Biodiversity in LCA methods

Some proposals to bridge the gap

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1. **Evea**
2. **I Care Environnement**
3. **Score LCA**

- Context and objectives
- Definitions
- Steps
- Findings
- Proposals for improvement
- Conclusion

- Context

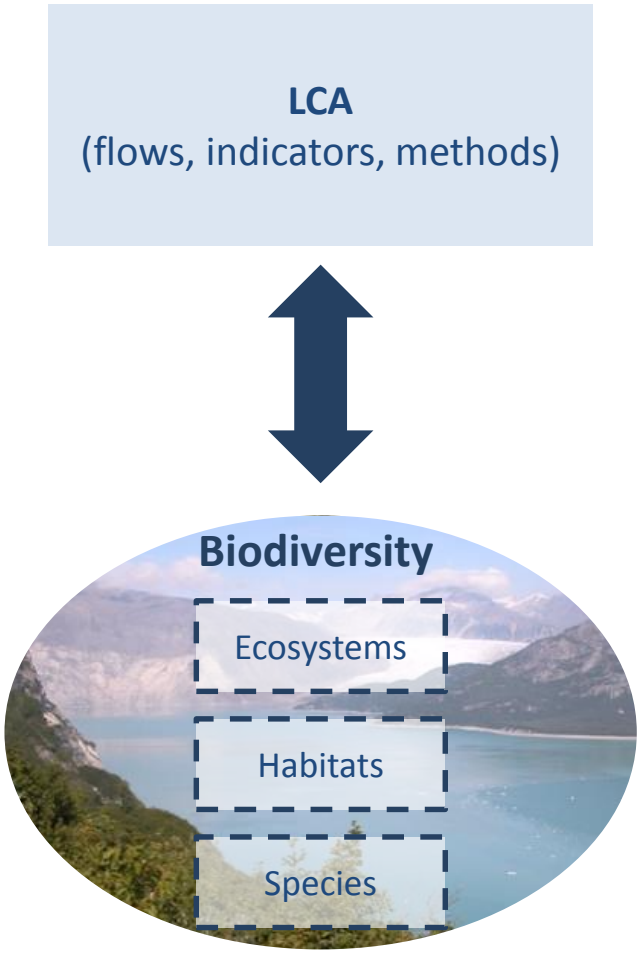
  - A study ordered by Score LCA :

    ''How to use LCA flows, indicators, and methods for biodiversity impact assessment?''

  - A study carried out by Evea and I Care
  - A study delivered in 2014

- Objectives

  - Achieve a state of the art on
    - biodiversity indicators and methods (LCA and others)
    - ongoing research about the integration of biodiversity in LCA
    - the current level of consideration of biodiversity in LCA
  - Identify ways to take into account biodiversity in LCA methods
  - [Compare methods, indicators and flows used in LCA with regulatory requirements for industrial sites]



- Definitions (scope of the study)

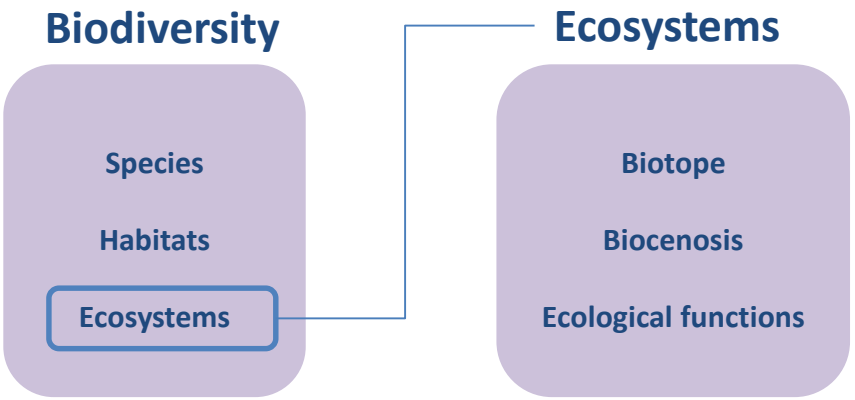
Biodiversity [CBD, UN 1992]

« Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part : this includes diversity within species, between species and of ecosystems. »

Ecosystem [CBD, UN 1992]

« A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. »

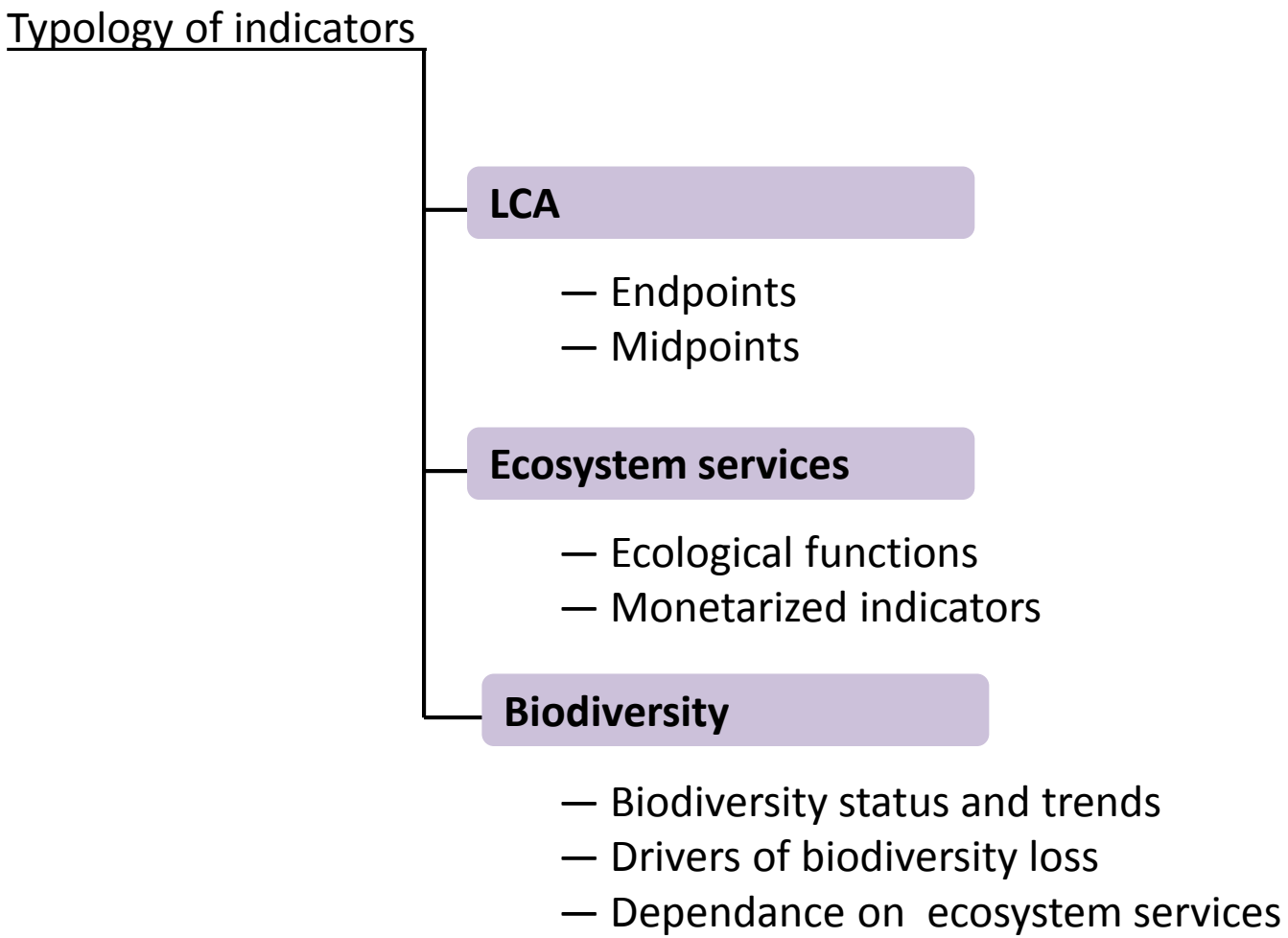
Biodiversity can not be reduced to ecosystems. Ecosystems are only one of the dimensions of biodiversity.



