

RESEARCH ARTICLE

MAPTkit: An environmental management decision-tool for inclusive, equitable and representative stakeholder attribute mapping

Victoria Hoare¹  | Caitlin E. Hinson^{1,2}  | Bethany M. Reyniers¹ | Ryan O'Shea¹ | Caroline Howe¹ 

¹Centre for Environmental Policy, Imperial College London, London, UK

²Science and Solutions for a Changing Planet DTP, Imperial College London, London, UK

Correspondence

Victoria Hoare

Email: victoria_hch@outlook.com;

v.hoare@imperial.ac.uk

Funding information

Engineering and Physical Sciences Research Council; London Interdisciplinary Social Sciences Doctoral Training Partnership; Science and Solutions for a Changing Planet Doctoral Training Partnership

Handling Editor: Prue Addison

Abstract

1. Inclusive, comprehensive Stakeholder Identification and Mapping processes are vital for successful environmental management. This is relevant as multi-disciplinary collaboration becomes increasingly popular, and the diversity of people influenced by, or involved in, the management of most projects is greater than ever before. Understanding how relevant parties are analysed in environmental management programmes is required to enable robust and considered methodologies as well as successful, just and equitable outcomes.
2. The aim of this study was to improve the attribute mapping process, increasing transparency and ensuring representation is both comprehensive and equitable. A rapid scoping review of Scopus and Web of Science was undertaken to collate and analyse peer-reviewed, published evidence on stakeholder analysis, with a focus on the mapping processes involved in identifying stakeholders and their attributes.
3. Of the Initial 359 identified papers, 61 were included after three stages of screening. Our results indicate that there is little consistency among practitioners to ensure that Identifying and Mapping Stakeholders is representative: <20% of Case Studies ($n=9$) checked the relevancy of their stakeholders after identification. Additionally, definitions at all stages of the stakeholder analysis process were inconsistent across the case studies. Fewer than half of the Case Studies included a definition of *Stakeholder* ($n=22$) or of *stakeholder analysis* ($n=25$).
4. Capturing a representative sample of relevant parties, without compromising on efficiency, financial or practical constraints, is difficult. Having consistent definitions for the term *Stakeholders* and *stakeholder analysis* within environmental management is an important step. Based on the scoping review, we formalise the Analysis process into six stages.
5. Through the scoping review findings, a decision support tool, MAPTkit (Mapped Attribute Profiling Toolkit) was developed to visualise the heterogeneity and

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2023 The Authors. *Ecological Solutions and Evidence* published by John Wiley & Sons Ltd on behalf of British Ecological Society.

representation of stakeholders across several user-determined attributes. This tool is non-prescriptive, drawing attention to potential issues with stakeholder analysis, such as misrepresentation of real-world stakeholder communities. This ensures engagement across the full range of people to ensure that environmental management projects are multi-disciplinary and collaborative, while promoting fair and equitable representation.

KEYWORDS

decision support tool, environmental equity, interdisciplinary and transdisciplinary environmental management, participation, stakeholder analysis, stakeholder identification, stakeholder mapping

1 | INTRODUCTION

Stakeholders are defined as an individual, group or organisation who can affect, or will be affected by, the outcome of a project, management, policy or scheme (Freeman, 2010), and they have a vital role in the management of the environment. This was first described by the 1998 United Nations (UN) Aarhus Convention which highlighted the importance of public access to environmental information and justice on environmental decision-making (UNECE, 1998). As a result, public participation has become intrinsic to national and international environmental policymaking and management (Mushove & Vogel, 2005; Reed et al., 2009, 2018).

Increasing Stakeholder Engagement in environmental management (e.g. natural resource management, habitat restoration and sustainability initiatives) reflects this discourse around the influential role of stakeholders in decision-making (Colvin et al., 2020; Prell et al., 2009). Both generally (Beery & Lekies, 2021), and after the COVID-19 pandemic (Berdejo-Espinola et al., 2021), the emerging awareness of the role of the environment in supporting society evidences that all people *could* be considered 'stakeholders' in the environment. This uniquely situates Stakeholder Engagement in environmental management, with the requirement to consider the wider implications of decisions on all individuals, communities and organisations (Colvin et al., 2020).

The role of participants has evolved into an iterative continuous process, providing several opportunities to influence decisions and to continually develop the management strategy in response to participant input (Fritz et al., 2018). Engagement processes are diverse, involving combinations of consulting, engaging, collaborating and informing, often tailored to suit the people involved (Harrington et al., 2008). Ultimately, engagement should become a co-decision-making process (Fritz et al., 2018), such as a multidisciplinary collaboration. These methods are designed to reduce conflict; facilitate learning; help identify suitable solutions and increase support for both project goals and implementation (Blackstock et al., 2007; de Vente et al., 2016; Derak et al., 2017; Shackleton et al., 2019).

Historically, increasing both stakeholder interactions and diversity helped improve the understanding and performance of environmental and resource governance (Zetina-Rejón et al., 2020). Decision quality improves with increasing variety in interests, allowing for

extensive information sharing (Curşeu & Schruijer, 2017; Vogler et al., 2017). Reduced diversity in interests results in conflicts, compromising decision quality through increasing rates of false consensus (Curşeu & Schruijer, 2017). The stakeholders' role, how they are engaged within the decision-making process, and the relationship they have to the ecosystem or environmental resource, all impact decision-makers' abilities to address different types of environmental problems (Bodin, 2017).

Identifying and engaging stakeholders, then implementing their contributions, is known collectively as stakeholder analysis (Fritz et al., 2018; Prell et al., 2009). Stakeholder analysis has been a pragmatic approach to natural resource management analysis and policymaking since the 1990s (Grimble & Wellard, 1997) and is commonly defined in today's literature by several key papers, including Reed et al. (2009) and Grimble and Wellard (1997). In this study, we formalise stakeholder analysis according to Reed et al. (2009) and based on the findings of our research into six stages, where the following terms are clarified as follows: Identification, the recognition of who can affect or is affected by, a decision or action (stages 1–3—identifying the problem, relevant groups and their roles); Mapping, the visualisation of key attributes and relationships (stages 4–7—attribute mapping, connections analysis and relevance assessment); all followed by Engagement, defined as the involvement of stakeholders within stages of research or decision-making.

