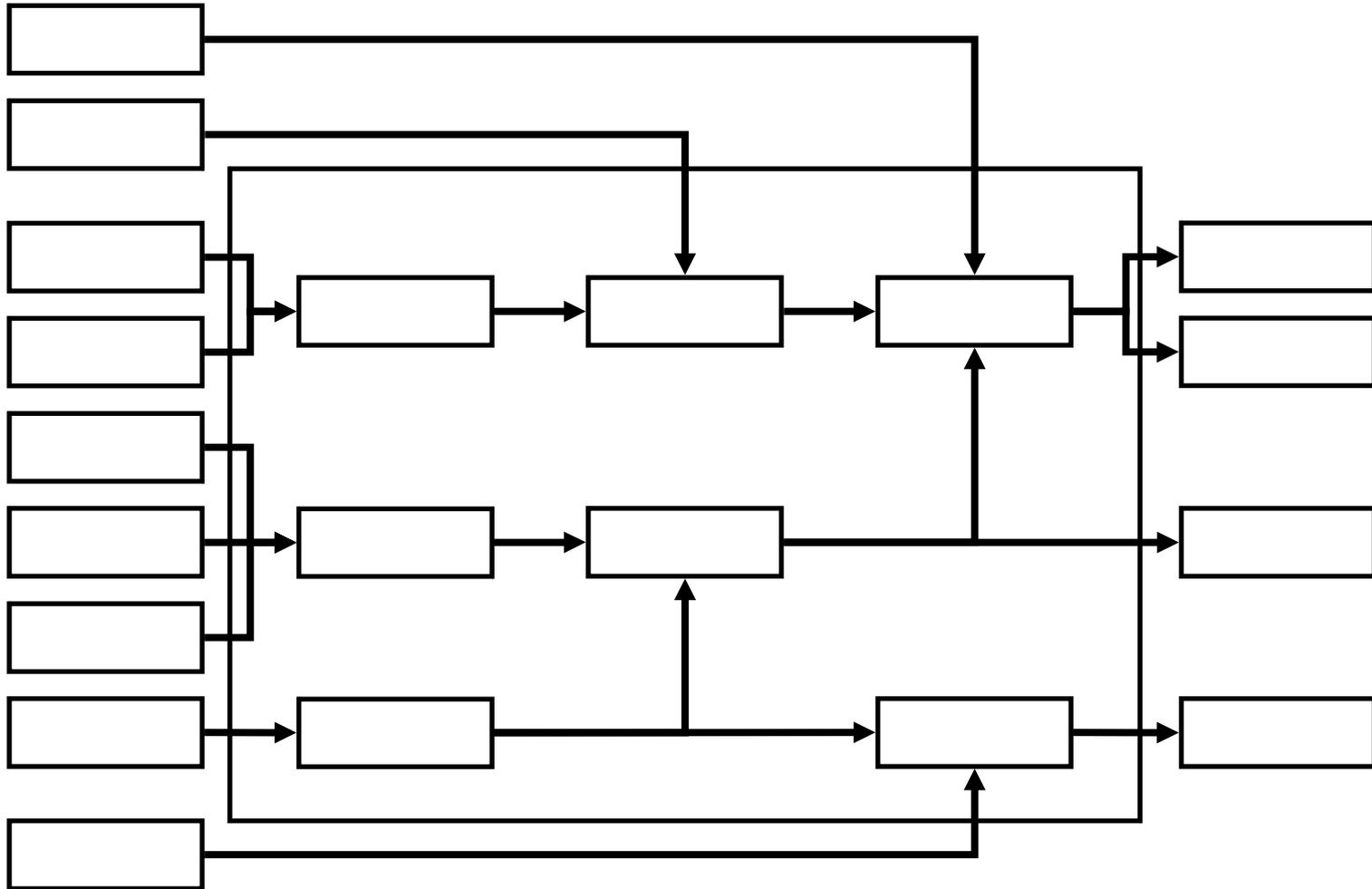
Present: LCA software assists in the process



Introduction to LCA: inventory modelling



Introduction to LCA: inventory modelling



Introduction to LCA: inventory

functional unit

inputs:	outputs:
<ul style="list-style-type: none">• sand 0.4 kg• bauxite 5.5 kg• iron ore 4.5 kg• air 9.2 kg• rock salt 1.7 kg• fresh water 8.5 kg• crude oil 2.2 kg• uranium ore 0.1 kg• ...	<ul style="list-style-type: none">• product 1 piece• carbon dioxide 7.5 kg• sulphur dioxide 2.1 kg• nitrous oxide 0.2 kg• methane 0.1 kg• inert waste 2.0 kg• hazardous waste 0.3 kg• ammonium 0.1 kg• nitrate 0.5 kg• phosphate 0.6 kg• ...

