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A simplified model for size and shape of microplastics in soil: implications for risk assessment and particle measurement

Highlights

- Size could not be modeled due to a poor data situation
- Shape distributions of soil and aquatic microplastics (MP) are equal off a higher proprotion of films in soil
- Risk assessment of soil MP is hampered by a lack of open data on MP size
- Particle measurements require higher reporting standards

Background

- MPs are ubiquitious in soil (Sajjad et al. 2022)
- MPs negatively impact terrestrial ecosystems
- Risk was not assessed for soil MP (Koelmans et al. 2022)
- One reason is the lack of contionous representations of particle characteristics (e.g. size and shape)

Methods

Study aim
Obtain a contionous representation for size and shape of MP in soil by simpilifying them with probability density distributions (Kooi & Koelmans 2019)

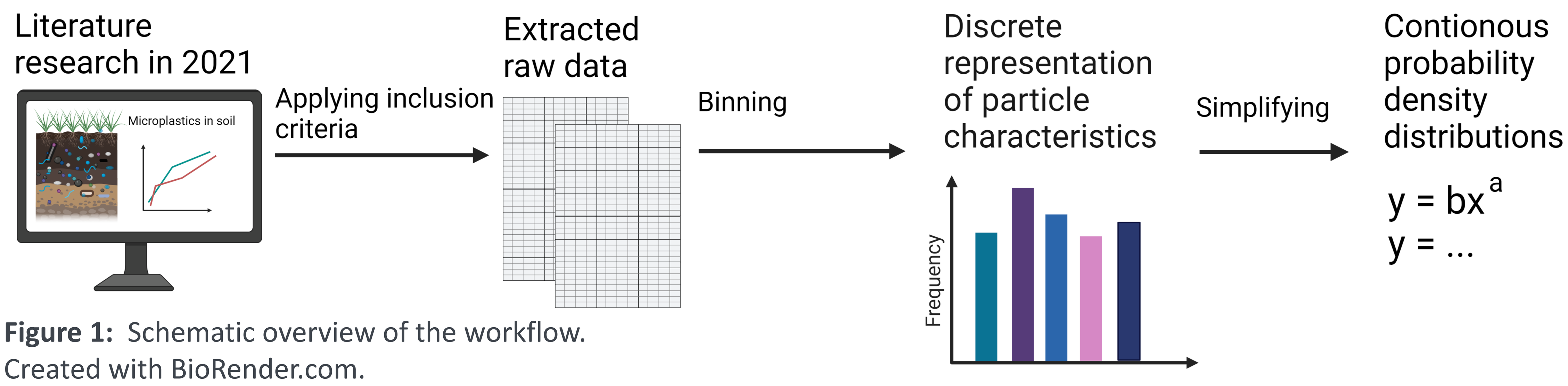

Figure 1: Schematic overview of the workflow. Created with BioRender.com.

Results & Discussion

- Only 14 % of the studies provided eligible data on size
- No trend was observed for particle size (slopes: -1.33 – 1.10)
- That is in contraction with aquatic MP where smaller particles have a higher abundances than larger ones
- Reasons for this discrepancy might be a a too strong focus on agricultural sites and challenges in extracting soil MP
- Fibers are predominant with a proportion of 40 %
- Shape of MP in soil follows a bimodal-like mixture of two normal distributions → comparable to aquatic MP
- The only exception is a higher amount of films that most likely originated from mulching

