Supplementary Table S1: PRISMA 2020 Checklist

PRISMA 2020 Checklist for Systematic Reviews

Manuscript: Assessing Water Sustainability for the Sustainable Development Goals: A Systematic Review and Bibliometric Analysis

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Table S1: PRISMA 2020 Checklist

PRISMA 2020 CHECKLIST - 27 ITEMS

Section/Topic	#	Checklist Item	Reported?	Location in Manuscript	Page #
TITLE					
Title	1	Identify the report as a systematic review.	Yes	Title page	1
ABSTRACT					
Abstract	2	Provide a structured summary including: background, objectives, data sources, study eligibility criteria, participants, interventions, study appraisal and synthesis methods, results, limitations, conclusions and implications of key findings, systematic review registration number.	Yes	Abstract section	1
Introduction					
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Yes	Introduction, Section 1.3	2-3
Objectives	4	Provide an explicit statement of all objectives or research questions the review addresses.	Yes	Introduction, end of Section 1.3	3
Methods					
Eligibility criteria	5	Specify inclusion and exclusion criteria for the review.	Yes	Methods, Section 2.4 (Eligibility criteria)	4-5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched. Specify the date when each source was last searched.	Yes	Methods, Section 2.3 (Data Collection)	4

Search strategy	7	Present the full search strategies for all databases, including any filters and limits used.	Yes	Methods, Section 2.3 (Search terms shown)	4
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review.	Yes	Methods, Section 2.4 (Study Selection)	5
Data collection process	9	Specify the methods used to collect data from reports.	Yes	Methods, Section 2.3 (Data Collection)	4
Data items	10a	List and define all outcomes for which data were sought.	Yes	Methods, Section 2.3 & 2.6	4, 6
Data items	10b	List and define all other variables for which data were sought.	Yes	Methods, Section 2.6 (48 fields)	6
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies.	Yes	Methods, Section 2.5 (Quality Assessment)	5-6
Effect measures	12	Specify for each outcome the effect measure(s) used in the synthesis or presentation of results.	N/A*	Not applicable (bibliometric)	N/A
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis.	Yes	Methods, Section 2.6 (Data Analysis)	6
Synthesis methods	13b	Describe any methods required to prepare the data for presentation or synthesis.	Yes	Methods, Section 2.6	6
Synthesis methods	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Yes	Methods, Section 2.6 (Biblioshiny, VOSviewer)	6
Synthesis methods	13d	Describe any methods used to synthesize results.	Yes	Methods, Section 2.6	6
Synthesis methods	13e	Describe any methods used to explore possible causes of heterogeneity among study results.	Yes	Methods, Section 2.6 (Temporal analysis)	6
Synthesis methods	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Yes	Methods, Section 2.5 (Quality checks)	5-6
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis.	Yes	Methods, Section 2.5; Discussion	5-6, 20
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A*	Not applicable (descriptive)	N/A
Results					

Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Yes	Results, Section 3.1; Figure 1	7-8
Study selection	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Yes	Results, Section 3.1 (564 excluded with reasons)	8
Study characteristics	17	Cite each included study and present its characteristics.	Yes	Results, Sections 3.2-3.4	8-12
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Yes	Results, Section 3.2 (Data completeness)	9
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group and (b) an effect estimate and its precision.	Yes	Results, Sections 3.3-3.9 (Tables & Figures)	10-17
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Yes	Results, Sections 3.3-3.9	10-17
Results of syntheses	20b	Present results of all statistical syntheses conducted.	Yes	Results, Sections 3.3-3.9 (Figures 4-19)	10-17
Results of syntheses	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Yes	Results, Section 3.8 (Temporal analysis)	15
Results of syntheses	20d	Present results of all sensitivity analyses conducted.	Yes	Results, Section 3.2 (Quality metrics)	9
Reporting biases	21	Present assessments of risk of bias due to missing results for each synthesis assessed.	Yes	Discussion, Section 5.8 (Limitations)	20
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A*	Not applicable (descriptive)	N/A
Discussion					
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Yes	Discussion, Sections 5.1-5.6	18-20
Discussion	23b	Discuss any limitations of the evidence included in the review.	Yes	Discussion, Section 5.8	20
Discussion	23c	Discuss any limitations of the review processes used.	Yes	Discussion, Section 5.8	20
Discussion	23d	Discuss implications of the results for practice, policy, and future research.	Yes	Discussion, Section 5.7; Conclusions	20-21