Within this study, the Stakeholder Identification process was considered to start when the studies had no stakeholders and end when not only all the *potential* stakeholders were identified but also those who would optimise the engagement process. Stakeholder Mapping allows for the visualisation of the stakeholders. This step can be used to identify gaps in stakeholder representation, highlight the optimum group of stakeholders to engage with, and justify the final group of stakeholders for engagement. Attribute Mapping involves assigning attributes to stakeholder groups or individuals, often distributed across a scale, to create a map displaying the attribute-stakeholder profile. This map facilitates the process of determining the stakeholders to include to ensure fair representation across attributes (Zingraff-Hamed et al., 2020). An example of commonly used attributes is '*power + legitimacy + urgency*' (Mitchell et al., 1997). Attribute Mapping can enable an understanding of dynamics between people, which in turn will help identify relevant

parties that hold a set of predetermined attributes desired for a study.

Appropriate identification is paramount for robust stakeholder analysis (Fritz et al., 2018). Identification and Mapping should be designed to obtain the most representative sample of the stakeholder community, at the time of the analysis (Leventon et al., 2016). This process should be reflective of real-world opinions, experiences, and priorities, while recognising that it is a snapshot of a dynamic situation (Achterkamp & Vos, 2007). Suitable Stakeholder Identification and mapping techniques should avoid under- or over-representation of groups (Leventon et al., 2016), ensuring those being engaged are representative and not biasing the overall agenda (Prell et al., 2009). As stakeholder analysis affects who is involved in the collaborative process, this will impact the subsequent outcome of a project (Fritz et al., 2018). Researchers need to be aware of the potential bias introduced during the selection process (Colvin et al., 2020), and that both the role (Ballejos & Montagna, 2008) and power (Achterkamp & Vos, 2007) of a stakeholder may change over time (Fritz et al., 2018).

Currently, the attribute mapping process is inconsistent and non-comparable across studies. While the stages may have been included within a study protocol, a description of how the process was carried out often lacks detail and clarity (Bendtsen et al., 2021; Fritz et al., 2018). The robustness of research, as well as environmental management and decision-making, is compromised when the selected groups are not fully representative of all roles or when researchers are not fully transparent as to why particular choices have been made (Colvin et al., 2020). Without a consistent attribute mapping technique to ensure those identified are representative of the true population and appropriately engaged, difficulties can arise when comparing across research studies. The robustness of any research outcome is limited and optimum outcomes for environmental management may not be reached. Such a technique, process or tool should not be inaccessible to researchers or practitioners, due to limited resources, time constraints or experience.

The aim of this paper was to create an accessible technique that provides a checkpoint for consistency in attribute mapping. Enabling researchers and practitioners to evidence the stakeholder mapping process they have used ensures fair representation across attributes relevant to the research project. Our tool, *MAPTkit*, was evidenced through a rapid scoping review, which provided an overview of current practices and commonalities across a broad range of environmental management studies. This study (i) catalogues how previous research and environmental management programmes have identified and mapped relevant parties; (ii) highlights research gaps in current stakeholder identification and mapping practices within environmental management and (iii) creates a tool that will aid researchers in determining and justifying the success of their stakeholder mapping. The tool was designed to inform the user of potential representation gaps and can be applied to a variety of environmental management circumstances of various disciplines and scales. The tool is non-prescriptive, where its function is to help the

user identify project-specific issues rather than provide solutions on a case-by-case basis. This approach requires the user to action a response to the information provided by the tool after reflecting on the outputs, for example, by altering the composition of stakeholders engaged.

It is important to note ongoing debates around the term 'Stakeholder' and movements across research to decolonise the language (Banerjee, 2003; Reed, 2022; Sharfstein, 2016). This paper will continue to use the term 'Stakeholder' when referring to specific processes within stakeholder analysis to reflect the usage of these terms within the methodology, and the articles this paper analyses. Where appropriate, this paper uses alternative terminology. Future iterations of this research, or any derived research, should reflect any updates to the terminology.

It is critical to reflect the multidisciplinary process of stakeholder analysis, observed within and across a variety of spatial scales (Raum, 2018; e.g. a regional area for habitat restoration Derak et al., 2017, on a local scale in a sustainability corporation Ikram et al., 2019, and on a global level looking at population movement of species Shackleton et al., 2019). Thus, the outputs of this research provide a freely accessible resource to enable researchers to evidence their attribute mapping process by providing transparency to the attributes their chosen stakeholders represent to ensure future stakeholder engagement in environmental management is fair and just.

2 | MATERIALS AND METHODS

A rapid scoping review was carried out based on methodologies as described by James et al. (2016) and Collins et al. (2015). Evidence was collected on methods, current practices and research gaps in Stakeholder Identification and Mapping, with results from this used to inform subsequent research methodologies. These findings informed the next stages that led to the development of a Mapped Attribute Profiling Toolkit (*MAPTkit*) to facilitate comprehensive and representative attribute mapping.

2.1 | Rapid scoping review

The search strategy was based on the following primary research question:

What are the most commonly applied methods for identification and mapping stakeholders in environmental resource management research and practice?

A search string was developed using SCOPUS as the search database. Articles from the initial results were reviewed to assess the accuracy of the results concerning the primary question. The final search string consisted of two sub-string specifications covering stakeholder identification and environmental resource management. The string

was applied to two academic databases: SCOPUS and Web of Science. A total of 511 articles were found, with 157 duplicates removed, leaving 359 articles for screening.

("Stakeholder mapping" OR "Stakeholder map" OR "stakeholder analysis" OR "Stakeholder network analysis" OR "Stakeholder network mapping" OR "Stakeholder identification" OR "actor identification" OR "Actor mapping")

AND

("Conservation" OR "Environmental Management" OR "Environmental Resource Management" OR "Natural resource management" OR "Social-ecological systems" OR "Social-ecological" OR "Socio-ecological" OR "human environment" OR "human-environment" OR "Nature-society" OR "Human-nature coupled systems" OR "natural-human coupled systems" OR "nature-human coupled systems")

Screening was conducted by the review team (CEH, VH, BMR, RO), with all articles blind screened twice at both title and abstract and full-text stages. Disagreements between reviewers were reconciled by mediation. Strict inclusion criteria were applied during evidence screening, with additional criteria applied at the full-text stage (Supporting Information Tables S1 and S2).

A key criterion was that the main scope of the article must consider and articulate methods for stakeholder identification. This criterion ensured that article content would be able to fulfil the extraction categories created analysis (Supporting Information Tables S1 and S2). At full-text screening, papers were also categorised into three key article types: framework, case study and audit. This was based on an agile recognition of the records containing different types of information (Table 1).

