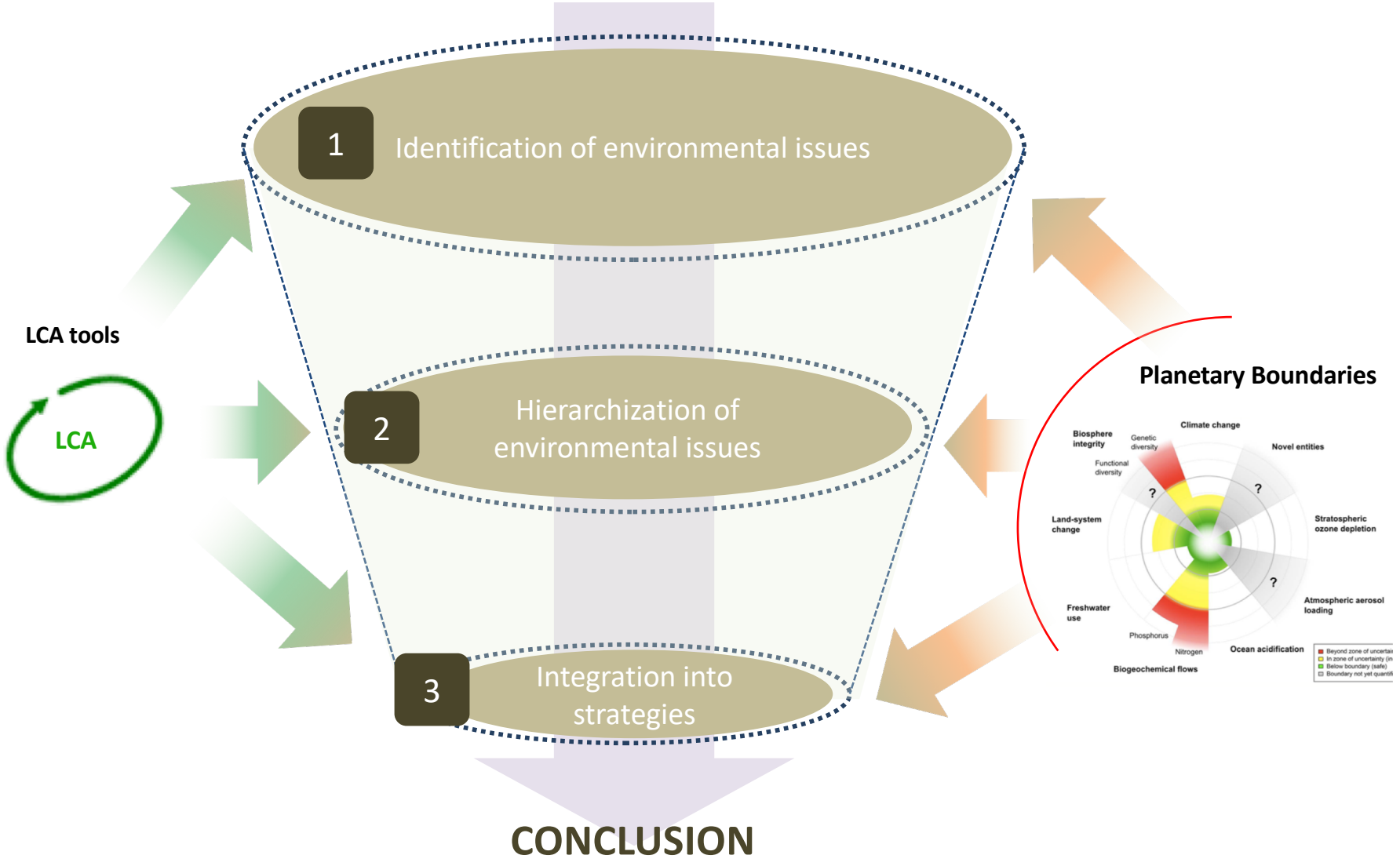
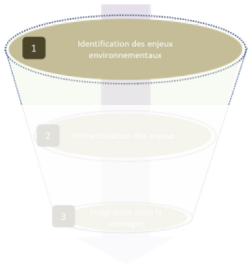
Environmental issues, hierarchization and strategic integration

Which place for LCA and Planetary Boundaries ?

ScoreLCA Conference, March 21st 2019

Agenda


1
Identification of environmental issues
2
Hierarchization of environmental issues
3
Integration into strategies
LCA tools
LCA
Planetary Boundaries
Climate change
Novel entities
Stratospheric ozone depletion
Atmospheric aerosol loading
Ocean acidification
Biogeochemical flows
Phosphorus
Nitrogen
Freshwater use
Land-system change
Biosphere integrity
Genetic diversity
Functional diversity
CONCLUSION



Life Cycle Analysis: a « holistic » and causal framework to classify environmental issues

LCA

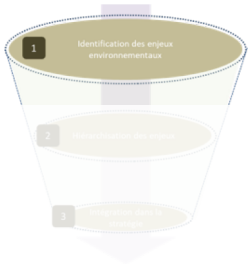
Flow	→	Impact indicator (Midpoint)	→	Damage (Endpoint)

- CO_2
- CH_4
- SO_2
- Phosphates
- Nitrates
- Energie
- Eau
- etc…

- Climate change
- Ozone depletion
- Ionising radiation
- Photochemical ozone formation
- Particulate matter formation
- Acidification
- Eutrophication
- Toxicity
- Land stress
- Water stress
- Mineral resources scarcity

