IMPROVING THE LIFE CYCLE IMPACT ASSESSMENT OF ECOSYSTEM SERVICES THROUGH THE USE OF AN INTEGRATED MODEL

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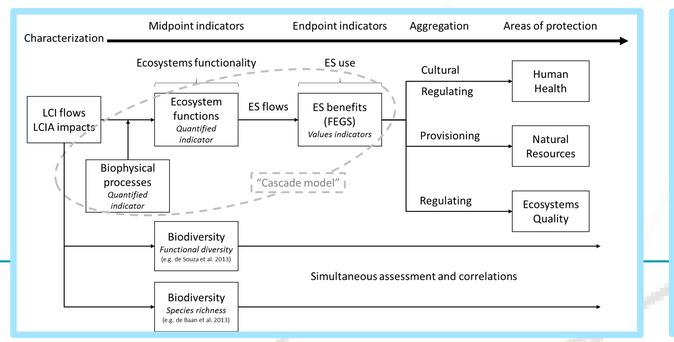
Context & Aim

Recently promoted, the characterization of impacts on **ecosystem services (ES) in Life Cycle Impact Assessment (LCIA)** is still in a primary development stage. After reviewing the few characterization models currently available, we could observe **a gap in concepts, theories and methods with specialised ES research**. As a result, we focus our research on developing a new characterization approach based on the tuning of **an integrated ES model** => **MIMES[1]** (*Multi-scale Integrated Model of Ecosystem Services*). The following problematics are addressed:

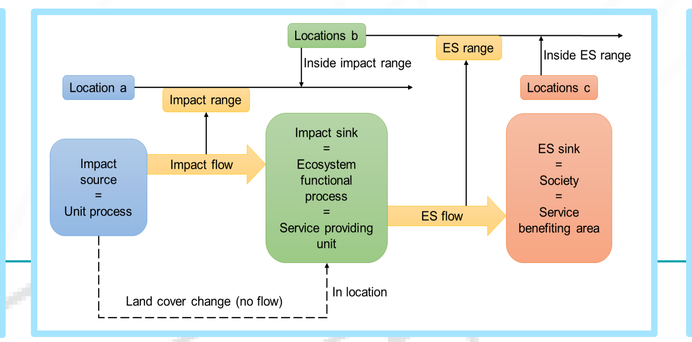
- What consensual concepts should frame the characterization of life cycle impacts on ES flows and their provision to society?
- Is an integrated modelling approach efficient to retrieve characterization factors useful in the context of LCIA, and more broadly, decision-making?

Conceptualize the modelling of ES for their assessment in an LCIA characterization model

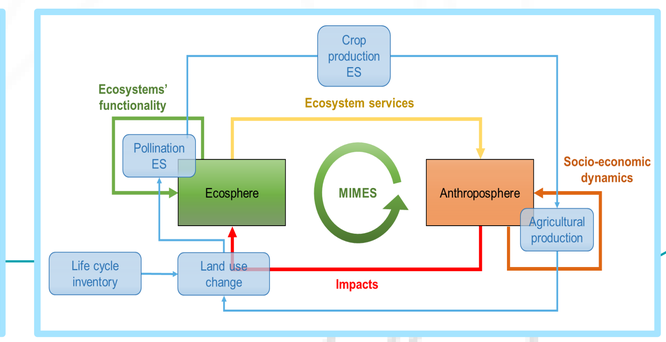
- Encompass the cascade model in the LCIA framework