2.2 | Data extraction and analysis

Data extracted could be grouped into seven umbrella concepts, or categories (Table 2). To ensure efficient data extraction, not all umbrella categories were extracted in all three of the key article types: only the reference information of the papers was extracted from all accepted articles. In situations where one accepted article had components that could be defined in more than one article type (e.g., contained both a framework and a case study), the relevant sections of the article were treated as separate records and so were extracted separately (as both an independent framework and independent case study), avoiding double counting.

TABLE 1 Definition of the three paper types identified within the scoping review.

Article type	Definition
Framework	The purpose of the paper is to develop/detail SH ID/mapping processes
Case study	Research focuses on a specific case study and the SH ID/ mapping process is clearly outlined in the methods
Audits	The purpose of the paper is to evaluate/audit/critique SH ID/ mapping processes

TABLE 2 Categories for extraction under the different article types defined within the scoping review (framework, case study, and audit).

Category	Framework	Case study	Audit
Reference information	x	x	x
Case study information		x	
Data collection methods	x	x	
Data analysis methods	x	x	
Presentation of information	x	x	
Attribute mapping techniques	x	x	
Summary of article	x		x

For extraction, reference information refers to the authors and article publication details, while case study information included details such as site location and date of data collection, allowing for analysis of spatial and temporal differences if required. Due to the categories that were extracted from Case Studies and Framework articles (Table 2) being common components of stakeholder analysis, the manner of inclusion or exclusion in the articles can be informative for this study on questions about the consistency of terminologies and practices. Framework and Audits elicited a summary of the article as this allowed for quick comprehension of the observational data that these papers could provide.

Data from the case study and frameworks articles were analysed by determining frequencies and modal groups, to establish common stages, methods and processes used for Stakeholder Identification and Mapping. Methods used to map attributes were identified across the Case Studies and subsequently adapted for use within the decision-making tool. Mapping techniques were extracted if the case study and/or framework explicitly stated that they were mapping, visualising, or otherwise placing the stakeholders within a matrix and followed this with an infographic.

2.3 | Framework data to inform case study analysis

This study used an iterative approach. We used the knowledge gained from the Framework extraction to inform further data that should be investigated within the Case Studies.

The Framework articles allowed us to identify the different stages of stakeholder analysis. These were then simplified into six stages: (1). identify the overall problem for the project to focus on; (2). identify types or groups; (3). identify the role of the stakeholder; (4). map attributes; (5). analyse connections and networks between and among the stakeholders and (6). assess the relevance of the stakeholder or stakeholder group(s).

Stages were recognisable by common repetition in Frameworks stating the importance that the role each stage had, although not all Frameworks focused on all or multiples, of the stages in their own work. Investigating the prevalence of these stages within the Case Studies can help identify the success of Framework application and

help isolate the gaps between Framework recommendation and case study application.

2.4 | MAPTkit development

The MAPTkit was developed by VH with support from CEH and BMR using Excel (Microsoft Corporation, 2018). The mapping techniques included in MAPTkit are designed to showcase the tools' function and were chosen based on (i) the frequency of method, indicating common acceptance of technique; (ii) if they were considered both easy to translate onto Excel and visually appealing or (iii) they were highly familiar to the intended users, which can increase perceived usability (Casaló et al., 2008). The techniques included in the tool were informed by the attributes and mapping methods identified in the scoping review ('Power', 'Interest', 'Dependence', 'Importance', 'Knowledge', 'Increasing Policy Influence', 'Conservation', 'Scale', 'Attitude', 'Information Collecting', 'Capacity', 'Urgency', 'Influence', 'Participation', 'Information sharing', 'Legitimacy'), with those commonly used in the Case Studies and Frameworks included within the support system. The attributes used in our example can be substituted by the user as required.

3 | RESULTS

3.1 | Overview

The initial search string yielded 511 articles, of which 61 articles were accepted after screening (Figure 1). In total, 12 Frameworks were identified, where the authors presented a novel method for Stakeholder Identification or Mapping. A further 46 articles included a case study, where an example Stakeholder Identification process was discussed in sufficient detail for replication. In addition, 16 Audit articles were identified as important and applicable research and were used as literature against which to compare results.

Accepted articles represent a snapshot of research and practice as of March 2021. The articles cover 37 journals, 19 years of research and over 30 countries. The results illustrate that research on the different components of stakeholder analysis found in the Case Studies covers a wide range of methods for initial identification and mapping. This data extraction can be grouped into four general areas: Stakeholder Data Collection, Stakeholder Mapping, Frameworks and stakeholder analysis stages.

3.2 | Stakeholder data collection

Under half the Case Studies omitted a definition for 'Stakeholder' ($n=22$), while just over half omitted a definition for 'stakeholder analysis' ($n=25$). The number of data collection methods within the Case Studies ranged between 1 and 6. Most Case Studies

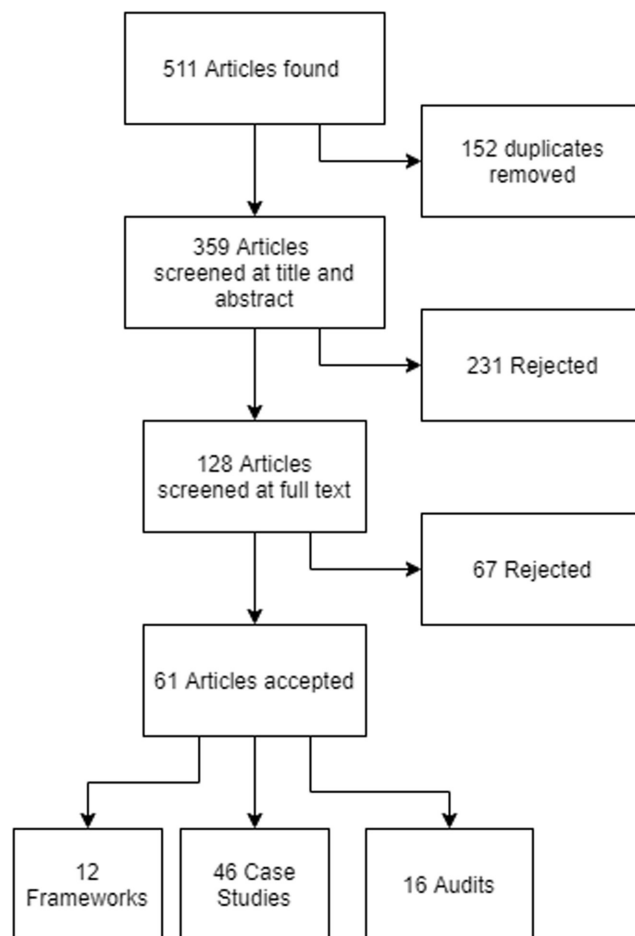


FIGURE 1 Scoping review process from initial number of article hits from the search string to final number of articles (and article type) accepted for meta-data extraction.

used a combination of four distinct identification methods ($n=12$; Supporting Information Table S4). Data Collection methods included: participant involvement through interviews or focus groups; informative analysis methods including field studies and social network analysis and sampling strategies such as snowballing or purposive sampling (Table 3, Supporting Information Table S4).