- Human Health
- Ecosystem degradation
- Resource depletion

Source: LC Impact



LCA: good of coverage of environmental issues (70%) and a relevance level in progress

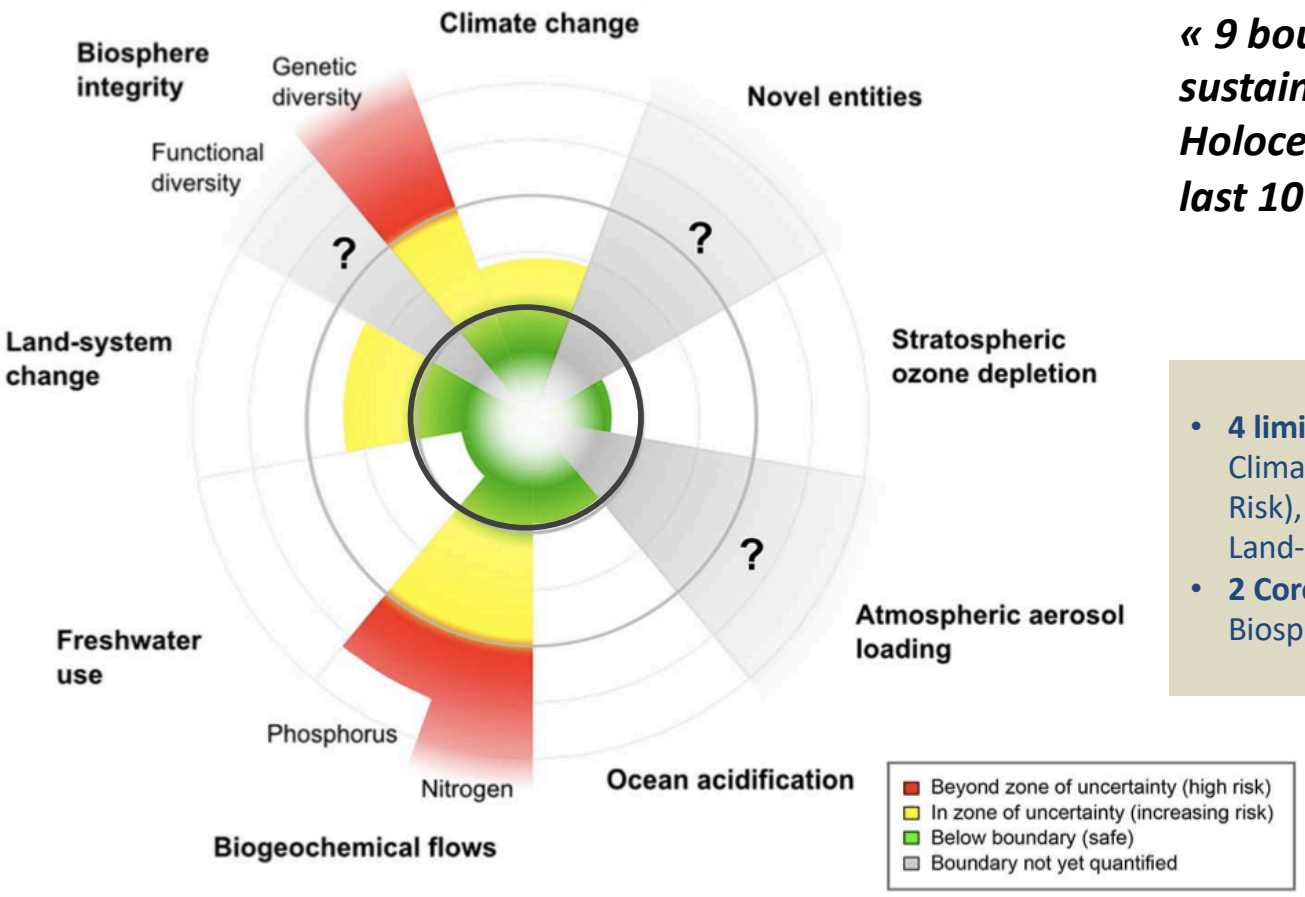
LCA

Issue	Sub-issue 1	Sub-issue 2	Sub-issue 3	Sub-issue 4	Sub-issue 5	Sub-issue 6
Climate change	Reduction of GHG emissions	Storage of GHG emissions	Adaptation to climate change			
Air quality degradation	Acidification	Photochemical ozone	Ozone layer destruction	Respiratory problems	Other health issues	
Nuisance	Odor pollution	Noise pollution				
Soil pollution	Pollution	Soil decontamination				
Industrial risks	Release of toxic substances	Explosion	Fire			
Depletion of energy resources	Total energy consumption	Non-renewable energy consumption	Renewable energy production			
Depletion of non-energy resources	Total raw material consumption	Zoom on critical raw materials	Non-energy renewable resources	Recycled resources		
Waste production	Total waste production	Zoom on hazardous waste	Energy recovery and waste recycling			
Degradation of water resources	Water scarcity	Water pollution	Competition between uses			
Land use change	Deforestation	Soil fertility depletion	Erosion	Soil artificialization		
Ecosystem degradation (endpoint damage)	Change or degradation of habitats	Invasive species	Pollution of habitats	Over-exploitation of resources	Climate Change	
Human health (endpoint damage)	Nutrition	Exposure to radioactive substances	Respiratory effects	Exposure to toxic substances	Access to drinking water	Climate change

