Biodiversity and Ecosystem Services: Meta-analysis, mind-mapping and Bayesian belief network modelling to better capture the role of biodiversity on ecosystem services

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ICCB : 27th International Congress for Conservation Biology
4th European Congress for Conservation Biology
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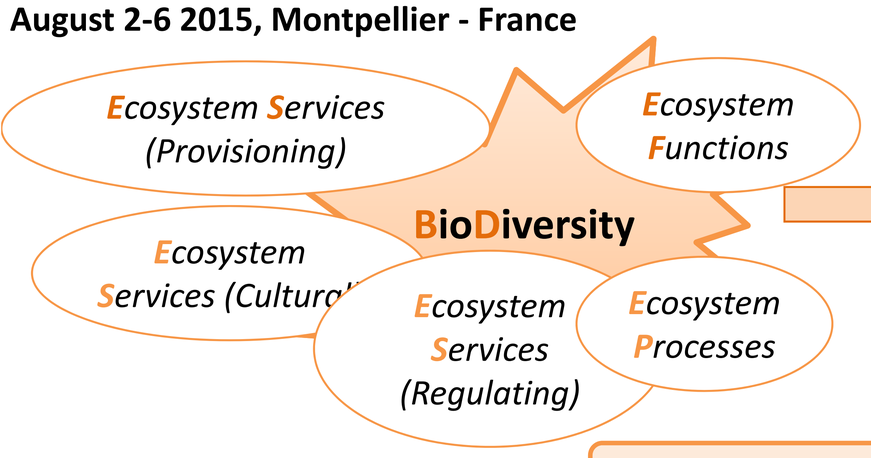


MOTIVATION

extend the scope of research showing NEW WAYS OF COLLABORATIVELY

representing and modelling the BD-ES linkages identified in the literature

OBJECTIVE

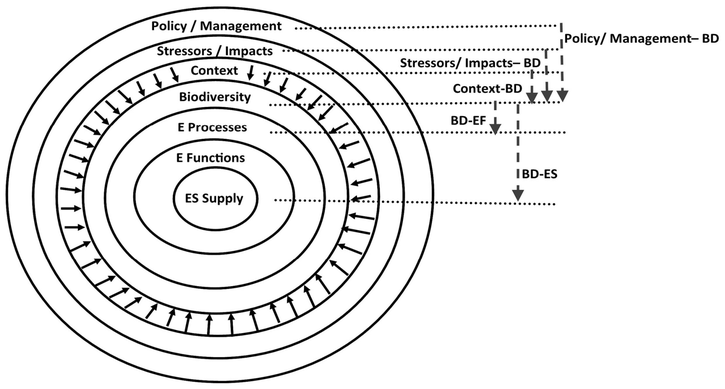
Perform a systematic review of existing publications, record findings in database:

- Select studies between 1992-2015 describing the links between BD-EF-ES-HWB (Human Well Being)

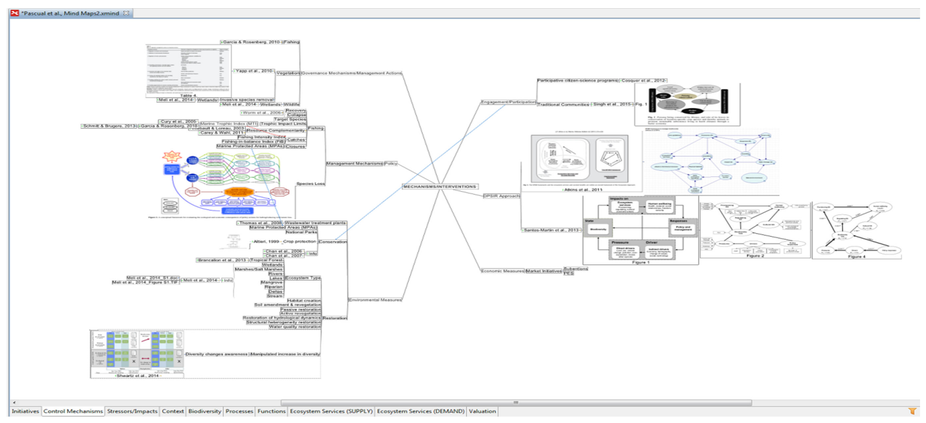
Meta-modelling

MIND MAPS (MM), Literature database (DB), data analysis possible application - Bayesian belief networks (BBN)