- Steps

1. Inventory of indicators of biodiversity
2. Analysis of indicators (potential for LCA)
3. LCA versus biodiversity studies : a case study
4. Recommandations for improvement

- Inventory of indicators of biodiversity

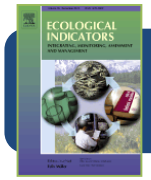


- Some identified indicators for biodiversity assessment

Existing and developing indicators in LCA

- 3 midpoints related to biodiversity: land use, ecotoxicity, acidification / eutrophication
- 2 endpoints related to biodiversity: Ecosystem Quality: characterization of the impacts on ecosystems by the PDF/PAF factors

- A lot of research supporting the development of the land use indicator



Biodiversity indicators

- 451 biodiversity indicators identified
  - Biodiversity status and trends: 172
  - Drivers of biodiversity loss : 264
  - Dependence on ecosystem services: 15
- Not limited to species and including all dimensions of biodiversity
  - Habitats, species, ecosystem services

- A lot of research supporting indicators of ecosystem services
  - Ongoing development of indicators of ecological functions, at the origin of ecosystem services
  - First series of “monetarized” indicators by ecosystem service and biome

- Some indicators trying to assess biodiversity in LCA methods exist, providing a limited vision of biodiversity issues
- Richness and diversity of indicators existing in biodiversity studies

- Synthesis on drivers of biodiversity loss taken into account by existing LCA methods

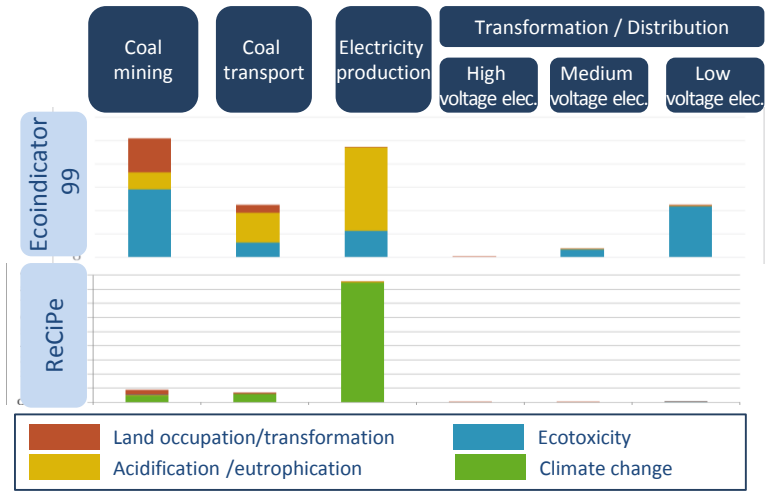
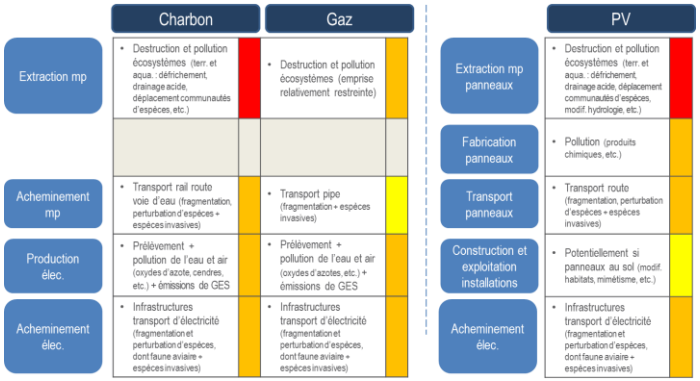
Pressures on biodiversity	Sub-types of pressure	Consideration in LCA methods
Habitat change	Land occupation	✓
	Land transformation	✓
	Fragmentation	
	Disturbances	
	Protection of habitats and biodiversity	
Alien species	Introduction of alien species	
	Use of means of spread of alien species	
Overexploitation	Water consumption	✓
	Endangered species	
	Participation in species diversity	
	Participation in genetic diversity	
	Sustainable use of natural resources	
Pollutions	Pollution of water bodies	✓
	Soil pollution	✓
	Air pollution	✓
	Acidification / Eutrophication	✓
	Pollutants and wastes emissions	
Climate change	GHG emissions	✓