Legend : Level of LCA coverage to assess sub-issues:

Completed	Partial	To be developed	Not suitable

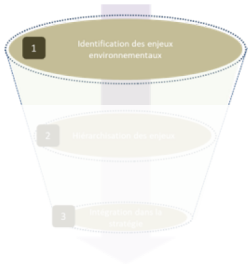
Planetary Boundaries: a new vision of environmental issues



« 9 boundaries not to cross to sustain Earth ecosystem in the Holocene, its current state for the last 10 000 years »

- **4 limits crossed, including 2 High Risk**: Climate Change, Biosphere Integrity (High Risk), Biogeochemical flows (High Risk), Land-system change
- **2 Core Boundaries**: Climate Change et Biosphere integrity

Source: Steffen et al., 2015



No straight forward transposition to LCA

LCA

Evaluation by Steffen et al.

Evaluation by Bjørn et al.

Aires de protection (ACV)	Limites planétaires	Catégories d'impact (ACV)
Human health	Climate change	Climate change
	Biosphere integrity	Ecotoxicity
		Ionizing radiations
	Land use change	Resource depletion
		Land use
	Water consumption	Water consumption
Ecosystem quality	Ocean acidification	Acidification
		Terrestrial eutrophication
	Biochemical flows	Fresh water eutrophication
		Marine eutrophication
	Aerosols	Photochemical ozone creation
		Dusts (RIPM)
	Stratospherical ozone	Ozone layer depletion
	New entities	Human toxicity
Resources		

1

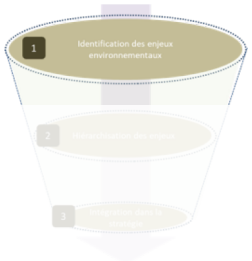
A logical covering of ecosystem quality and related effects on human health, but a blind spot on resources

2

The concept more than the values of Planetary Boundaries values is transposed by LCA practioners to impact indicators

Legend

- Crossing danger zone
- Crossing uncertainty zone
- Within the safety zone



A difficult matching between LCA and Planetary Boundaries

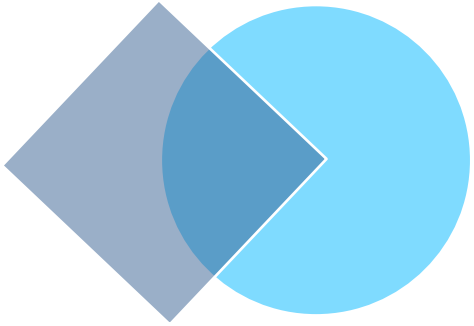
LCA

Impact of one emission ≠ State of the system

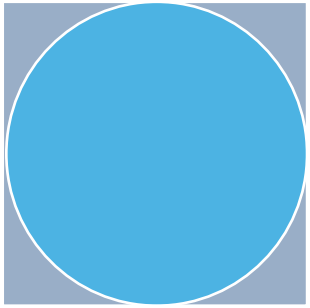
Resources indicators, human health and ecosytem quality ≠ Focus on the Earth ecosystem

Planetary Boundaries

Possible approaches

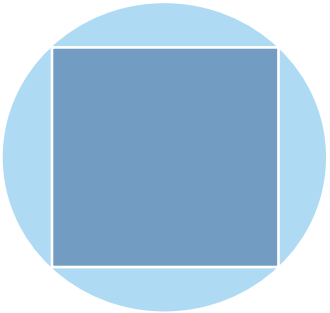


Shaky matching between LCA impact indicators and Planetary Boundaries values



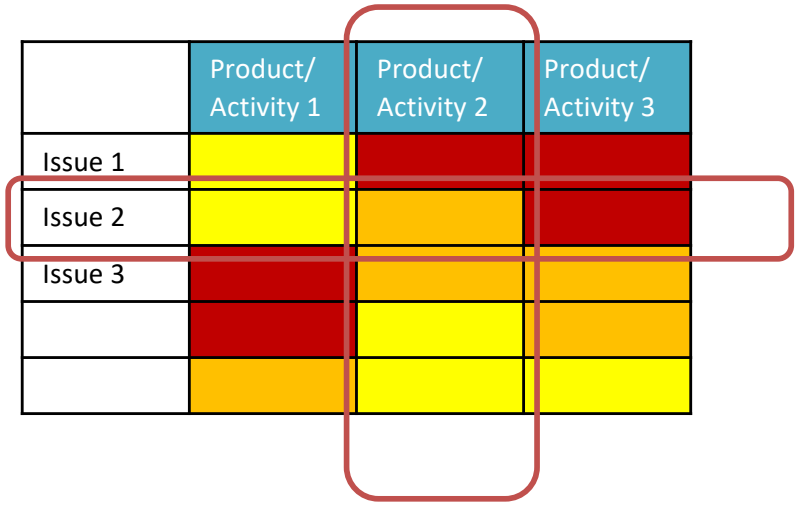
Using Planetary Boundaries as weighing and normalizing values