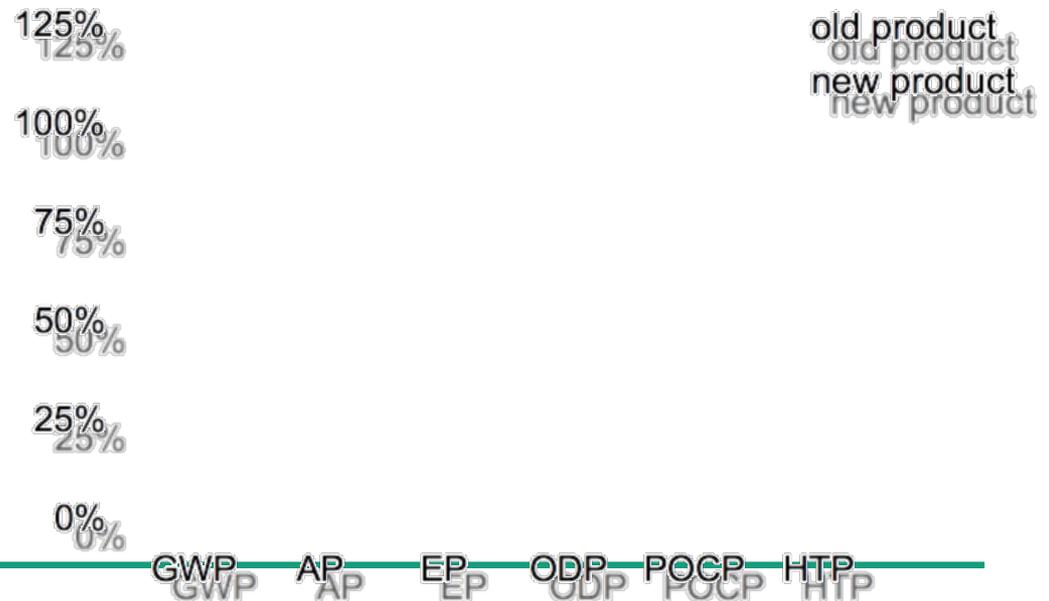


Application of LCA

Quantification of the environmental burden of products

- Addresses multiple issues at a time
- Break-even points of benefits vs. disadvantages
- Comparison of products, systems or services
- Footprinting, benchmarking
- Product development

NOT a result: the decision



Specific challenges and limits of LCA

Issues in the LCA community

- Allocation of inputs/outputs in multifunctional processes
- Limited coverage of environmental impacts
- Limited representation of space and time

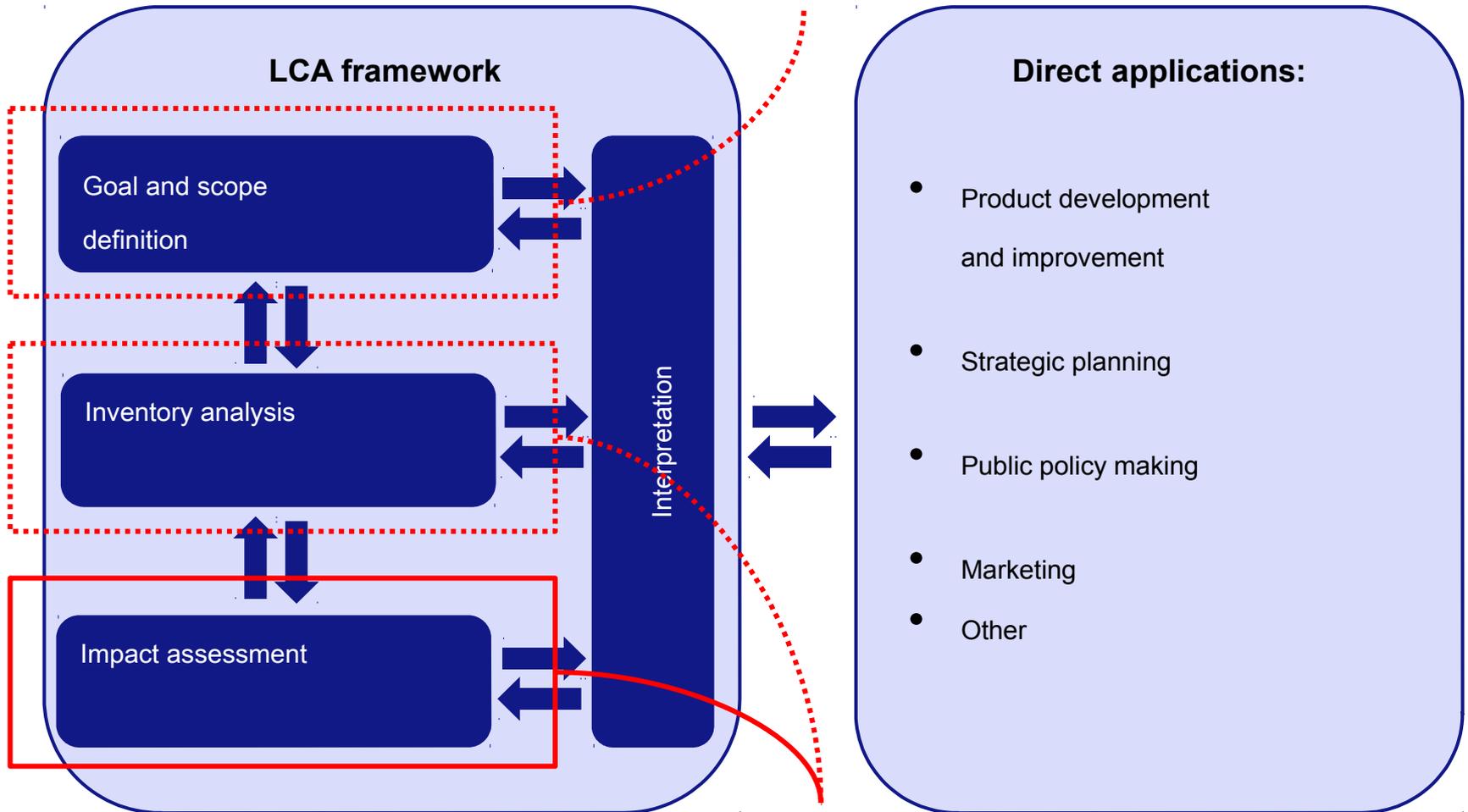
Overall challenge of LCA in general and biodiversity in particular