Case Studies identified relevant stakeholders using three broad styles; participant involvement, informative analysis methods and sampling strategies (Table 3). Participant Involvement was the most prevalent way in which Case Studies identified relevant stakeholders, with Interviews ($n=35$) and known experts ($n=23$) being the most common. There were 18 Case Studies that used both interviews and known experts.

Informative analysis methods were techniques that relied on the analysis of non-participant data to identify stakeholders. Document analysis ($n=20$), where written information, reports, transcripts and media, were analysed to identify stakeholders. A field study ($n=16$), field observations or pilot studies were common. Social network analysis ($n=17$) described and numerically defined the connections between stakeholders through the representation of their position within a network.

TABLE 3 The origins of how different studies sourced the information on who their relevant stakeholders were, with several papers including more than one technique.

Stakeholder data collection method		Frequency
Participant involvement	Interview	35
	Known experts	23
	Focus groups	13
	Survey	11
	Workshops	8
	Informal conversation	5
Informative analysis methods	Document analysis	20
	Field study	16
	Social network analysis	17
Sampling strategies	Snowballing	21
	Purposive	12
	Stratified	4

Sampling strategies were methods of data collection designed to find a representative group of individuals and were commonly applied through participant involvement and informative analysis methods. Snowballing ($n=21$) is often applied in combination with interviews ($n=18$), or known experts, ($n=15$) where participants are asked to name other people who are relevant to the research. Purposive sampling ($n=12$) focuses on gaining a group spread across attributes the stakeholder represents, and stratified sampling ($n=4$) aims to remove bias in selection through non-prescriptive selection.

3.3 | Stakeholder mapping

In studies including mapping ($n=26$), the attributes used were extracted. The attributes were defined in the articles by means of categorical assessment, using either scales from high-medium-low, or numerical scales. For example, the attribute 'power' used a scale of high to low power, while 'interest' used a scale of 1–5 (5 indicating greatest interest). The specific definition of each attribute, and its affiliated scale, differed between the articles. There were 15 instances of an article using an attribute without an explicit definition (Table 4). This most commonly occurred for the attribute 'influence' ($n=4$) and 'interest' ($n=4$). Additionally, several attributes had a "circular" definition ($n=10$). This was when an attribute was given a definition that used the attribute name in the description (e.g. "interest" can be defined as the interest that the stakeholder has for the project" [$n=4$]) or when an attribute was given a definition that used a different attribute name in the description (e.g. "Power" is the influence that a stakeholder has on a project" [$n=2$] or the inverse "Influence" is the power that a stakeholder has on a project" [$n=4$]).

In most articles ($n=18$), the attributes were mapped in pairs, often to isolate the group that fell into the highest level of the scales for both attributes. The most frequently occurring attribute pairs were 'power + interest' ($n=7$), and 'influence + interest' ($n=4$). All other attributes and combinations were found in 1 incidence

(Supporting Information Table S5, Table 4). 'Influence' was prevalent across the pairings, included with 'dependence', 'importance' and 'capacity'. In some cases, more topic-specific attributes were used, such as 'potential for conservation' (De Lopa, 2001) and 'participation' (Reyes-García, 2019), highlighting that attribute assignment is also undertaken on a case-by-case (Table 3). In non-pairing cases, five were used as individual attributes 'attitude' ($n=1$; Xu et al., 2016), 'position' (Mannetti et al., 2019), 'Access to information' ($n=1$), 'Knowledge' ($n=1$) and 'Satisfaction' ($n=1$; dos Muchangos et al., 2017). 'Power, urgency + legitimacy' ($n=1$) were the only examples of three attributes being mapped at once.

Mapping visualisation techniques were extracted for each attribute, as some articles used multiple mapping techniques for different attributes (Table 5). A Four cornered matrix was the most common method ($n=14$), with scatter plot ($n=10$) and grid ($n=8$) methods using a similar two-dimensional scale technique for pairs of attributes. Radar Charts and Venn Diagrams ($n=4$) enable the comparison of multiple attributes.

3.4 | Frameworks

The 12 references that presented methodologies self-described as Frameworks, or a related term, and represented a wide variety of disciplines including natural resource management ($n=4$), environmental decision-making ($n=3$), waste management ($n=1$), climate change ($n=1$), transdisciplinary research ($n=1$), conservation ($n=1$) and environmental conflicts ($n=1$). Common themes across the 12 frameworks were the use of participatory methods, with stakeholder engagement, used to identify or classify other stakeholders, as well as stakeholder prioritisation, where identified stakeholders were included in further engagement in different ways, such as providing information or co-design (Luyet et al., 2012; Sharpe et al., 2021; Stanghellini & Collentine, 2008). Most of the frameworks ($n=11$) included the classification of stakeholders through attribute mapping. Other processes were represented across a range of frameworks: identifying stakeholder type ($n=7$), role ($n=6$), relevance ($n=5$) and connections ($n=5$). Additionally, some frameworks included an initial stage of identifying the environmental problem or issue due to be addressed ($n=5$). The most distinct framework, only following two of the six processes listed above, (Walton & Rivers, 2011) generated stakeholder information through analysis of interview transcripts and written materials. Framework presentation was commonly through a list of steps or stages ($n=10$), with prominent methods of flow diagrams ($n=3$) and pictorial representations ($n=4$). Methods of data collection and analysis that refer to information from case study material included in Framework articles are included in the previous results sections. In the case where no attributes were analysed ($n=1$), the method focused on the perspectives of the stakeholders relative to the issues present within a given situation (Walton & Rivers, 2011).

Unique examples of method adaption include the following: network-based analysis, either using environmental systems

TABLE 4 Attribute occurrence in case study articles, associated definitions, frequency of use and common attribute pairings.