Precise definition of limits on a restricted number of indicators



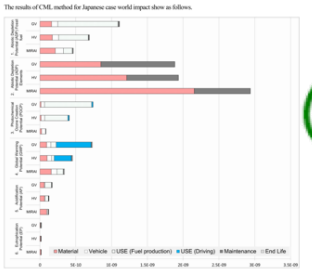
Definition of a new area of protection and new impact indicators derived from Planetary Boundaries

Issue hierarchization: different perspectives



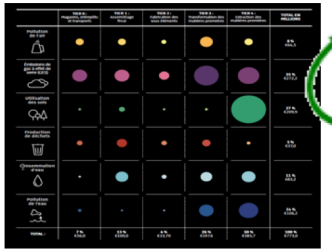
Society perspective

Method 1 : relative impact
Contribution of the activity to the overall impact



ACV

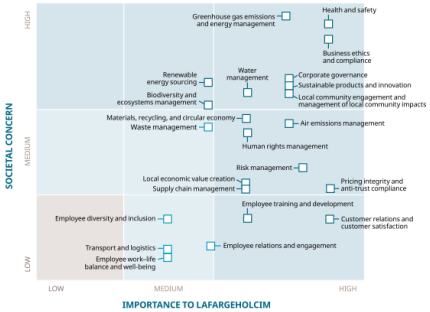
Method 2 : global impact
Impact in absolute value compared in a common unit

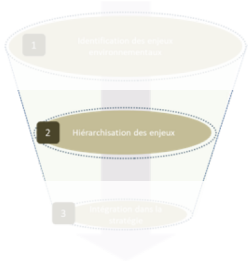


ACV

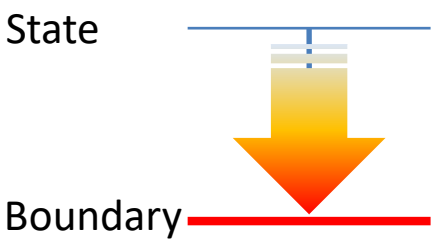
Company perspective

Method 3 : Materiality
Strategic importance for the company





Concept of Planetary boundaries « should » have a strong impact on hierarchization

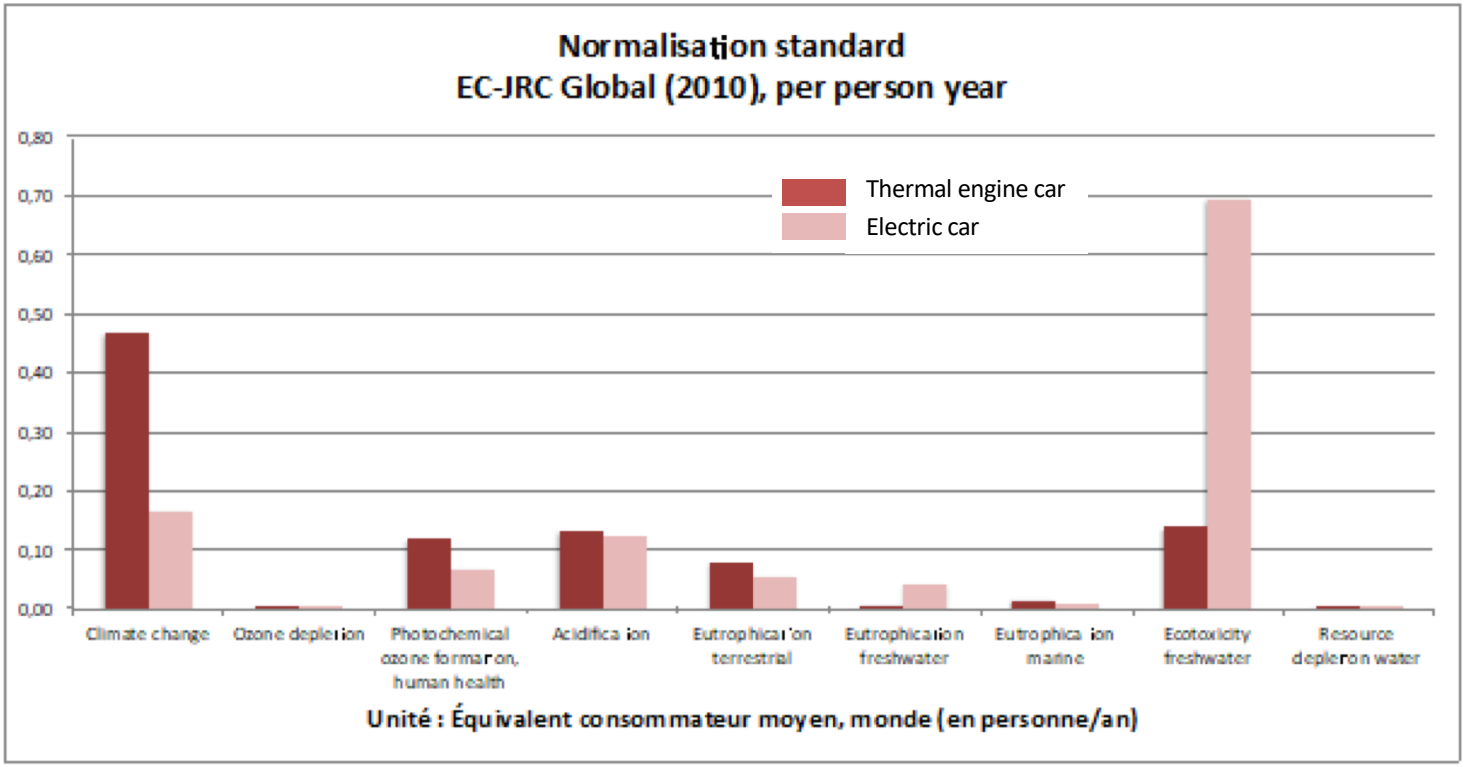


- Change of perspective: « Earth centric » and not « Human centric »
- Most important issue should be the issue where current state is exceeding or closest to boundary …
- … but hierarchy between the planetary boundaries is still an open question
  - Concept of « core boundaries » : climate and biosphere integrity biosphère