- Simplifying a very complex subject with hidden normative assertions
- Answering ethical questions through means of technology



Introduction to LCA: ISO 14040/14044 framework

UNEP/SETAC Life Cycle Initiative guidelines



Development of indicators

for land use impacts



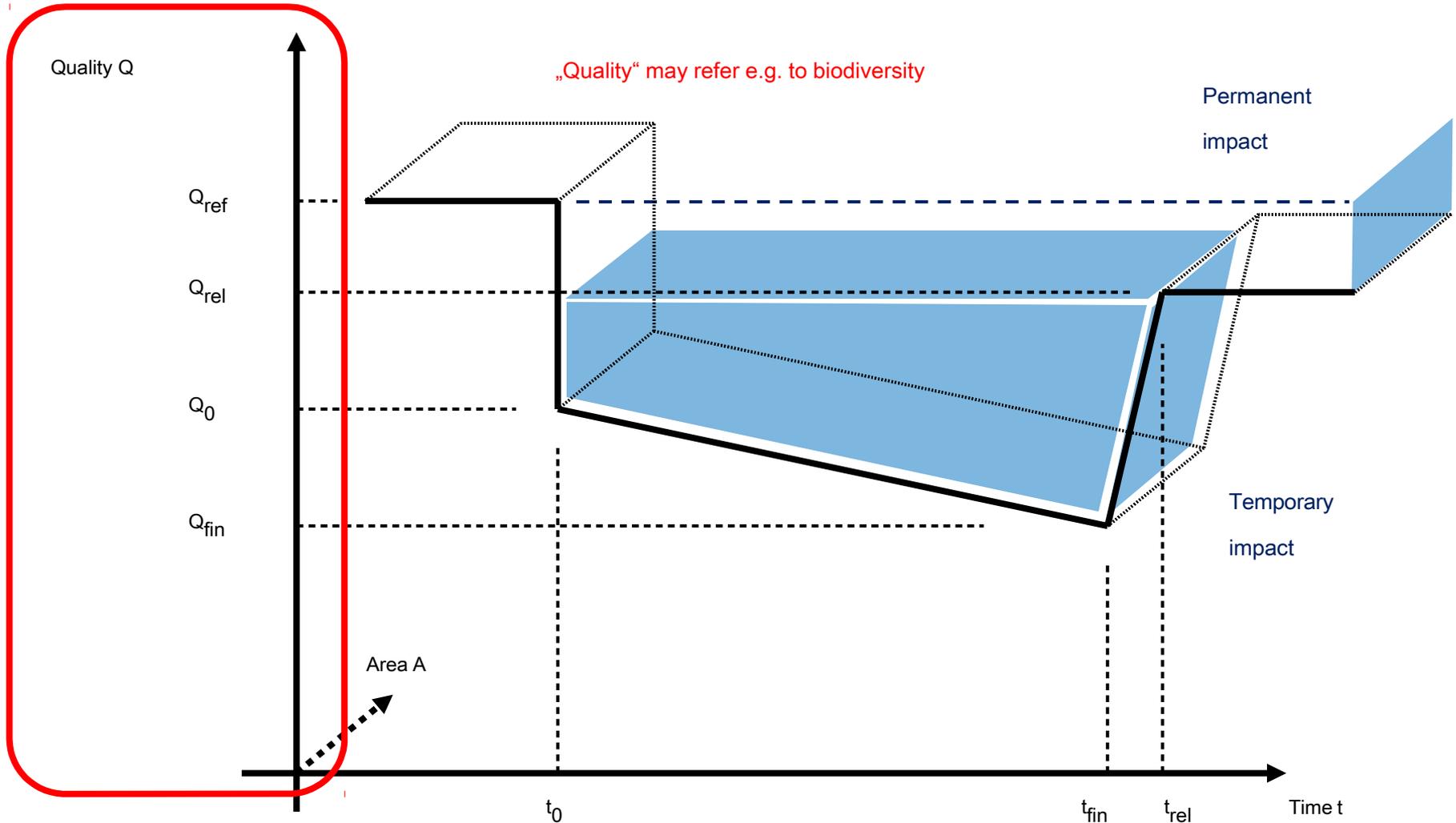
Context: land use in LCA

Context: UNEP/SETAC Life Cycle Initiative

- Description of the state of a surface element with quality Q , area A , and time t
- Taking the integral of all elements gives the impact.
- Simplified: $\text{Impact} = \Delta Q \times A \times \Delta t$



Context: land use in LCA



Biodiversity in LCA: approaches

One expression of the Q axis in the UNEP/SETAC land use framework

Selected approaches

- Koellner & de Baan (from 2003): species richness ~ land use type
 - Empiric, not mechanistic link between land use and biodiversity
 - Started with only plants, today significantly more taxa
- Michelsen (from 2008): state of biodiversity ~ key factors
 - Very open, loose definition, but highly flexible
- Lindner (2008): biodiversity value ~ species richness valued by rarity
 - Mathematical structure similar to Simpson index
 - Describes more a potential than actual biodiversity



Koellner/de Baan

(Koellner from 2003, de Baan from 2012)

Species density depending on land use type

- Literature research: species per area
- Normalisation of data to 1 m² per species-area relationship (SPAR)
- Relative to regional species density

Application

- Characterisation factors per land use type per region
Forest, pasture, field... very broad land use type definitions
- Switch between land use types → change of biodiversity
- Data on biome level, some on ecoregion level



Michelsen (from 2008)

Biodiversity determined through regionally specific inputs

- Global factors for relevance of regions
 - Rarity
 - Vulnerability
- Regionally specific key factors for biodiversity
 - Choice of key factors depending on region
 - Ordinal scale for key factors
 - Arithmetic average of key factors
- Change of key factors → change of biodiversity



Lindner (2008)

Rarity rated richness

- Basis: Habitat suitability matrix
 - Rows: land use types | columns: species
- Calculation of RRR per land use type
 - Sum of all potential habitat areas per species ~ abundance
 - Abundance → rarity
 - Sum of all rarity values of species per land use type
- Change of land use types → change of biodiversity
- Demonstration in one case study on southern California



Quantification of biodiversity: lack of normative conventions

No globally unified definition of biodiversity

■ Convention on biological diversity (CBD)

- Diversity within species
- Diversity between species
- Diversity between ecosystems

Very generic high-level definition
→ need for elaboration

■ Millennium Ecosystem Assessment (MEA)

- Variability
- Quantity and quality
- Distribution

Various aspects of biodiversity
→ different goals



Quantification of biodiversity: lack of normative conventions

No globally unified definition of biodiversity

■ Ecosystem services (according to MEA)

- Provisioning services
- Supporting services
- Regulating services
- Cultural services

Various services provided by biodiversity
→ different goals

■ The Economics of Ecosystems & Biodiversity (TEEB)

- Interpretation for economic decision processes
- Tangible values: substitution of technical solutions
- Intangible value: e.g. willingness to pay

