Leaf litter decomposition as a functional indicator of chemical stress in ecological risk assessment

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Background

- Current ecological risk assessment approaches can benefit from a better understanding of how **changes in diversity relate to changes in ecosystem functioning**[1], to increase environmental realism & improve understanding of stressor effects on ecosystems.
- Freshwater leaf litter decomposition is a key process in **organic matter transformation**, and is crucial to well-functioning aquatic ecosystems[2].
- The leaf litter detritivore biodiversity-decomposition relationship is widely researched, but **no overall consensus has been established** on the type of relationship.

Tarr Steps in the Somerset countryside/Credit: Getty

Therefore we carried out an 'overview of reviews' to explore consensus in biodiversity - decomposition relationships.

Aims

1. **Determine if there is <u>consensus in the type of relationship</u> between leaf litter decomposition and aquatic biodiversity across reviews**

2. **Assess the degree to which any consensus is dependent on the <u>quality of review methods</u> and the <u>overlap in the literature</u> included in different reviews**

Methods

Step 1

Systematically searched for reviews that discussed the biodiversity-decomposition relationship in freshwater ecosystems, using the Web of Science and SCOPUS databases.

Step 2

Recorded the type of relationship reported within each review as either positive, negative, no relationship or mixed. Mixed referred to reviews that showed that overall the relationship varied (e.g. a mix of positive and no relationship).

Step 3

Assessed the methodological quality of reviews using the AMSTAR2 quality assessment tool[3], which assesses each review against 16 quality criteria.

Step 4

Measured the degree of overlap between the primary literature and the search terms of each systematic review, by calculating the percentage of overlap using the Corrected Covered Area method[4] (Figure 2).

Results

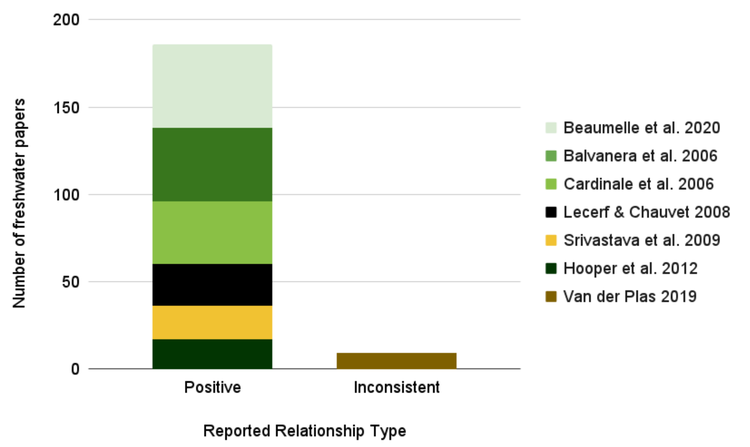

Figure 1: Number of primary studies in each review addressing freshwater decomposition, grouped by the reported biodiversity-decomposition relationship type. "Inconsistent" refers to a review with evidence for more than one type of relationship .

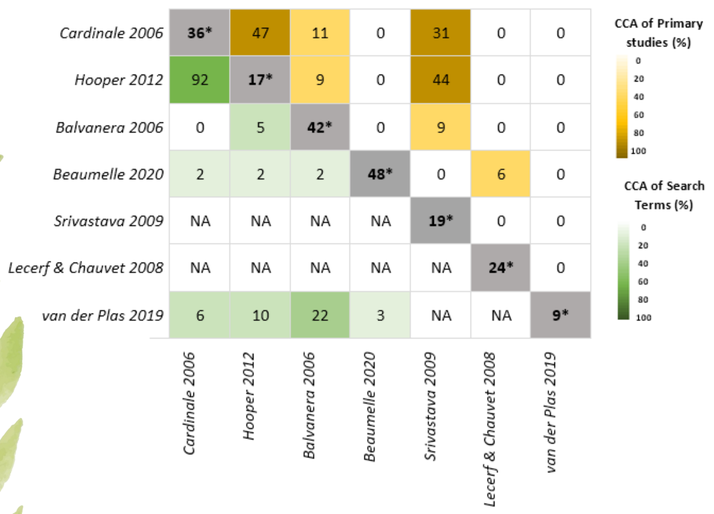

Figure 2: Percentage overlap of literature (top right, yellow) and search terms (bottom left, green). Srivastava (2009) and Lecerf & Chauvet (2008) did not report search terms . Total freshwater papers in each review (grey , asterisk).

- Six of the seven reviews reported a positive relationship between rate of leaf litter decomposition and increasing species richness, indicating a **strong consensus in the type of relationship** (Figure 1).
- **Methodological quality of reviews was low based on AMSTAR2 criteria**, highlighting potential for improving ecological review methods. However, reviews generally met criteria influencing the robustness of reporting the decomposition - biodiversity relationship.
- There was a **high overlap of primary papers included in three reviews**, all of which reported a positive relationship (Figure 2).
- The review reporting a mixed relationship had overlapping search terms , but had no overlapping primary literature with other reviews due to stricter inclusion criteria .

Key Findings

- **There was consensus between most reviews that changes in decomposer biodiversity reflect a similar directional change in freshwater leaf litter decomposition.**
- **This consensus reflects a large degree of overlap between the literature considered in most reviews.**
- **The shape of the biodiversity—decomposition relationship and how it may be altered by stressors needs to be explored further.**

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References:

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