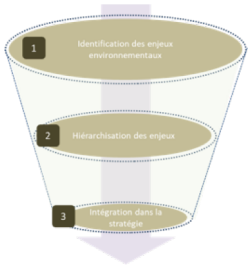
Normalization	Monetized impact	Materiality analysis
« Carrying capacity » (emission quota) , to be used as a normalization factor	Monetarization coefficients could take into accound distance to threshold	Stakeholder should prioritize environmental issues that have boundarie exceeded or close to (this is the case for climate)

Example: comparison of thermal engine car vs. electric car in normalized impacts

From « standard » normalization …

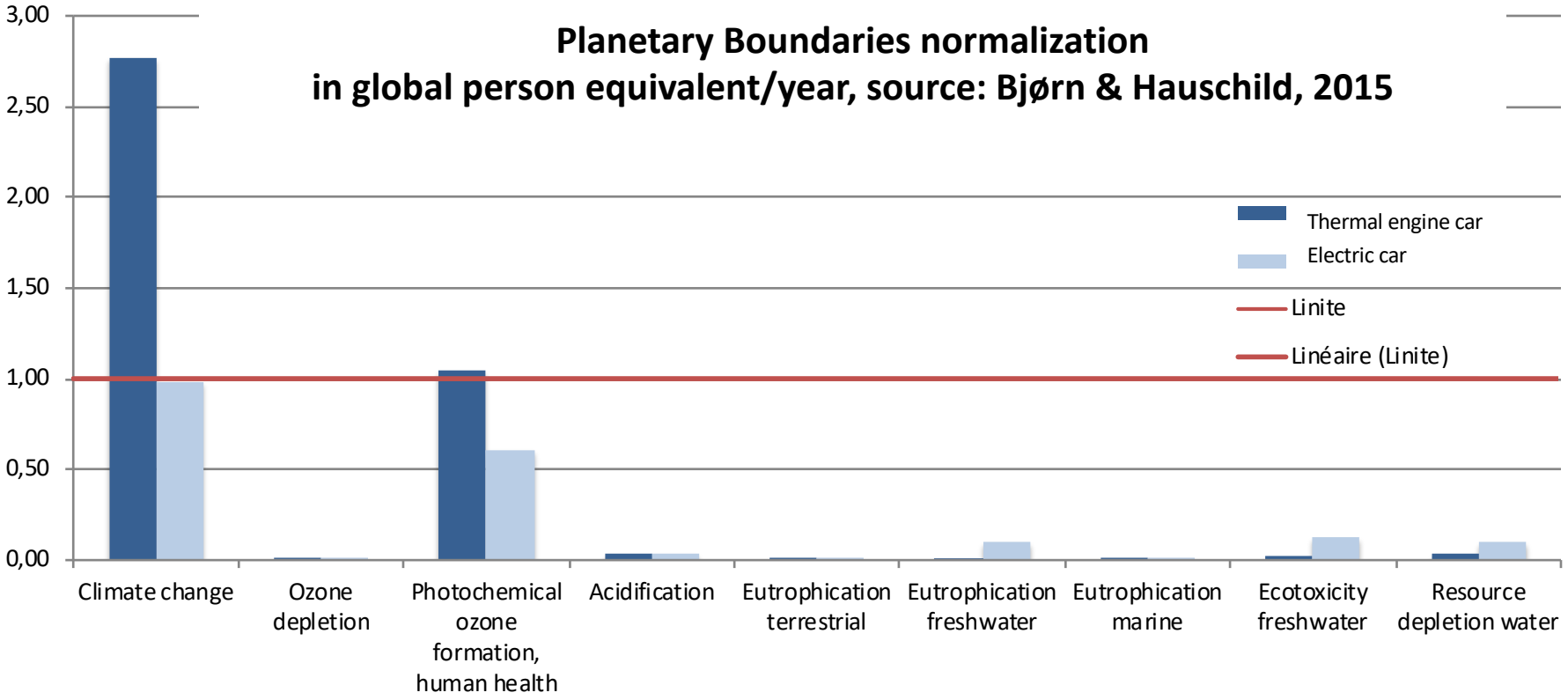


Comparative LCA between a thermal vehicle (dark red) and an electric vehicle (light red), normalized results, Global, JRC data 2016, for 15,000 km driven (i.e. one year of use)

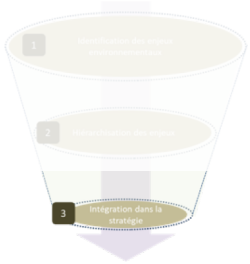


Example: comparison of thermal engine car vs. electric car in normalized impacts

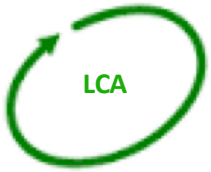
… to Planetary Boundaries normalization



Comparative LCA of thermal engine and electric car (French electricity mix),
Planetary Boundaries normalized results, for 15 000 km (equivalent to 1 year in use).
Sources: Bjørn & Hauschild, 2015 ; JRC, 2016