Attributes	Words used in definition	Frequency	Common pairings
Access to information	Uses attribute as definition	1	
Attitude	Relating to opinion	1	Knowledge
	Relating to confidence	1	
Capacity	Mobility of resources	1	Influence
Dependence	Undefined	1	Influence
Importance	Relating to impact	1	Influence
Influence	Relating to power ^a	4	Capacity; dependence; importance; interest; potential for conservation
	Undefined	4	
Information collecting	Undefined	1	Information sharing
Information sharing	Undefined	1	Information collecting
Interest	Relating to impact ^a	1	Influence; power
	Relating to perception	1	
	Undefined	4	
	Uses attribute as definition ^a	4	
Knowledge	Relating to understanding	2	Attitude
Legitimacy	Relating to socially acceptable behaviours	1	Power; urgency
Participation	Relating to events	1	Scale
Position	Relating to incorporation	1	
Potential for conservation	Relating to the project goals	1	Influence
Power	Coercive, utilitarian or normative	1	Interest; legitimacy; urgency
	Relating to influence ^a	2	
	Relating to mobility of resources	3	
	Relating to promotion ^a	1	
	Undefined	2	
Satisfaction	Relating to Stance	1	
Scale	Undefined	1	Participation
Urgency	Undefined	1	Power; legitimacy

^aDenotes definition identified as circular.

modelling (Elias, 2012) or social network analysis (Mbaru & Barnes, 2017), allows the user to identify connections between stakeholders and to not base stakeholder identification on attributes alone. In another, a supply chain perspective was applied which enabled the identification of stakeholders in a multi-level complex system (Fritz et al., 2018). Five frameworks used criteria-based Stakeholder Identification methods to enable classification in general environmental management (Luyet et al., 2012; Sharpe et al., 2021) and specific situations, like Water-Energy-Food

nexus (Melloni et al., 2020), river catchment management (Stanghellini & Collentine, 2008) and waste management (Heidrich et al., 2009). Four frameworks provide a generalist approach (Leventon et al., 2016; Luyet et al., 2012; Reed et al., 2009; Sharpe et al., 2021). Some Frameworks provided distinct methods such as discourse analysis of transcripts and other written materials (Walton & Rivers, 2011) or a framework designed for trans-disciplinary researchers with experience in science (Leventon et al., 2016).

TABLE 5 Mapped attributes identified in the case studies and the mapping techniques.

Attributes	Frequency of mapping techniques						
	Four cornered matrix	Scatter plot	Grid	Radar chart/venn diagram	Bar chart	Network web	Other
Access to information					1		
Attitude							1
Capacity	1						
Dependence		1					
Importance		1					
Influence	5	3					1
Information collecting			1				
Information sharing			1				
Interest	5	3	2			1	
Knowledge					1		
Legitimacy				1			
Participation			1				
Position				1			
Potential for conservation	1						
Power	2	2	2	1		1	
Satisfaction					1		
Scale			1				
Urgency				1			
Total	14	10	8	4	3	2	2

3.5 | Stages of stakeholder analysis

Independent steps of stakeholder analysis that could be isolated within the Framework articles were simplified into six stages and analysis of case study articles established their frequency of use (Supporting Information Table S4). Over half of the papers ($n=25$) identified the overall problem that the project would focus on which required stakeholder engagement (stage 1), then identified stakeholder types or groups ($n=34$, stage 2), classified the role the stakeholder had ($n=27$, stage 3), and categorised their relevant stakeholders ($n=36$) through processes such as attribute mapping (stage 4). Some studies also included a stage where the connections and networks between, and among, the stakeholders are analysed ($n=18$, stage 5). Only a few articles included a stage where the stakeholder or stakeholder group was assessed for relevance after identification ($n=9$, stage 6).

As these six stages are common throughout the literature, the formalisation of stakeholder analysis to this structure can be justified. In addition, we structure these six stages under the first two elements of stakeholder analysis: Identification and mapping, with engagement to follow stage 6.

3.6 | MAPTkit

The results of this review have identified significant inconsistencies in attribute mapping, a technique used for stage 4 of the analysis

process. As in this review we see the modal group of analysis steps as stage 4 ($n=36$; Figure 2), we can justify the need for an attribute mapping support tool to both support practitioners in transparent stakeholder analysis and mapping.

Our tool, MAPTkit, allows the user to define their stakeholders into different groups, a generic list is provided but is customisable by the user for each user's circumstance. As such, these groups can be edited by the user to best fit their project. MAPTkit is designed to encourage researchers to ensure that the people they have identified represent their chosen attributes.

The primary mapping techniques used in MAPTkit are a four-cornered Matrix (Table 5), as it was the most frequently used ($n=12$); a Venn diagram, as it was the only replicable method to display a triple attribute combination; and radar charts, as it is the only replicable method used for 'attitude'. Radar charts were also used as an additional method of displaying 'power, urgency + legitimacy' in their composite parts. This provides a way of presenting the attributes in isolation, should the user substitute one of 'power', 'urgency' or 'legitimacy' for an alternative attribute. These mapping techniques also function for other attributes than the ones exemplified currently in the tool, as it allows for the attributes to be compared in threes (Venn diagram), pairs (four-cornered matrix) and singularly (radar chart).

Once the user has determined the groups and the number of individuals in each group, they can allocate a Likert scale for group across a set of attributes (Figure 3). Once completed, the user is presented with several output graphs, displaying the attribute profile.

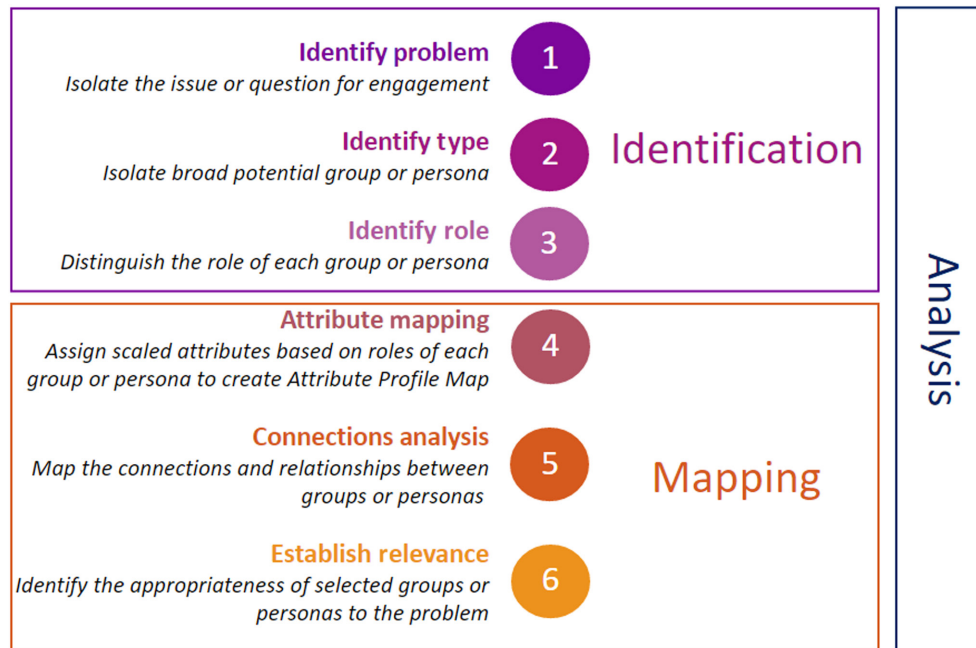


FIGURE 2 The formalised stages of stakeholder analysis: Stages 1–3 as Identification, Stages 4–6 as Mapping to be followed by Engagement.