[From Curran et al., 2011]

- A limited number of sub-types of drivers is taken into account
- « Habitat change » and « Pollutions » are the more detailed drivers in the LCA methods

• LCA versus biodiversity studies : a case study

3 modes of electricity supply (kWh of coal, gas,and photovoltaic)

	LCA methods	Biodiversity studies
Methodology	• Modeling on the software Simapro7 by 3 methods – Eco-indicator 99 – Impact 2002+ – ReCiPe	• Analysis of biodiversity studies on: – Impacts by drivers and sub-type of drivers of biodiversity loss – Impacts on habitats, species and ecological functions – Geographically located case studies
Illustrations		

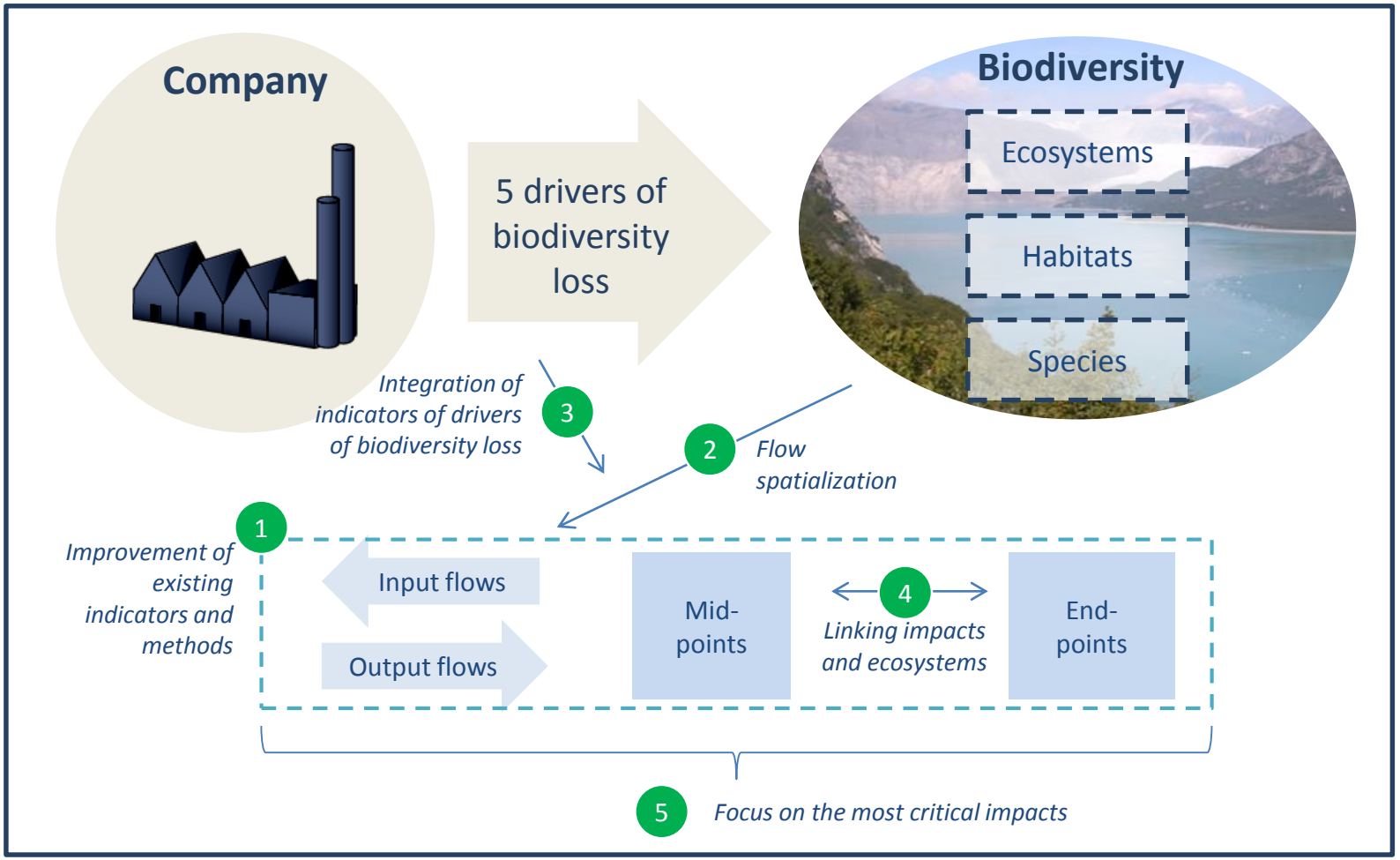
- LCA methods show interesting midpoints to assess biodiversity issues and a relevant hierarchy between technologies at the endpoint step
- An important weight attributed to the PDF factor for Climate change in ReCiPe
- Some issues are clearly missing compared with biodiversity studies (fragmentation, …)