Pragmatic context-dependant valuation
→ Problem: choice of valuation methods



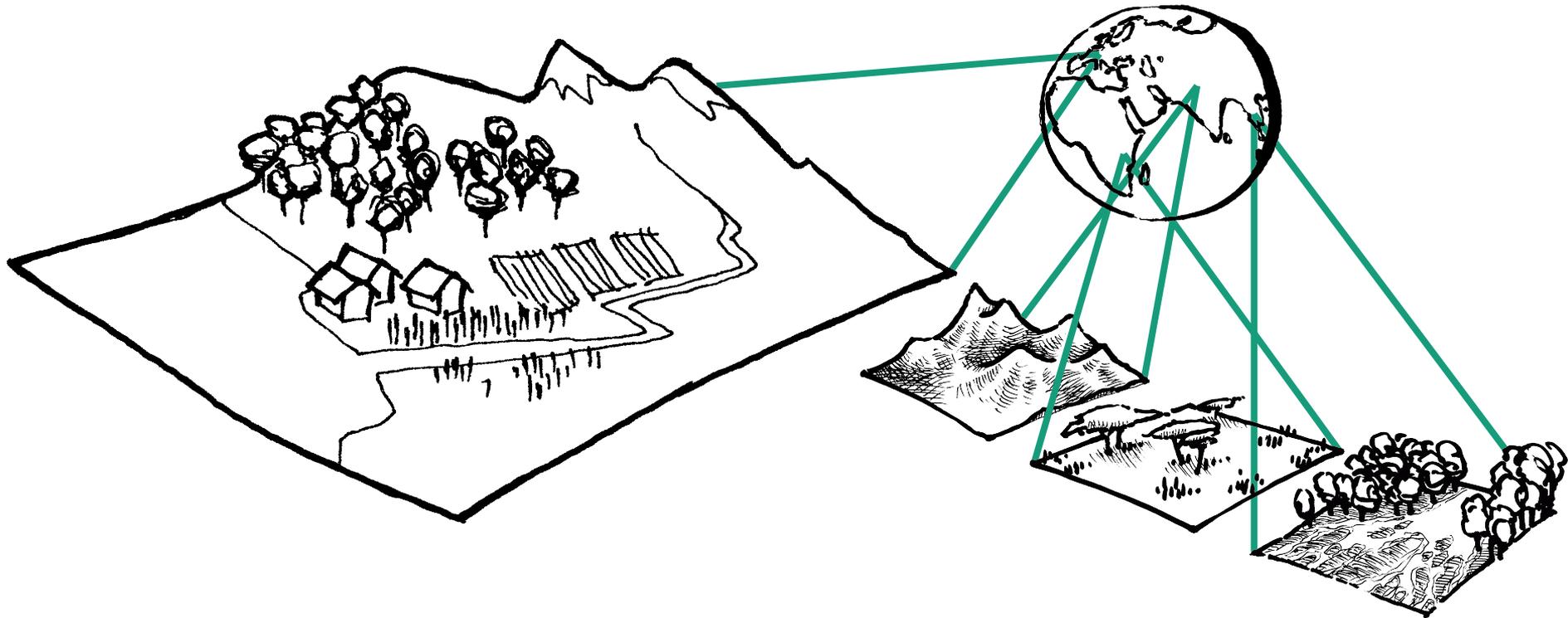
Quantification of biodiversity: lack of normative conventions

No recommendation for handling trade-offs between goals

- Few rare species vs many ubiquitous species
- Carriers of ecosystem services vs rarity
 - Which ecosystem services?
 - What does „rare“ mean?
- Naturalness = value in itself?
- Monetization
 - Discounting
 - Willingness to pay/accept
 - Price elasticity



Quantification of biodiversity: my current approach



Quantification of biodiversity: my current approach

Combination of the best aspects of existing methods + original development

- Biodiversity = global weighting × local constitution
- Weighting factor based on aspects of biodiversity with globally accepted relevance; locally specific aspects used to describe constitution
- Weighting factor can be interpreted as potential,
local constitution as realization of potential

Result: dimensionless index number, but points in the right direction

- High impact = not preferred
- Integration of various aspects and influences
- Enables aggregation and trade-off calculation



Quantification of biodiversity: my current approach

Global weighting of regions

- Delineation: e.g. ecoregions, biomes, anthromes...
- Strong normative component
 - Inclusion of relevant stakeholders
 - Normative competence needed (e.g. authorities)
or widely accepted (e.g. NGOs, experts)
- Potentially useful approaches, e.g.
 - Relative species density (Koellner)
 - Species numbers and rarity (Lindner)
 - Species number, endemism, vulnerability of ecosystem (Brethauer)
 - Biodiversity hotspots (Olson)



