

Appendices

A Methods

A systematic meta-synthesis was conducted to answer the research question: 'which effects does river sand mining have on the physical, chemical, biological and anthropogenic environment?'. The databases used are Scopus, Web of Science and Google Scholar which have been proved to have a high coverage of citations in the geosciences (Martín-Martín et al., 2018). Searches in Scopus included the title and keywords, searches in Web of Science included all fields and searches in Google scholar included the full text of publications.

Criteria for inclusion and exclusion were determined a priori and are listed in Table 1, as well as a justification for each decision and were based upon guidance by Siddaway et al. (2019). Literature was required to be open access or available via subscriptions of the University of Amsterdam library, written in the English language and relevant to the research question and topic to be included. No authors, affiliations or journals were excluded and there were no exclusion criteria for year of publication to include relevant older studies. The authors did maintain a critical perspective vis-à-vis the older papers to ensure their present day relevance.

The search terms that were used to find literature are the following: ("sand" OR "gravel" OR "sediment") AND ("mining" OR "extract*" OR "excavat*") AND ("river" OR "channel" OR "instream") AND ("impact" OR "effect" OR "environment"). Due to the limited advanced search possibilities in Google Scholar, Harzing's Publish or Perish software was used to search through the results. Additional search terms were used to further sort through the identified records. The terms used are: "physical", "bio*", "organic", "chemi*", "anthropo*", "human", "man-made", "infrastructure" and were used both separate and in combination. Literature that was found through a specific search on one environment, e.g. the physical, but (also) related to another environment, e.g. biological, was manually marked as relating to either or both.

A flowchart of the selection process is shown in Figure S 1. After the initial search through the databases, which was based on the search terms and inclusion criteria, the literature found was checked for duplicates. Of the remaining literature, first the title was screened for relevance, second the abstract and finally a full-text assessment for eligibility was conducted. A number of articles were identified through forward and backward searches or other sources.

Table S1: Overview of the inclusion and exclusion criteria and their justification which were used to select literature.

Inclusion	Exclusion	Justification
Relevant to research question and topic	Irrelevant to research question and aim	Limit the scope and allow focus on the research question
All authors, affiliations and journals	none	Avoid/minimise bias
English-language studies	Non-English language studies	The researchers are English speakers and have no available resources to translate articles.
All levels of open access or via subscriptions of the University of Amsterdam library	Studies with restricted access or that are behind a paywall	Ensure the research is not part of a funded project
All years	None	Include relevant older studies

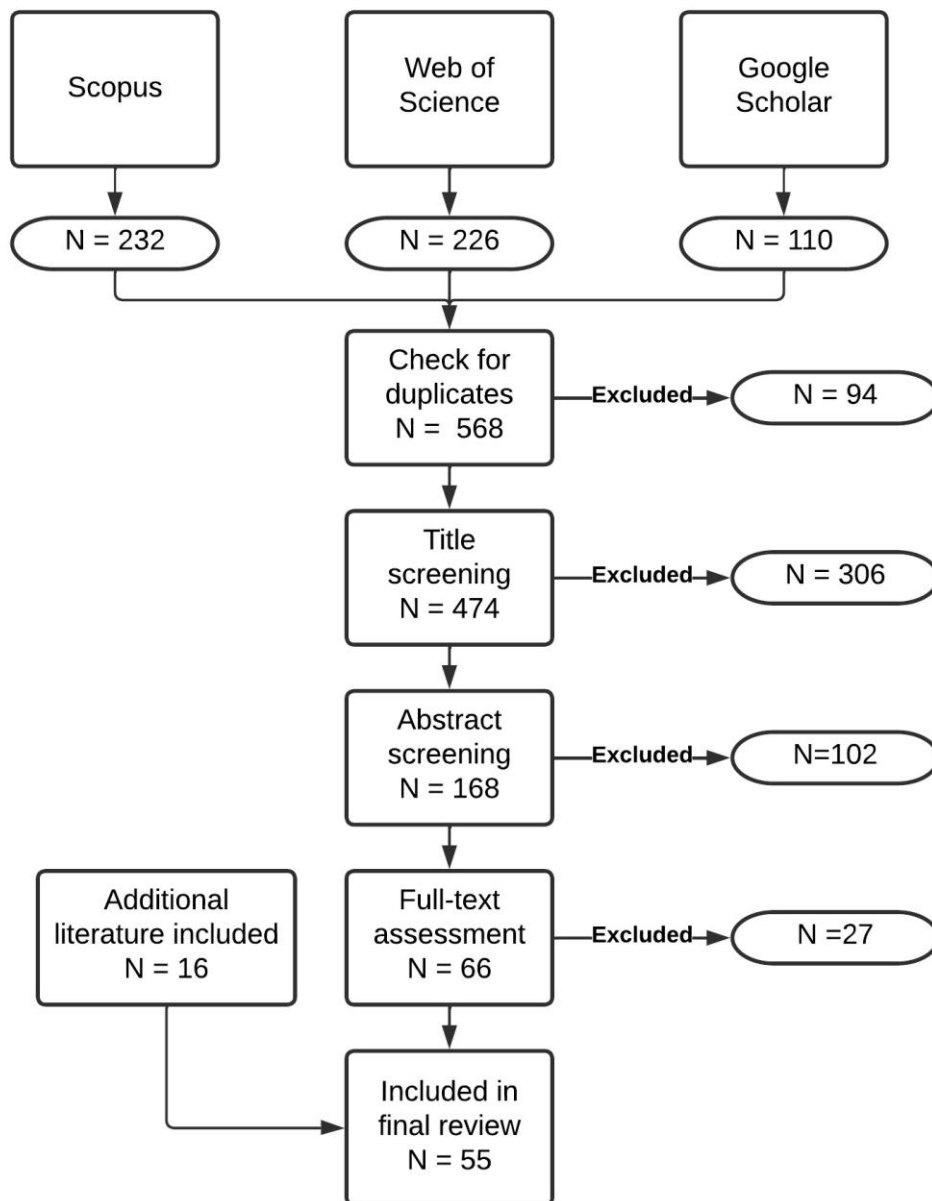


Figure S1: Workflow of the literature review with the number of records at each stage represented by "N".

References

Martín-Martín, A., Orduna-Malea, E., Thelwall, M. & López-Cózar, E. D. (2018). Google scholar, web of science, and scopus: A systematic comparison of citations in 252 subject categories. *Journal of informetrics*, 12(4), 1160–1177.

Siddaway, A. P., Wood, A. M. & Hedges, L. V. (2019). How to do a systematic review: A best practice guide for conducting and reporting narrative reviews, meta-analyses, and meta-syntheses. *Annual review of psychology*, 70, 747–770.