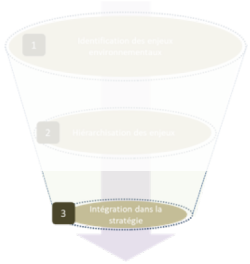
LCA has proven a key tool for environmental strategy



- Clear increase in the place given to environmental issues into corporate strategy
  - With predominance of the climate issue

- LCA has strongly contributed to this evolution, by providing an overall view of the company's impact (from the supply chain to the use of the product) …
  - Set benchmarks at sectoral level with "sector average" LCAs carried out by professional federations
  - Understand at what point in the value chain the most important impacts occur
  - Position the performance of the company's products in relation to other products on the market, but also evaluate the company's environmental performance through organizational LCA
  - Initiate eco-design actions to use the company's levers
  - Anticipate materiality by detecting significant environmental impacts that are not yet material

- … with still 2 weakness points
  - Some issues not properly covered
  - Hierarchization of environmental issues



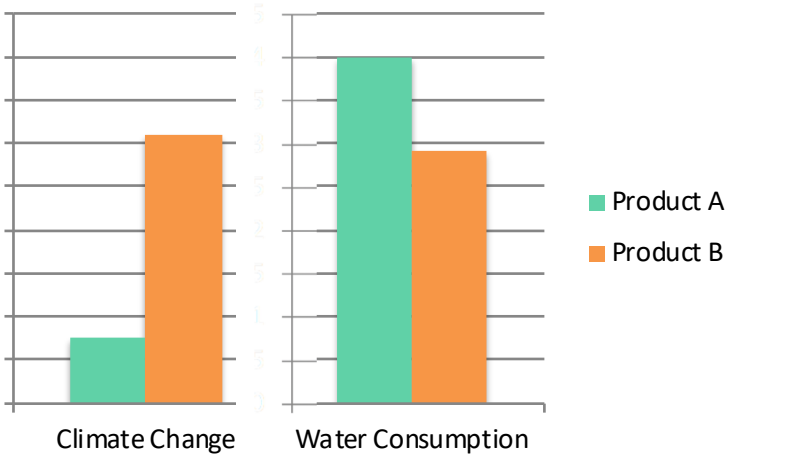
Added value of Planetary Boundaries: from a « relative » perspective to an « absolute » perspective of product environmental impacts

LCA

« relative » perspective

Is A more sustainable than B ?

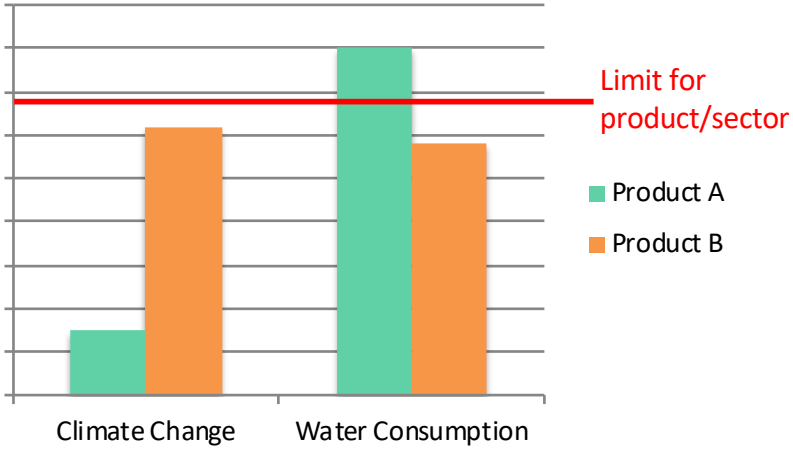
- What is the impact of my product as compared to the alternative solution? (variation, market standard, …)
- By how much do I reduce impacts?



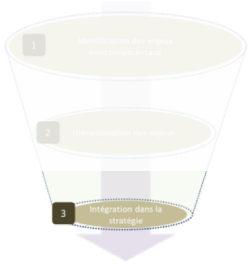
« absolute » perspective

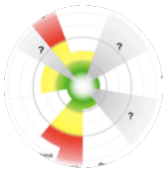
Are A and B sustainable ?

- Which maximum impact is allowed for this product or service?
- Is the impact compatible with Planetary Boundaries?
- Is my impact reduction large enough?
- Is one impact category more important than the others for this product?