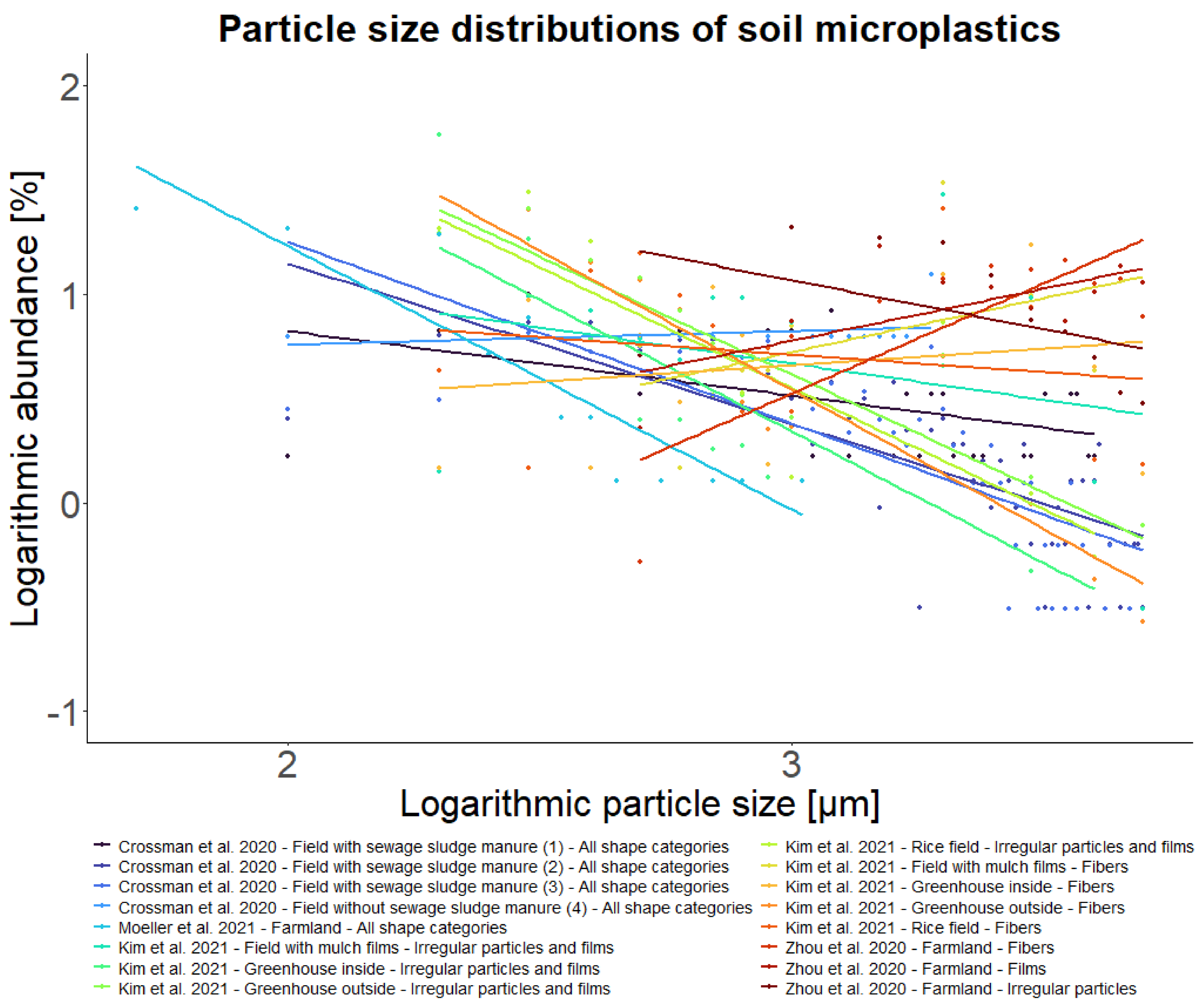

Figure 2: Abundances of particle sizes of soil microplastics. The fitted regression lines showed no trend for the abundance of different particles sizes (n = 16). The legend refers to the different kinds of land usage at each sample site. Some studies differentiated between shape categories. Studies that did not specify their shape categories have been labelled "All shape categories". (1) – (4) refer to four different locations studied by Crossman et al. (2020). For references on the studies in the legend see Reinhardt (2021).