This enables the user to reflect on the distribution among chosen attributes and, therefore, determine if further Identification is required. In addition, including an explicit justification step and recognition of potential identification issues, which *MAPTkit* use provides, is key in ensuring increased transparency across environmental management.

MAPTkit can be applied in an iterative manner such that the list can be continually developed with clear reasonings and justifications, providing clarity to those conducting, accessing and disseminating the research and its outcomes. This helps to eliminate any potential for ambiguity in the reasoning behind stakeholder analysis. The purpose of *MAPTkit* is not to redefine how attributes are allocated, or presented, but rather to ensure that consideration is given to the attribute allocation process, subsequently providing the user with a more informed decision when finalising their stakeholders and prioritising accountability of decisions made during the stakeholder analysis process.

4 | DISCUSSION

This study presents a snapshot of real-world examples of Stakeholder Identification. The main problems identified within this review are ambiguities in Stakeholder Identification, Mapping and Analysis. This is in part driven by a lack of uniformity across the field of stakeholder analysis within environmental management, especially regarding definitions and attributes. While there are several frameworks and common practices that provide for some consistency, as shown through the emergence of stakeholder analysis research over the past decades, the field of multidisciplinary environmental

management is too large and variable to have a ‘silver bullet’ approach. Consequently, a case-by-case approach to designing stakeholder analysis is customary practice (Koure et al., 2022). The decision-making and implementation stages of stakeholder analysis can be considered the most important as they are often reliant on successful engagement. Taking both the importance of engagement and the need for as much flexibility as possible into account, we developed *MAPTkit* which allows practitioners and researchers to prioritise a well-considered, justified and representative set of stakeholders to allow for inclusive and equitable engagement in environmental management.

4.1 | The scoping review

The scoping review highlights the broad range of studies that have undertaken stakeholder analysis within an environmental setting. It is apparent that approaches for the identification of relevant parties in environmental management are severely under-studied (Colvin et al., 2016). Consequently, in-depth, detailed methods for identifying and analysing stakeholders, within an environmental framework, are lacking and generally non-repeatable. Most notably, in this study, of the initial 511 papers captured in the search stage, only 61 were accepted for data extraction. Many papers rejected at the full-text screening stage ($N=67$, Figure 1), were removed as they either omitted the Stakeholder Identification process or did not include sufficient information for the method to be repeated. While some studies have investigated techniques to identify stakeholders prior to engagement (Achterkamp & Vos, 2008; Fritz et al., 2018), there is no exhaustive synthesis of the literature for future research to