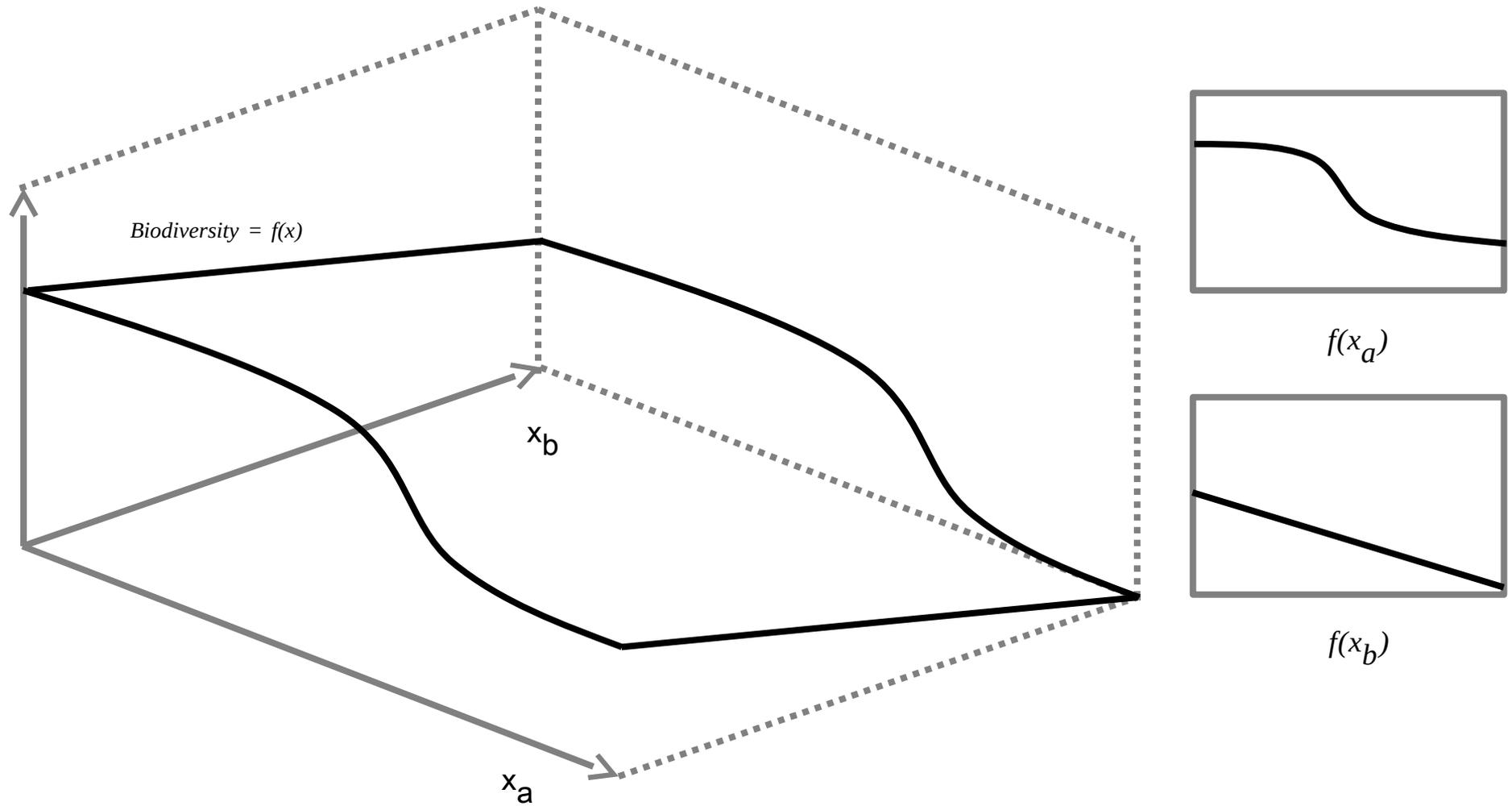
Quantification of biodiversity: my current approach

Local description of constitution of biodiversity
in the context of a regionally specific representation

- Literature research, expert interviews etc.
 - What does biodiversity mean in that region?
 - Which parameters constitute biodiversity in that region?