Other information					
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Yes	Methods, Section 2.2	4
Registration and protocol	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Yes	Methods, Section 2.2	4
Registration and protocol	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Yes	Methods, Section 2.2 (Not registered - explained)	4
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors.	Yes	Funding statement (end of manuscript)	22
Competing interests	26	Declare any competing interests of review authors.	Yes	Conflicts of Interest statement	22
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Yes	Data Availability Statement	22

Other Supplementary Details

1.1 Dataset Characteristics

Temporal Coverage:

- Year range: 1995 - 2025 (30 years)
- Peak publication years: 2022-2023 (78 papers, 33.9%)
- Recent trends (2024-2025): 22 papers (9.6%)

Temporal Distribution:

Year	Papers	Percentage
2025	8	3.5%
2024	14	6.1%
2023	42	18.3%
2022	36	15.7%
2021	19	8.3%

2020	7	3.0%
2015-2019	58	25.2%
2010-2014	32	13.9%
1995-2009	14	6.1%

1.2 Data Completeness:

Field	Complete	Percentage
Authors	230/230	100.0%
Titles	230/230	100.0%
Years	230/230	100.0%
Journals	225/230	97.8%
DOIs	222/230	96.5%
Abstracts	223/230	97.0%

1.3 Other information's:

1.3.1 Data Extraction & Quality Assessment

1.3.1.1. Bibliometric Data Structure

48 columns extracted for each paper:

Core Metadata (10 columns):

- Content.Authors (full names)
- Content.Author full names
- Content.Title
- Content.Year
- Content.Source title (journal)
- Content.Volume, Issue, Page start, Page end
- Content.Art. No.

Identifiers & Links (5 columns):

- Content.DOI
- Content.Link
- Content.PubMed ID
- Content.Publisher
- Content.Document Type

Citations & Metrics (3 columns):

- Content.Cited by
- Content.Open Access
- Content.Impact Factor

Research Classification (10 columns):

- Methods
- Key findings
- Area of Research
- SDG Tags
- Keywords (author & index)
- Funding Details
- Affiliations
- Correspondence Address

Abstract & Content (5 columns):

- Content.Abstract
- Content.Author Keywords
- Content.Index Keywords
- Content.Molecular Sequence Numbers
- Content.Chemicals/CAS

Additional Fields (15 columns):

- Publication details, references, language, access type, etc.

1.3.2 Author Information Verification

Process:

- All 230 papers verified for complete author information
- Method: CrossRef API integration for author retrieval
- Success rate: 100% (all papers have full author names)
- Format: Given name + Family name, semicolon-separated

Quality Assurance:

- Manual verification of ambiguous cases
- Cross-reference with multiple databases
- Standardised name formatting

1.4. Thematic Analysis Framework

1.4.1 Major Research Themes Identified

Theme 1: Assessment Frameworks & Indices (35%)

- Water sustainability indices
- Composite indicator systems
- Multi-criteria assessment frameworks
- Safe operating space approaches

Theme 2: WEFE Nexus Integration (22%)

- Water-Energy-Food-Ecosystem nexus
- Cross-sectoral sustainability
- Integrated resource management
- Synergies and trade-offs

Theme 3: Water Resource Carrying Capacity (18%)

- Carrying capacity evaluation
- Water footprint analysis
- Resource availability assessment
- Pressure-state-response models

Theme 4: Groundwater Sustainability (12%)

- Groundwater depletion assessment
- Aquifer sustainability
- Groundwater-surface water interactions
- Long-term resource security

Theme 5: Basin & Regional Assessment (13%)

- Watershed-scale evaluation
- River basin management
- Regional water security
- Transboundary water governance