Operationalization of Planetary Boundaries: from boundary to trajectory, should enable to evaluate « sustainable and fair impact » at product level





Limite de la planète

State

Planetary boundary

Threshold of the impact of human activities

Capacity

Temporal trajectories

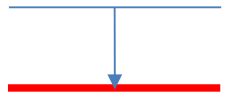
Share of responsability

Allocation per sector / product

Planetary Boundary X

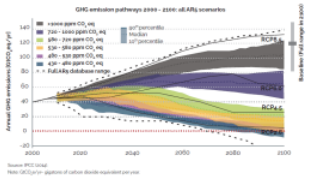
Current value of the control variable

Value not to be exceeded for the control variable

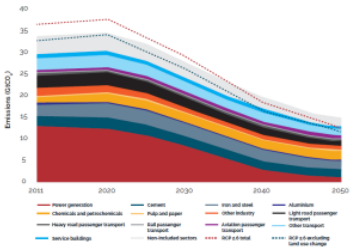


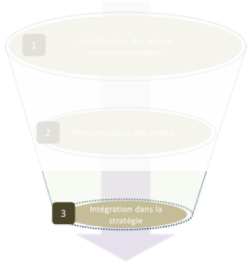
Calculation of a **maximum annual impact** not to be exceeded otherwise there is a risk of exceeding the Planetary Boundary in the medium term

On the basis of physical and economic models, development of a **temporal trajectory** of the planet capacity in order to optimize the transition towards a model of human activities compatible with the Planetary Boundary

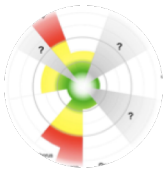


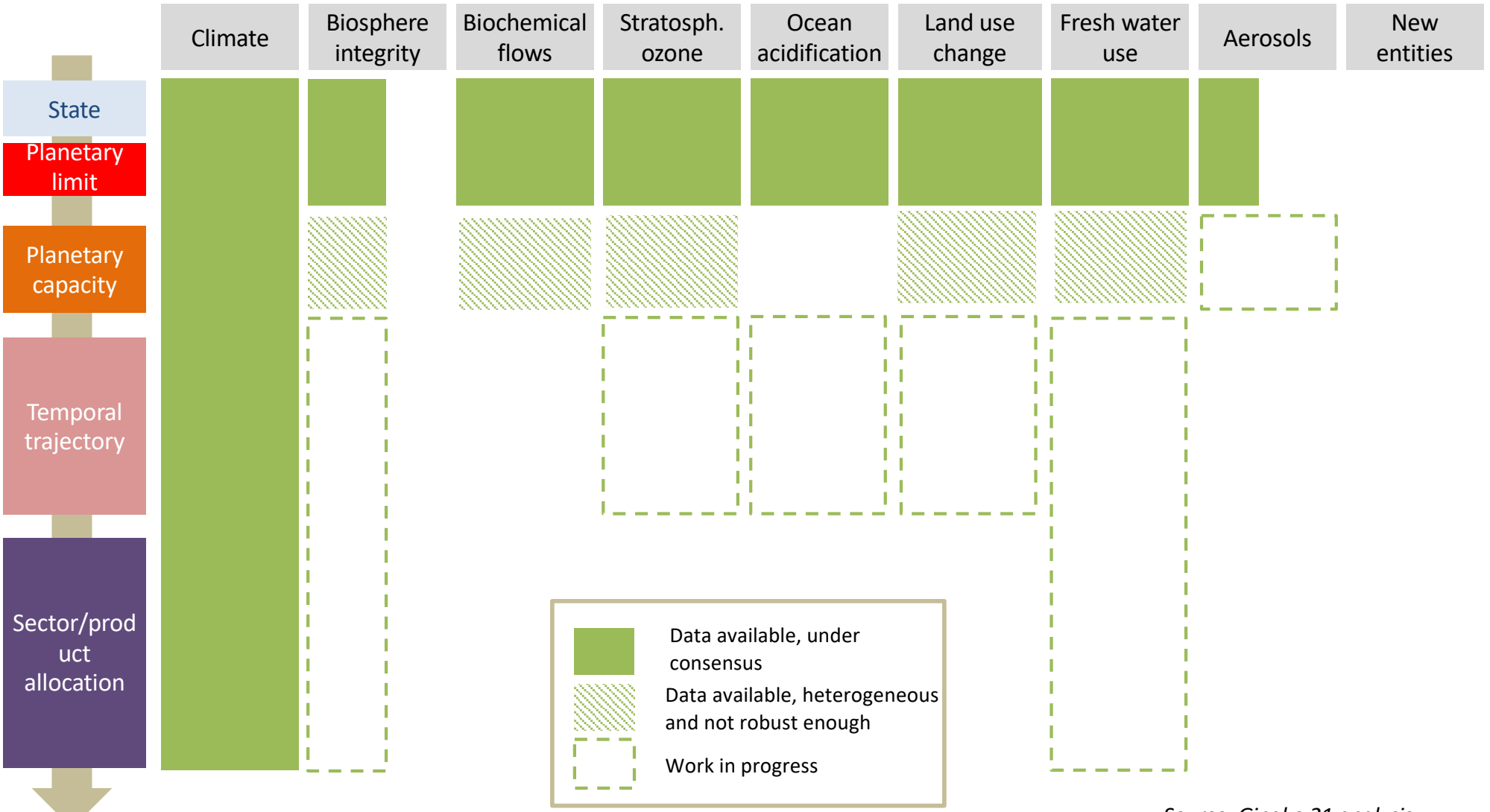
On the basis of technological considerations (available technologies), macro-economic (optimisation of the overall cost), micro-economic (economic feasibility for the actors) and equity considerations, building a **consensus** on the allocation of the reduction trajectory to the various sectors, i.e. the different products



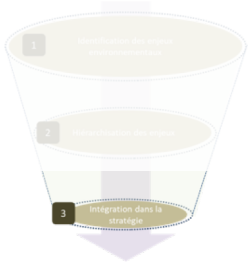


… but this operationalization is currently not available for most of planetary boundaries