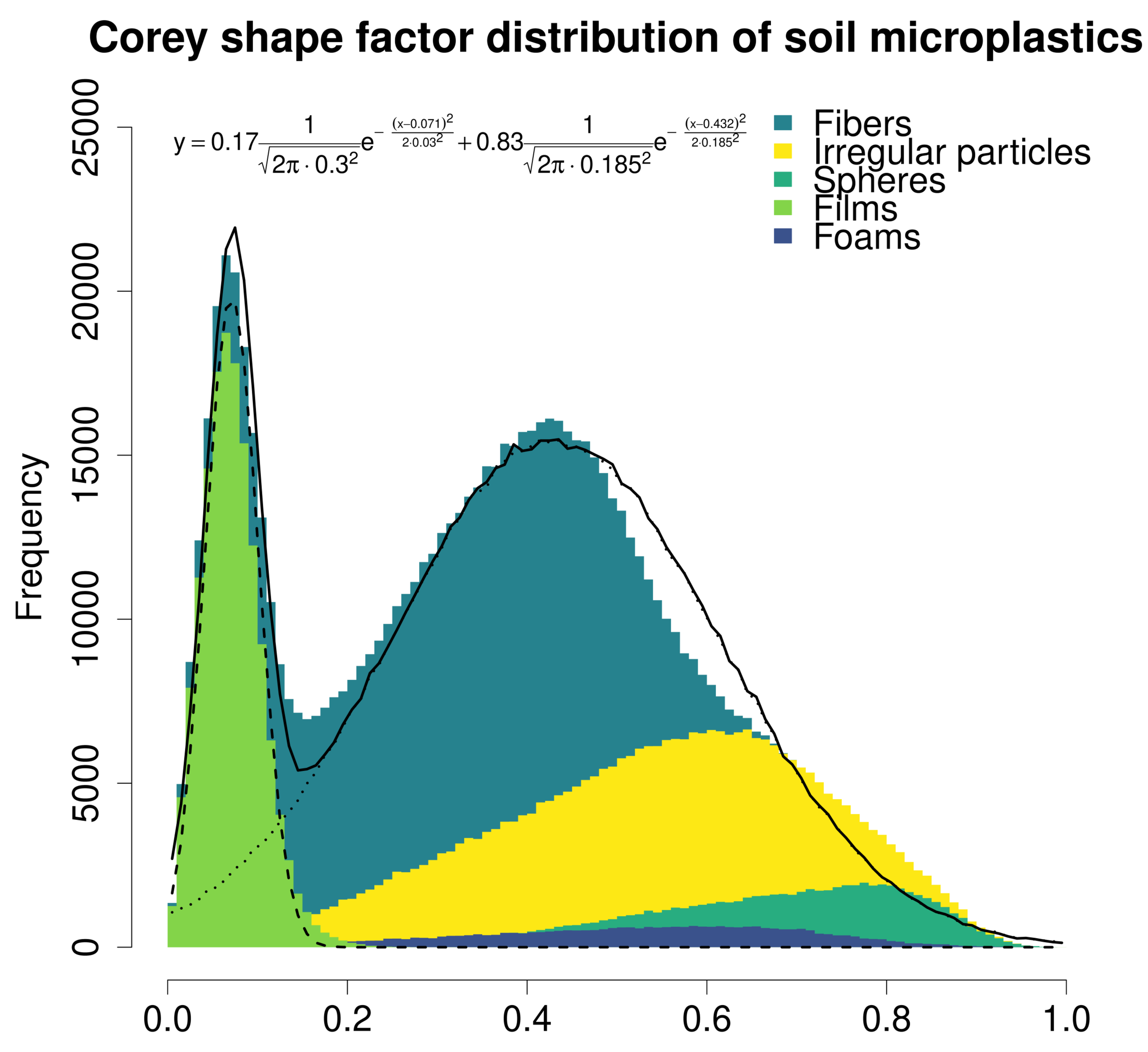

Figure 3: Corey shape factor distribution of soil microplastics. The equation was derived from fitting a mixture distribution to randomly generated data of n = 10^6 microplastics (solid line), which is the sum of two normal distributions for films (dashed line) and all other shape categories (dotted line).

References

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