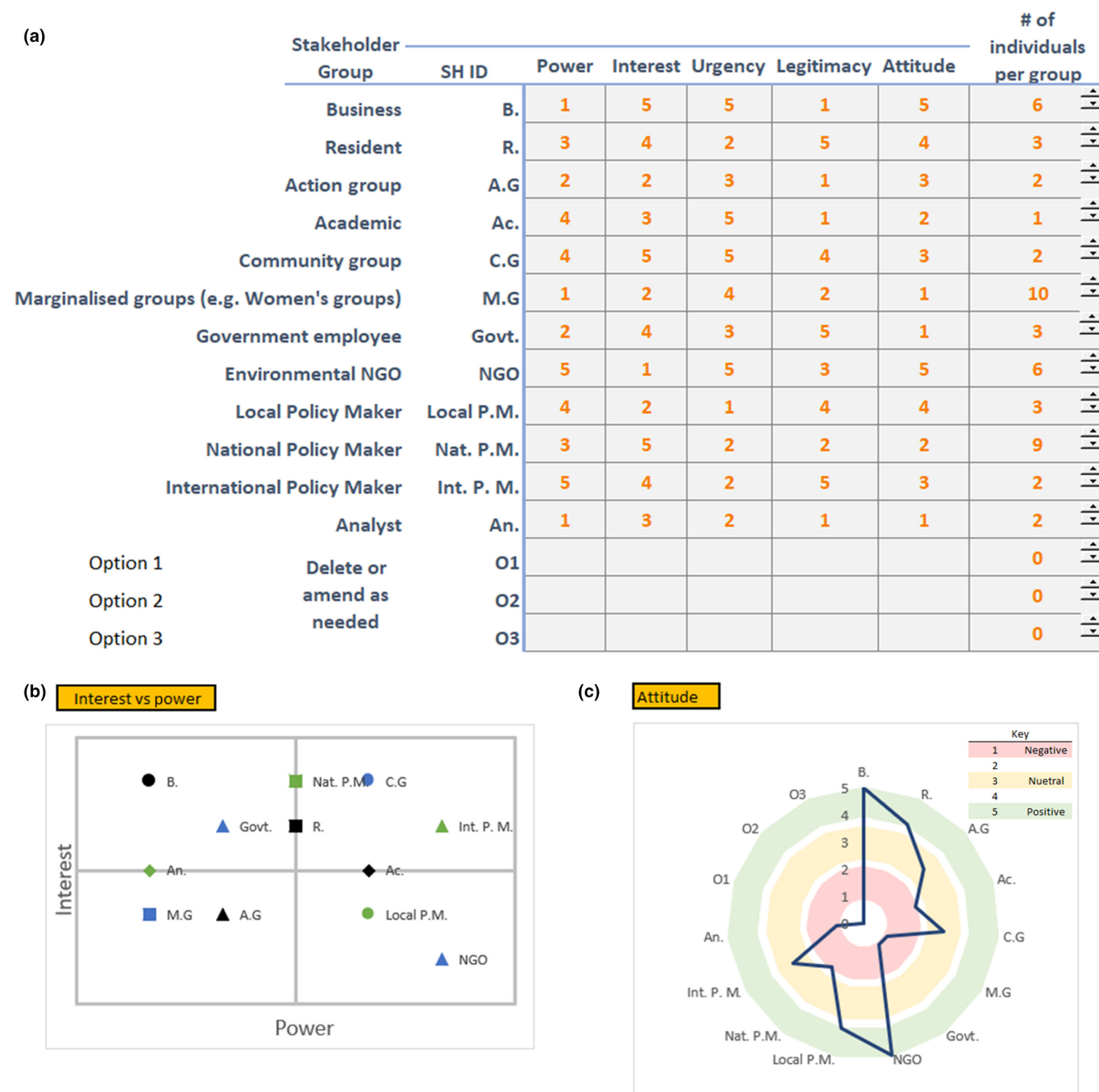


FIGURE 3 The authors have used five example attributes to demonstrate the function of the tool. Future iterations of the tool will have a selection of attributes that the user can select from to tailor their MAPTKit output. (a) Demonstrates the in-put user interface. The user allocates each group (the list is an example and the user is encouraged to tailor it) a scale of 1–5 for each of the example attributes. (b) A two-by-two matrix is used to display two attributes profiles. (c) A Radar chart displays single attributes.

utilise. This hinders effective stakeholder management, with consequences including among others false consensus, a lack of diversity of opinion, and unfair representation of those affected by the scenario (Fritz et al., 2018). Further development is required in this area to develop a stronger consistency of approach in terminology, methodology and repeatability. Without further improvement in stakeholder analysis practices, there is a risk of rewarding privilege, related to both power and/or specific perspectives, where complexity in socioecological systems is ignored (Colvin et al., 2020).

Two key papers (Grimble & Wellard, 1997; Reed et al., 2009) are relied upon for definitions for *stakeholder* and *stakeholder analysis* within environmental management studies included in this paper's review. While there is consensus that stakeholder analysis is comprised of identification, mapping and engagement, there is no widely accepted baseline definition for these three concepts. The fact that these three building blocks are, in and of themselves, lacking in clarity, means that stakeholder analysis continues to rely on variable definitions and methods of application. Additionally, around 50%

of the papers in the review neglected to include their definition of *Stakeholder* ($n=22$), or their definition of *stakeholder analysis* ($n=25$). Although the parameters for whom, or what, can be considered a relevant party are at the discretion of those conducting the research, without a clear, transparent definition, who could be considered a stakeholder becomes ambiguous, and research becomes difficult to replicate and therefore less robust. Due to the generally accepted concept that society and nature are interrelated (Khan et al., 2021), all people *could* be considered stakeholders in the environment (UNECE, 1998). Unlike other sectors where the boundaries are set, the boundaries for environmental stakeholders are often ambiguous. Consequently, capturing a sample that is representative of key stakeholders, while not compromising the efficiency, financial or practical constraints of the project is a difficult challenge. In addition, the importance of challenging the colonialist origins of 'stakeholder' presents an opportunity to resolve the misrepresentation of people who should be considered in decision-making (Banerjee, 2003; Reed, 2022; Sharfstein, 2016). Having consistent, decolonised and formalised understanding of these terms within environmental management would be the first step in dealing with this challenge.

Across the Case Studies extracted, a wide range of sampling and research techniques were used to obtain an understanding of whom they should include within research. However, these techniques tend to rely on the existing social networks of those conducting or consulted in the study and may potentially limit Stakeholder Identification and Mapping to the 'usual suspects', a common issue for environmental management (Colvin et al., 2016; Reed et al., 2009). We found that Case Studies commonly made use of specialist and local knowledge through techniques such as snowball sampling ($n=21$), and/or network analysis ($n=17$; Table 3). Additionally, purposive (deliberate researcher choice; $n=12$) and stratified sampling (systematic selection across known groups; $n=4$), were also observed methods. The downside to fostering a list of 'usual suspects', done deliberately or inadvertently, often comes at a cost to stakeholder diversity and can limit dialogue (Mercer-Mapstone et al., 2019). To prevent this, alternative identification measures could be used in the data collection stages. For example, the use of methods such as document analysis ($n=20$) and field studies ($n=16$), can add systemisation to the process, increasing the robustness and repeatability of stakeholder identification and providing justification to support who is included in the final list. Increasing the range of stakeholder identification methods applied can broaden the scope and number of those identified, essentially making it as far removed from a pool of 'usual suspects' as possible.

The stakeholder mapping methods applied across the articles were often unclear and inconsistent in terminology use, definitions and method design. This results in increased uncertainty across the practice of stakeholder analysis within environmental management. Confusion over language has been shown to impede public participation efforts (Hull et al., 2003). Ambiguous definitions of key concepts and terminologies have historically inhibited the adoption of broadly accepted perspectives in certain areas of environmental management (Ouyang et al., 2019), as they tend to generate a high

range of diversity in research objectives and outcomes (Chatzimentor et al., 2020). In contrast, the adoption of clearly defined terminologies improves accuracy and efficiency within environmental science and management practice (Hull et al., 2003). While stakeholder mapping is likely to be most effective when designed in a study-specific manner, making methods utilised in one study scenario less transferable to another, the same cannot be said for terminology definitions that require consistency and transferability. For example, in this review, three different definitions were used to define the attribute 'power', while two definitions were used to define 'influence'. For both these attributes, the definitions became circular in that one attribute was defined within the context of the second attribute. So 'power' was described as 'the ability to influence', and 'influence' was described as the 'power over an outcome'. Without consistent definitions, mistranslations, or a wide range of interpretations, are more likely to occur (Chatzimentor et al., 2020). Consequently, clear and consistent definitions that can be utilised by everyone involved in Stakeholder Mapping and Identification within environmental management are required.

Of the 16 mapping attribute combinations identified in this scoping review (Supporting Information Table S6), only two of them occurred more than once ('Power + Interest' and 'Influence + Interest'). This indicates an overall preference for a specific style of attribute mapping, favoured at the expense of other attributes. These prioritised attributes are often synonymous with each other, which may compound difficulties that arise from false consensus and 'usual suspects', especially as these techniques have a propensity to exclude potential individual stakeholders (Mercer-Mapstone et al., 2019). This should be addressed, either through deliberately increasing the diversity of attributes mapped for a group, or by otherwise having a diverse range of widely used attributes and case-specific attribute allocation. This will improve the overall Stakeholder Identification effort being invested into the process, which will increase the accuracy and representativeness of the final set of participants.