- Focus on methodological differences within LCA methodologies

	Study of land transformation	Study of climate change applied to ecosystems	Number of « substances » considered		Differentiation by type of impacted ecosystems	Aggregation factors	Spatialization
Eco-indicator 99 (unit: PDF*m²*yr)	• Yes	• No	• Ecotoxicity • Acidif./ eutrophication • Land use	196 9 142	• No	• Use of the PAF factor, not very specific	• No
IMPACT 2002 + (unit: PDF*m²*yr)	• No	• No	• Ecotoxicity • Acidif./ eutrophication • Land use	2.589 7 88	• Terrestrial / aquatic	• Unavailability of acidification/ eutrophication factors	• Possible with the Impact World + version
ReCiPe (unit: species.yr)	• Yes	• Yes	• Ecotoxicity • Acidif./ eutrophication • Land use	26.752 20 75	• Terrestrial/ fresh water / marine water	• Good accuracy of factors	• No

Legend: Strength Weakness

- Proposal : 5 ways to improve the calculation of biodiversity in LCA methods



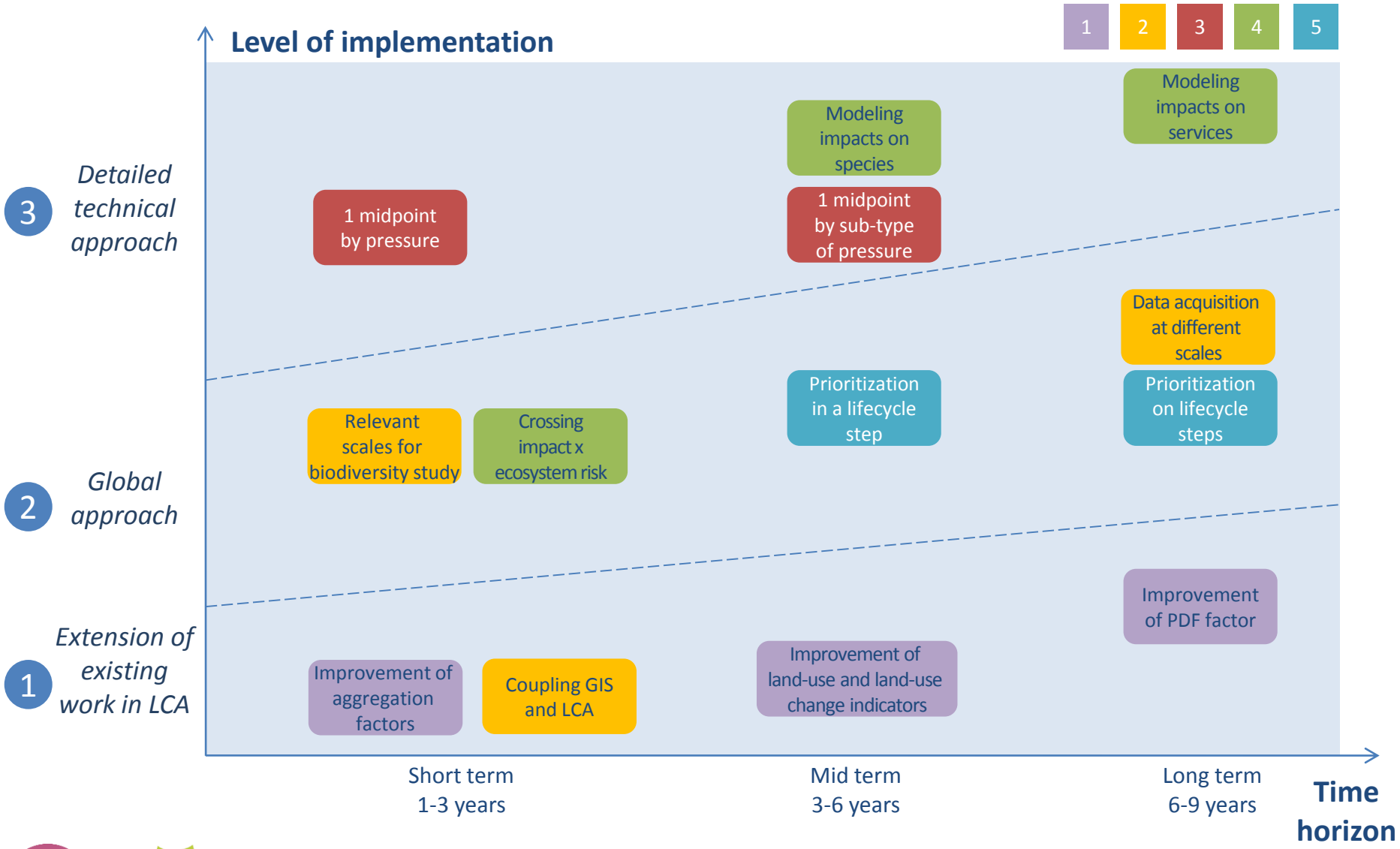
- Proposal : 5 ways and in-depth approaches

Level of complexity →

		Approach A	Approach B	Approach C
1	**Improvement of existing indicators and methods**	Improvement of aggregation factors for PDF indicator	Improvement of land use and land use change indicators	Improvement of the PDF coefficient
2	**Flow spatialization**	Definition of relevant scales for biodiversity study on value chain and lifecycle steps	Coupling GIS and LCA	Data acquisition on the different scales