Enable better informed decision-making



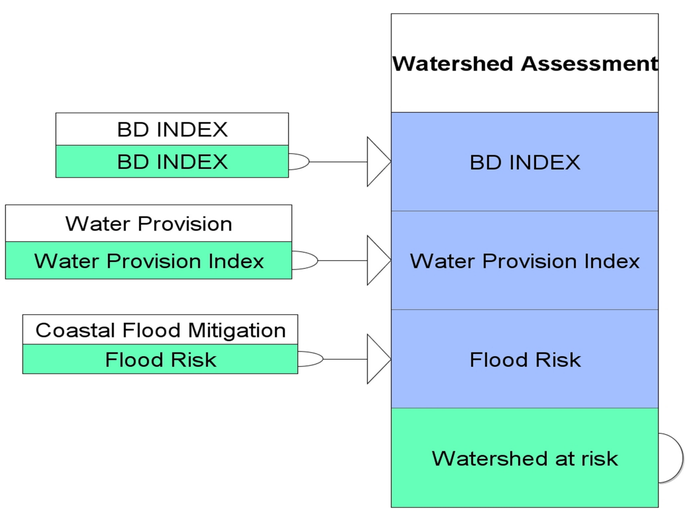
The discourse reviewed described a layered dependency structure

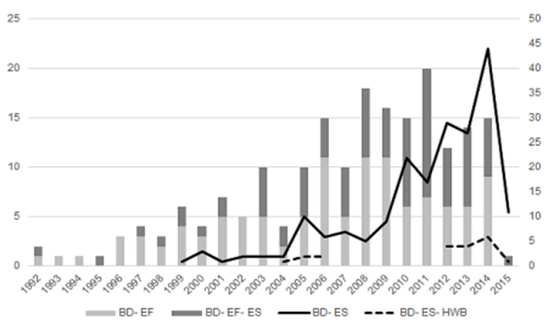


mind maps, an initial level to organize the existing knowledge (used XMIND 6)

Data analysis = Results (Publications DB) + MM (links)

Identified Watershed assessment as a good case study → **built model to assess the Watershed**