- Spatialize the cause-effect chains towards ES flows

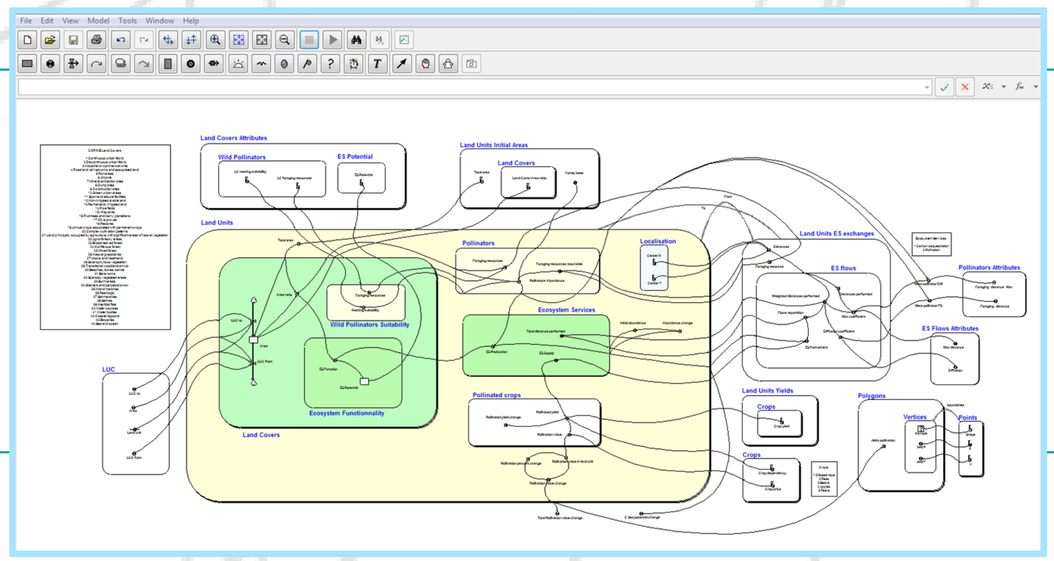


- Frame the dynamic interactions between Ecosphere and Anthroposphere



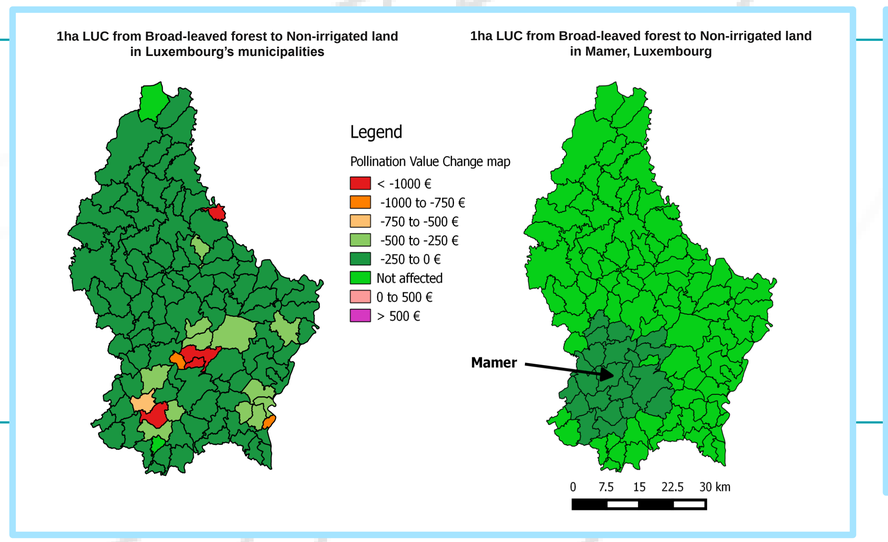
Implement the built framework in the MIMES[1] model

