Linking condition to services

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- Working definition:
 - ecosystem condition: those charcteristics of the ecosystems that are not services per se, but affect the availability of multiple services
- This suggests an operative way forward:
 - − find characteristics that influence ES
 (→ systematic review)
 - put them into a large database
 - identify (groups of) "influential characteristics"
 - compare them to existing proposals for condition indicators, find gaps, redundancies, etc.

Data source

- OpenNESS (Task 3.1, "Contribution of natural capital to ES flows")
 - systematic review of **12 ES** with **60 papers** for each $(\rightarrow 720 \text{ papers altogether})$
 - first results published (Smith et al. 2017, Ecosystem services)
 - database available for further reanalysis
- We filtered the papers, and did a more deatiled analysis:
 - kept only 10 ES
 - only European papers (the task was to support EU policies)
 - only kept primary studies testing statistical relationships between EC and ES
 - randomly selected 10 papers for each ES
 - $(\rightarrow 100 \text{ papers altogether})$



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- Timber production
- Freshwater fishing
- Pollination
- Pest regulation
- Carbon sequestration
- Erosion protection
- Flood protection
- Water quality regulation
- Air quality regulation
- Recreation (aesthetics)

- Urban
- Cropland
- Grassland
- Woodland and forest
- Heathland and shrub
- Sparsely vegetated land
- Wetlands
- Rivers and lakes
- Marine inlets and transitional waters
- Coastal
- Shelf
- Open ocean

- What kind of characteristics to consider?
 - reasonably variable (constant or extermely variable is not OK!)
 - can be linked to a location (mapped)
 - can (potentially) be covered by data sources over large areas
 - can indicate a state
 - Biodiversity
 - Abiotic ecosystem attributes
 - Landscape pattern
 - Management intensity
- What to exclude? (examples)
 - persistent/constant characteristics (e.g. geology)
 - extremely variable characteristics (but their annual means can be OK)
 - "micro-characteristics" of ecosystems (no chance for data)
 - climate
 - ecosystem extent, ecosystem services
 - changes of state (get the state itself instead)

















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(describing the more abstract characteristics of ecosystems) is needed. Prefiled

(functional groups, communities) or more technical details on "indicator" design-

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N of relationships vs ES

Aesthetic landscapes (aesth) Air quality regulation (a.qual) Water quality regulation (w.qual) Water flow regulation (flood) Mass flow regulation (erosion) Atmospheric regulation (carbon) Pest regulation (pest) Pollination (pollin) Freshwater fishing (fish) Timber production (timber)



N of relationships vs ET



relationships vs characteristic types



Extent of ecosystem (sub)types



Management intensity



ET













Grasslands

- dry grasslands
- mesic grasslands
- wet grasslands
- alpine grasslands
- inland salt steppes
- sparsely wooded grasslands

General lessons

- Condition is not "uni-dimensional": for most ETs there are several characteristics that matter:
 - That are more or less independent
 - That should be distinguished (a typology!!!)
- Condition can meaningfully integrate a broad variety of relevant ecosystem/landscape/use characteristics
 - including biodiversity, pressures, abiotic ecosystem attributes, etc.
- Linking E characteristics to ES: can be an external "anchor" for the concept of ecosystem condition



Advantages of linking EC to ES "early in the process"

- Meaningful groups of charactersitics ("condition aspects") can be selected and prioritized
 - a core set of condition aspects (for each ET)
 - more parsimonious & more coherent sets of indicators
 - better (more meaningful) aggregation will be possible
- A direct "a priori" link to ES
 - more relevant, more justifiable indicators ("rooted in science")
 - easier to communicate ("good condition means services, which means money")
 - an easier integration of condition indicators into ES capacity models