Source: Gingko 21 analysis

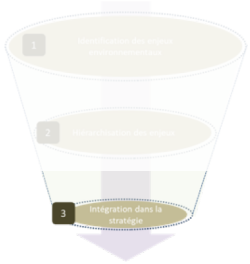


Planetary boundaries: a potentially useful framework for corporate strategy

- 3 main benefits
  - Hierarchisation of environmental issues from a scientific view point (earth ecosystem)
  - Moving from a relative to an absolute vision of environmental impact
  - « science-based » pathways for capping environmental impacts – although socially built

- First applications of Planetary boundaries values as normalization factors in LCA studies, however such values are not enough robust for proper implementation in business strategy
  - On-going work to make such tools operational
  - Confirmed by R. Clift, 2017

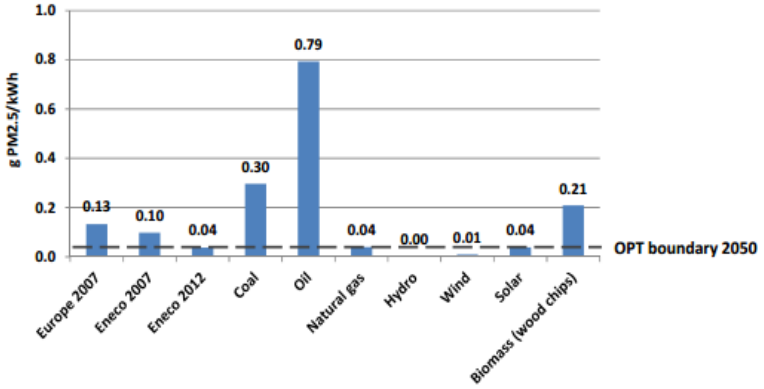
- Only one operational application of Planetary Boundaries for trajectories : Climate Change
  - Science Based Targets and ACT speed up sectoral commitment
  - On the other limits, work in progress but no short term results expected



Planetary Boundaries: a field of innovation for academics and companies

- What is at stake is threefold
  - Extend operationalization of boundaries to non climate issues (next candidates: water and biodiversity ?) Ensure convergence of academic approaches to produce consistent and robust datasets (carrying capacities)
  - Test on various geographies and product families

- Planetary Boundaries will be a field of innovation for the 5 coming years
  - For academics in a « top-down » approach of inovation (non climate trajectories) and stnadardization
  - For companies in a « bottom-up » approach to experiment and test pragmatic boundaries and see how it adds value and sense to their environmental strategies



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What was publsihed since the end of the study

Revue de littérature par Gingko 21 – nous pouvons vous adresser la plupart de ces articles

Authors	Title	Year
Delwyn Jones	Positive LCA Factoring Planetary Boundaries	2017
Roland Clift	The Challenges of Applying Planetary Boundaries as a Basis for Strategic Decision Making in Companies with Global Supply Chains	2017
Vera Heck	Land use options for staying within the Planetary Boundaries – Synergies and trade-offs between global and local sustainability goals	2018
Coline Butler	Environmental Health, Planetary Boundaries and Limits to Growth	2019
Anders Bjørn	Integrating planetary boundaries into the life cycle assessment framework for assessing absolute environmental sustainability of products and systems	2019
Morten Ryberg	Development of a life-cycle impact assessment methodology linked to the Planetary Boundaries framework	2018
	Prospective Assessment of Steel Manufacturing Relative to Planetary Boundaries: Calling for Life Cycle Solution	
Hy Dao	National environmental limits and footprints based on the Planetary Boundaries framework: The case of Switzerland	2018
Sami Kara	Target-driven Life Cycle Engineering: Staying within the Planetary Boundaries	2018
Nicholas Bowles	The livestock sector and planetary boundaries: A 'limits to growth' perspective with dietary implications	2019
Mo Li	Towards meaningful consumption-based planetary boundary indicators: The phosphorus exceedance footprint	2019

Improve LCA/Planetary Boundaries methodology

Integrating planetary boundaries into the life cycle assessment framework for assessing absolute environmental sustainability of products and systems. A.Bjørn, 2019 PAS ACCESSIBLE/ABSTRACT VAGUE

Development of a life-cycle impact assessment methodology linked to the Planetary Boundaries framework. M. Ryberg, 2018

The livestock sector and planetary boundaries: A 'limits to growth' perspective with dietary implications. N.Bowles, 2019

Land use options for staying within the Planetary Boundaries – Synergies and trade-offs between global and local sustainability goals. V.Heck, 2018

Towards meaningful consumption-based planetary boundary indicators : The phosphorus exceedance footprint. Mo Li, 2019

Build a consensus on allowance rules(sector/region)

National environmental limits and footprints based on the Planetary Boundaries framework: The case of Switzerland, Hy Dao, 2018

Consequences for product design

Target-driven Life Cycle Engineering: Staying within the Planetary Boundaries. S. Kara, 2019

Consequences for companies strategy

The Challenges of Applying Planetary Boundaries as a Basis for Strategic Decision Making in Companies with Global Supply Chains. R. Clift, 2017

Emerging technologies that might change our positionning on planetary boundaries

Prospective Assessment of Steel Manufacturing Relative to Planetary Boundaries: Calling for Life Cycle Solution. M. Ryberg, 2018

The livestock sector and planetary boundaries: A 'limits to growth' perspective with dietary implications. N.Bowles, 2019