3	**Integration of indicators of pressures on biodiversity**	Integration of an indicator by pressure	Integration of an indicator by sub-type of pressure	/
4	**Linking impacts and ecosystems**	Crossing impact and risk level for ecosystems	Modeling impacts on species	Modeling impacts on ecosystem services
5	**Focus on the most critical impacts**	Prioritization of impacts in a lifecycle step	Prioritization on the most impactful lifecycle steps	/

Approaches with higher or lower consideration of biodiversity and different horizons of implementation

- Toward a progressive implementation of biodiversity complexity in LCA



- Conclusion
  - It will take time and efforts for LCA methodologies to increase relevance regarding biodiversity issues because of :
    - Intrinsic complexity (ecosystem dynamics, predictability issues, …)
    - No common culture between LCA & Biodiversity communities
  - In LCA :
    - At endpoint level : ecosystem quality
    - At midpoint level : Land Use is a very representative indicator
    - Numerous methodological limits, but well known and well documented
  - First : improve the LU indicator
  - In a second time : enlarge the scope to “global biodiversity “
    - Via drivers on biodiversity loss
    - Via ecosystem services (integrating ecological function)
  - Real improvements can be expected from coupling with GIS
  - Problematic of weighting and aggregation for a biodiversity endpoint still remain

THANK YOU

Report available at [ScoreLCA website] :

http://www.scorelca.org/scorelca/ressources_internes.php