1.5. Geographic Distribution

1.5.1 Case Study Locations (22 Strongest Papers)

Asia-Pacific (14 papers, 63.6%):

- China: 6 papers (Taizhou, Yunnan, Northwest China, Yangtze River, Zhuhai-Macao)
- Sri Lanka: 1 paper (Mahaweli River)
- Vietnam: 1 paper (Srepok River)
- Japan: 1 paper (collaboration)
- India: 1 paper
- Global/Multi-region: 4 papers

South America (1 paper, 4.5%):

- Brazil: 1 paper (Eastern Amazon)

Europe (2 papers, 9.1%):

- Mediterranean: 1 paper
- Bulgaria: 1 paper

Global/Methodological (5 papers, 22.7%):

- Framework development without a specific case study

1.5.2 Research Priorities by Region

China: Carrying capacity, water footprint, regional sustainability South/Southeast Asia: Basin management, water security, nexus approaches Mediterranean: WEFE nexus, participatory governance Global: Framework development, comparative indices

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1.6. Methodological Approaches

1.6.1 Assessment Methods Frequency

Indicator-based approaches (45%):

- Composite indices
- Multi-criteria indicators
- Sustainability scorecards

Modeling approaches (25%):

- System dynamics
- Hydrological models
- Optimisation models

Footprint analysis (15%):

- Water footprint
- Grey water footprint
- Virtual water

Integrated frameworks (15%):

- DPSIR (Driver-Pressure-State-Impact-Response)
- WEFE nexus models
- Safe operating space

1.6.2 Emerging Methodologies (2024-2025)

1. AI-powered assessment: Machine learning for sustainability prediction
2. Remote sensing integration: Satellite data for groundwater monitoring
3. Participatory approaches: Stakeholder-driven indicator development
4. Bayesian networks: Uncertainty quantification in assessment
5. Multi-dimensional frameworks: Integration of all sustainability dimensions

Other Supplementary Information

Supplementary A: Search Strings Used

Core search string:

("water sustainability" OR "sustainable water" OR "water sustainability assessment")
AND
("assessment" OR "evaluation" OR "indicator" OR "index" OR "framework" OR "methodology")

Extended search dimensions:

AND (
"environmental" OR "social" OR "economic" OR "governance" OR
"WEFE nexus" OR "water-energy-food" OR
"carrying capacity" OR "water footprint" OR
"groundwater sustainability" OR "water security")

Supplementary B: Database Search Dates

Database	Search Date	Date Range	Results
Scopus	Nov 2025	1995-2025	1140 to 230

Supplementary D: Data Quality Metrics

Metric	Value
Author completeness	100%
Title completeness	100%
Year completeness	100%
Journal completeness	97.8%
DOI completeness	96.5%
Abstract completeness	97.0%
Duplicate rate	0%
Format consistency	100%

Data Collection and Extraction

Data Items:

A standardised data extraction form was developed to capture 48 bibliometric fields for each included paper:

Core Metadata (10 fields):

- Authors (full names), Title, Year, Journal/Source, Volume, Issue, Pages,

Article number, Publisher, Document type

Identifiers (5 fields):

- DOI, PubMed ID, Publisher link, Open access status, Impact factor

Citations and Metrics (3 fields):

- Citation count, h-index, Journal impact metrics

Research Classification (10 fields):

- Assessment methods, Key findings, Research area, SDG alignment,

  Author keywords, Index keywords, Funding details, Affiliations,

  Correspondence address, Geographic focus

Content (5 fields):

- Abstract, Author keywords, Index keywords, Research methods, Frameworks

Additional Fields (15 fields):

- Publication details, References, Language, Access type, etc.

Data Extraction Process:

1. Automated extraction from databases (Scopus format, 48 columns)
2. Manual verification of author names using the CrossRef API (100% completeness achieved)
3. Quality control: Two reviewers independently verified a 10% random sample
4. Data stored in Excel format (.xlsx) for analysis
5. Missing data: <3% for abstracts, <5% for journal names