- Literature research
 - Laws
 - Strategy documents
 - Documentation of EIA processes
 - Reports from conservation NGOs
 - Scientific publications



Quantification of biodiversity: my current approach



Quantification of biodiversity: my current approach

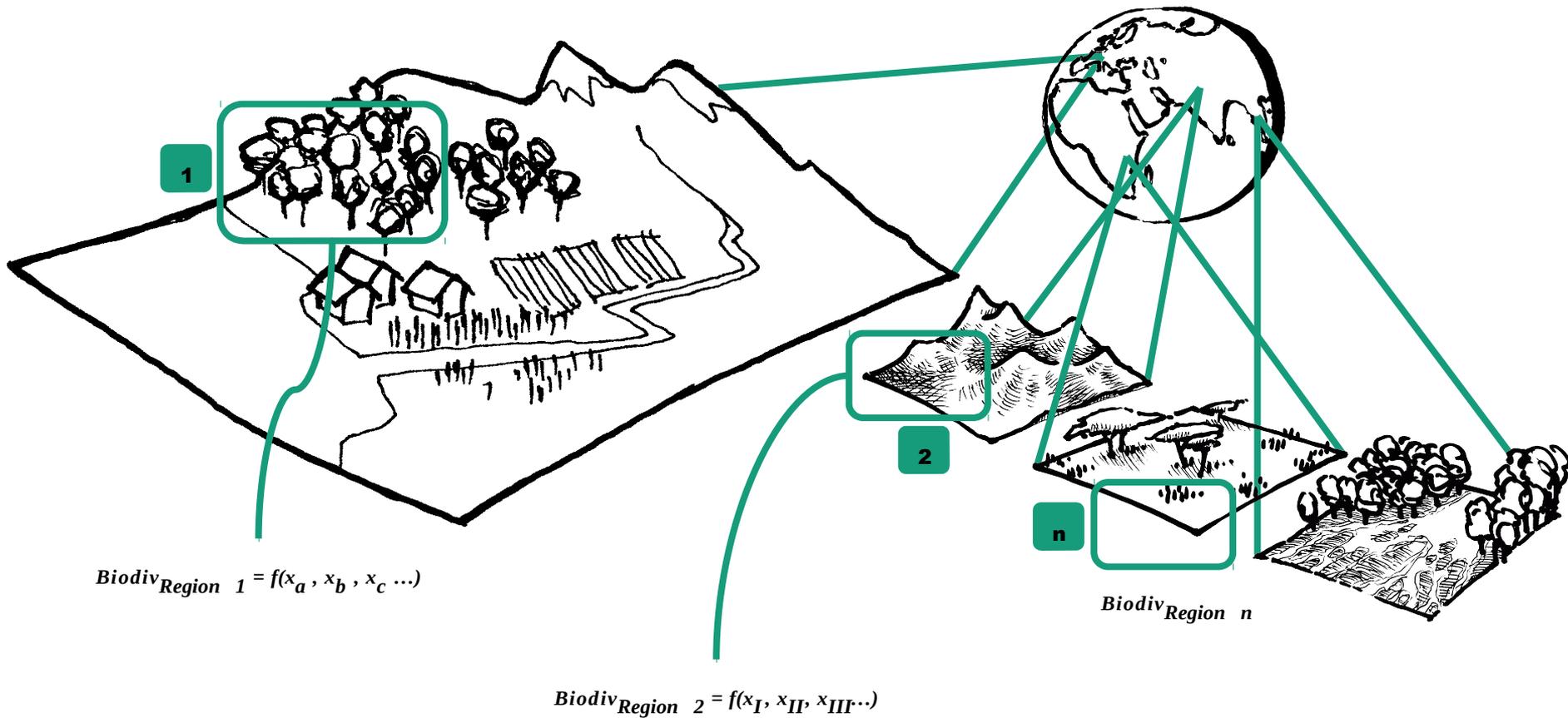
Local description of constitution of biodiversity