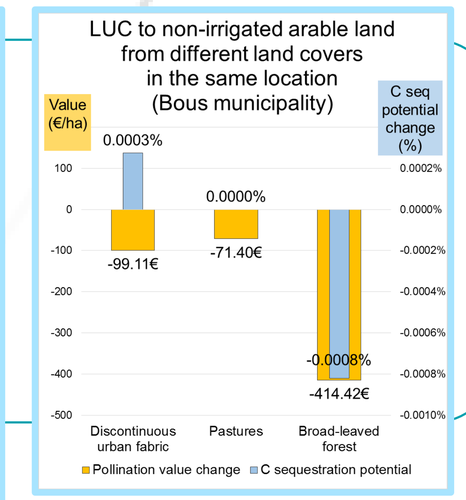
- Multi-scale, dynamic and multi-functional coupling of models in the SIMILE modelling language:
  - ES models such as InVEST pollination[2] and Biome BGC[3]
  - Socio-economic model based on environmentally-extended multi-regional input-output
  - Land Use Change (LUC) model
  - Scenarios (e.g. climatic, technologic, demographic)



Retrieve monetary characterization factors

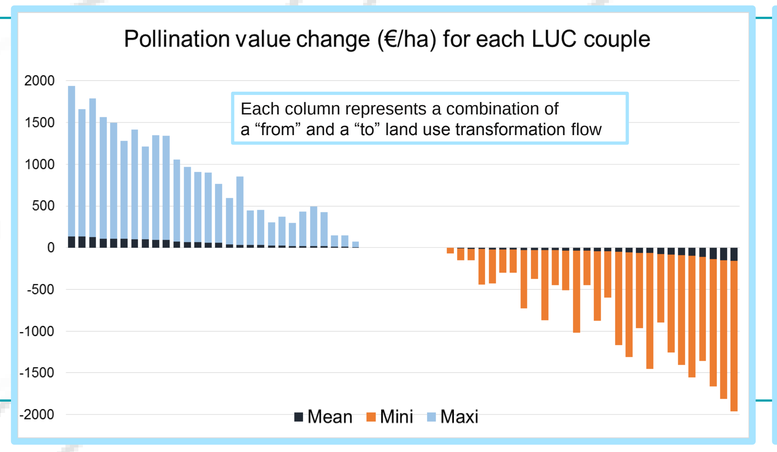
- Assess the monetary benefice changes due to impacts on ES flows from inventory flows
  e.g. Impact on pollinated crop yields from a land cover change from broad-leaved forest to non-irrigated arable land
- Assess trade-offs and synergies between ES

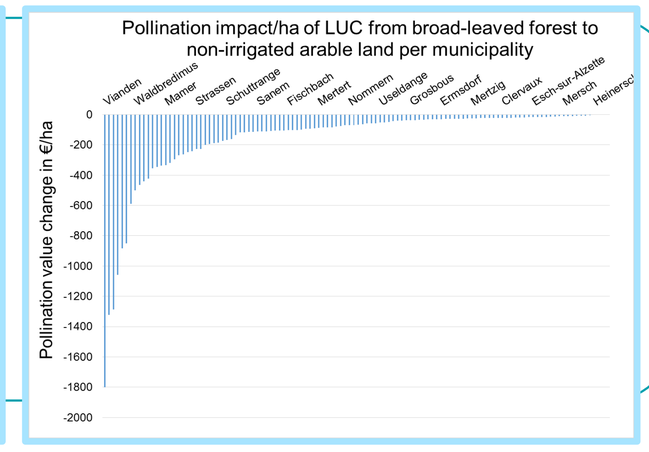




Understand and communicate the variability and uncertainties

- Provide characterization factors compatible with life cycle inventory flows information
- These shall be useful to decision-making given their spatial variability and associated uncertainties





Conclusion

The use of an integrated model allow us to:

- Consider the **flow nature of ES**
- Cpnsider the **multi-functional aspect of ecosystems**
- **Value the direct benefits** to society of ES
- **Spatialize** our assessment at multiple scales, while putting down the basis for the modelling of **dynamic human-environment interactions**

Outlook

Apply our methodology to a case study on the implementation of the 20-20-20 directive in Luxembourg.

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References
1 Boumans et al. (2015) in *Ecosystem Services* 12:30-41
2 Lonsdorf et al. (2011) in *Natural Capital*, Oxford Press
3 Available @ http://www.ntsg.umt.edu/project/biome-bgc