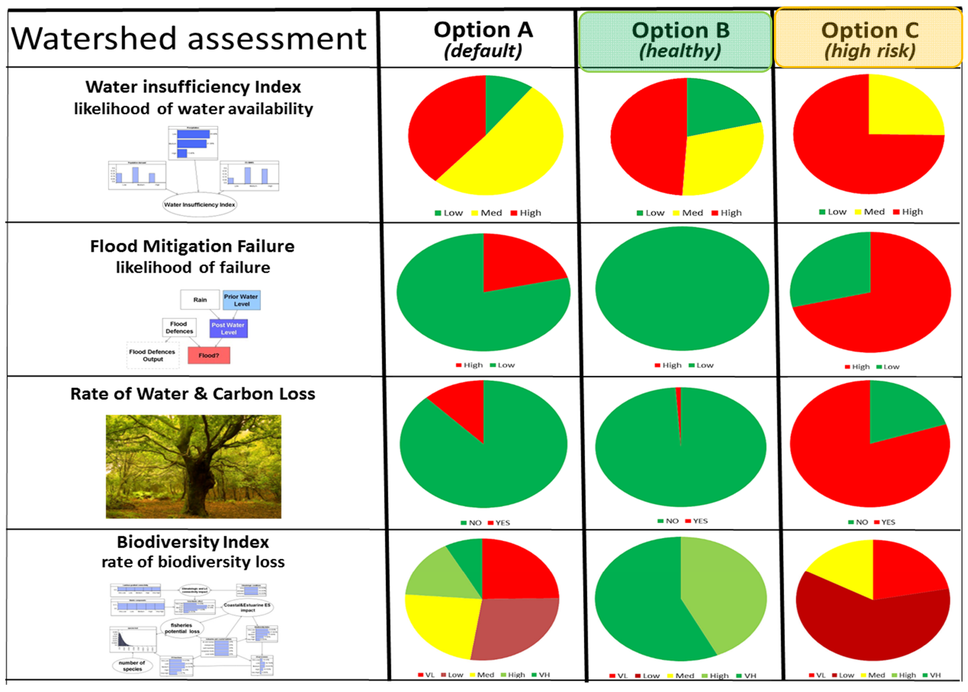
- **3 scenarios** Option A, Option B, Option C
- **Option A** is the **default - no evidence** (uninformed priors)
- **Option B corresponds to a** sustainable management scenario
- **Option C corresponds to a** poor management practices scenario
- **Selected the ES most often** discussed in relation to watershed **(water supply, flood mitigation, carbon sequestration)**
- Built a BBN to estimate the output in each ES (used AGENARISK)
- Integrated the components into a network of networks, an OOBN, to estimate the total watershed risk assessment indicator (WRI)

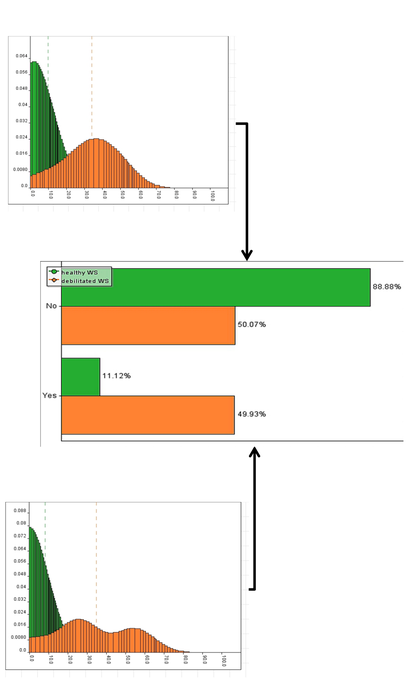
Estimated a watershed risk assessment indicator (WRI) for different ES management options

	Option B (human loss)	Option B (ES loss)	Option C (human loss)	Option C (ES loss)
Mean (rate of loss)	8.65 (1.052, 39.4)	8.156 (0.83, 42.79)	34.375 (1.052, 39.4)	35.051 (0.83, 42.79)

- Estimations were computed with the BN model feeding the evidence to the inputs and **propagating** the information to the rest of the model
- The **mean WRI estimated with the BN shows a clear difference between bad management practices (50.1% risk of collapse) and good management (11.12% risk of collapse)**
- The variance associated to the human loss indicator (243.41) is larger than that of the ES loss indicator

Watershed assessment using different ES management scenarios (Human loss rate, ES depletion rate)





CONCLUSIONS

- Organizing existing knowledge using global **Multi-Layered Mind Maps** facilitates the identification of the different factors described as contributors to the **BD-EF-ES dependencies**.
- These Mind Maps serve as **initial building blocks** in any process developed to model some aspect of the **BD-EF-ES** problem area.
- Translating the theoretical knowledge of Mind Maps into BBN models enabled us to explicitly handle the uncertainties associated to the knowledge gaps identified.
- The graphical representation component of both Mind Maps and BBN facilitates the task of transforming the mind maps to a particular solution.
- OOBN enables the development of components which can be plugged/unplugged as further knowledge and data is generated.
- **Organizing existing knowledge into maps and models helps identify knowledge gaps. These suggest future research questions, which should be addressed if the BD-EF-ES linkages are to be better understood**

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