in the context of a regionally specific representation

- Regionally specific biodiversity potential function
 - State = absolute level
 - Change over parameter = (partial) deviation
- Inclusion of soft, semi-quantitative data through fuzzy modeling
 - Transfer of qualitative data into quantitative contexts, enabling of use of calculation models
 - Added information, not strictly scientifically verifiable, but with common sense and transparent documentation



Quantification of biodiversity: my current approach



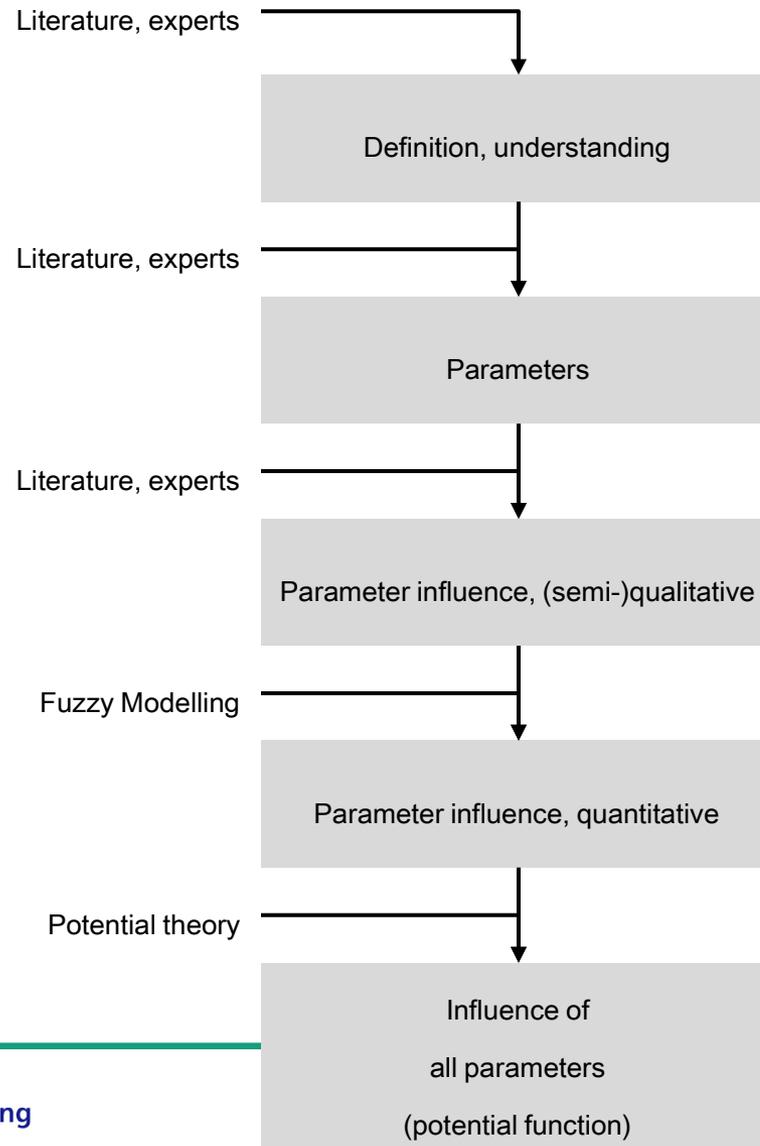
Quantification of biodiversity: my current approach

Guideline for expert interviews

- Preparation
 - Literature research
 - Choice of interview partners
- Questioning
 - Relevance of ecosystems and species
 - Transform fuzzy data into crisp data, get confirmation
- Topic matrix: e.g. diversity of ecological niches
 - Physical/chemical, structural
 - Space, time
 - Conquest by neozoa/neophytes

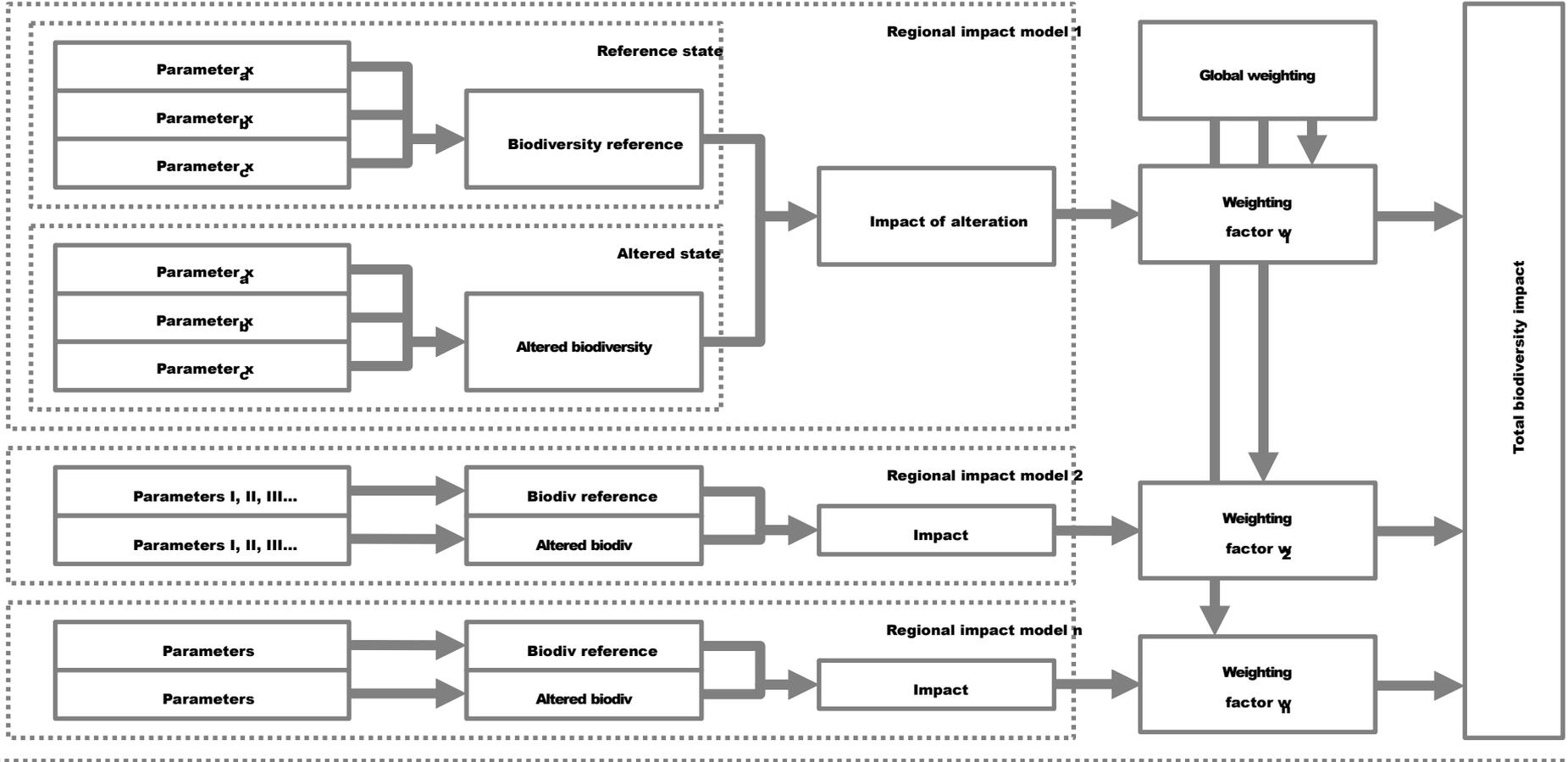


Quantification of biodiversity: my current approach



Quantification of biodiversity: my current approach

Detailed, regionally specific biodiversity assessment and global aggregation



Outlook

What does biodiversity in LCA mean for companies, governments, NGOs?

- Aggregation of biodiversity impacts across value chains
- Benchmarking of products
- Communication of condensed biodiversity information
 - Business-to-business
 - Business-to-consumer
- Does not replace a site-specific assessment (EIA, SEA)

Constructive criticism welcome!



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