We also observed a disparity in effort with respect to implementing the six stages of stakeholder analysis that this study derived from the Framework articles. The six stages in analysis are as follows: problem identification, stakeholder type, stakeholder role, attribute mapping, connection analysis and relevance (Figure 2). Within the Case Studies, the inclusion of each of these six stages varied between 19.5% and 54%, with stage 6 being included the least ($n=9$; Supporting Information Table S6). This may be due to a lack of awareness of the original Frameworks, or because adhering to all of them falls outside of the parameters of the study resources, for example, there are time constraints, minimal implementation power or financial barriers. This formalisation of stakeholder analysis (Figure 2) (which we derived from the Frameworks within this scoping review), provides an opportunity for structural consistency in the way in which identification and mapping can be approached, while providing the flexibility for case-by-case study design. However, without consistent use of each stage, there will be increased disparity in stakeholder analysis efforts between studies. Ensuring a consistent effort across the different elements

of stakeholder analysis reinforces the importance of transparency within the decision-making process in environmental management (Sharpe et al., 2021). Additionally, the fact that stage 6, an opportunity for reflection and review, is the least frequently completed stage, suggests the method lacks a retrospective check that the set of stakeholders is representative. Neglecting this stage indicates a lack of accountability, as no effort has been evidenced to identify gaps. Stage 6 is not the only method that could be used for retrospective analysis and critical thinking within stakeholder analysis. Our tool *MAPTkit* reflects stage 4, attribute mapping, while Social network analysis determines the connections between stakeholders, stage 5 (Mbaru & Barnes, 2017; Mills et al., 2014; Prell et al., 2009). Either can be used both during and after identification stages in an iterative manner to check the structure and robustness of stakeholder networks and identified groups or individuals (Mbaru & Barnes, 2017).

Encouraging the diversification of stakeholder analysis methods across a wider variety of science disciplines highlights the push towards more interdisciplinary research within the environmental sector (Leventon et al., 2016). Some options for diversification could include widening the scope of methods used in data collection, such as including the use of matrix mapping (Sharpe et al., 2021) and discourse analysis of written material (Walton & Rivers, 2011). Increased use of computational methods to manage databases can also support the development and use of decision support systems and online tools (Shim et al., 2002). Despite these suggestions having been put forward by some researchers, the uptake of new methods has been limited. This may result from a variety of factors, including limited access to the methods and tools, time and cost of training for use, or the accessibility and simplicity of the methods. Furthermore, as highlighted previously, the use of familiar methods and attributes is common within stakeholder analysis, yet this allows for limitations in framework application if use goes against normal practice.

4.2 | *MAPTkit* (Mapped Attribute Profiling Toolkit)

MAPTkit has been designed to be a non-prescriptive technique, allowing those conducting the research to make the most informed decisions possible with respect to their choice of groups, while remaining within the realms of realistic application. The opportunity to reflect on the attribute profile of the included stakeholders can both enable justification for engagement, and demonstration of identification gaps, which can significantly improve the subsequent engagement stages. Even the 'best' methods for engagement fall short of the optimum desired outcome due to real-world difficulties if relevant groups are missing or barriers to recruitment (time availability, lack of awareness, lack of funds, lack of general interest and interpersonal disputes; Holifield & Williams, 2019; Luyet et al., 2012) are not considered. Fostering meaningful participation requires sufficient resources (Reed et al., 2018) and, therefore, methods that transparently audit stakeholder analysis practices are required to increase the robustness of involvement in environmental management. This is the role that decision support processes can fill, specifically, a decision support process that allows for critical

reflection on a stakeholder mapping process. *MAPTkit* enables users to isolate problem areas in their attribute profile maps and either move to mitigate these, or account for them within their research findings.

Ultimately, *MAPTkit* provides the stakeholder mapping phase the 'right to succeed'. Decisions are not made in a circular, undefined or ambiguous manner but with deliberation and in recognition of the benefits and drawbacks of the reality of the stakeholder engagement methods. For example, Raum et al. (2021) developed a web content-based analysis tool that provided a systematic method to generate knowledge of potential stakeholders from multiple websites, a resource for stages 2 and 3 (Raum & Rawlings-Sanaei, 2022). *MAPTkit* and Raum et al.'s tool performs different functions, where *MAPTkit* accounts for reflection on the mapped attributes after identification, while Raum et al.'s tool acts as an additional method of identification. This suggests that the use of tools to assist in decision-making not only has a valuable place in the realm of stakeholder analysis but that it has the potential to fill gaps in the current repertoire of methodologies. Regardless, this step of reflection, mitigation, and justification is extremely important to continue holding those undertaking research, who are potentially in a position of power, accountable for their actions and limiting the further marginalisation of already under-represented groups.

While there is some discourse around the use of 'power + urgency + legitimacy', and 'interest' versus 'influence' attribute mapping, as these techniques have a propensity to exclude individuals (Mercer-Mapstone et al., 2019), the style of application of attribute mapping methods can highlight these identification gaps. By increasing the variety of inputs into this tool, it is more likely to aid the identification of gaps and therefore enable researchers to avoid using stakeholder analysis to continue to engage with easily accessible groups and 'usual suspects'. The current Beta form of *MAPTkit* is available online (*MAPTkit*, 2023) for intended use by any practitioner to alter and develop its function for tailored improvement, therefore making its use specific to the situation. Additionally, our review indicated that it was not exclusively the mapping method at fault, but the lack of reflection and approaches for mitigating potential issues within a standardised stakeholder analysis process, as highlighted by the minimal number of case studies that reviewed their stakeholders *after* identification. Future application to case study material will provide complete evidence of *MAPTkit*'s usability and success in identifying bias through reflective identification. Even in the current Beta phase, *MAPTkit* accounts for these potential biases, not by eliminating them, but by creating a non-prescriptive method to hold those in power accountable for their stakeholder analysis decisions.

5 | CONCLUSIONS

This study highlights that current stakeholder analysis practices and, core understandings, are no longer fit for purpose with respect to recent changes within environmental management practice, for example, different types of participation, agency and power (Reed et al., 2018). Minimal consistency and variable interpretations of key concepts, such as the definition of *stakeholder* or *stakeholder analysis*

etc. increases ambiguity and reduces the impact of participation. In the multidisciplinary circumstances of environmental management and research, consistency is important to maintain a united approach to complex global issues that impact populations on a variety of scales.

Mitigation of these issues is needed to ensure justified, efficient and effective inclusion and collaboration of stakeholders in environmental management. The key finding in our scoping review is that only a limited numbers of research projects include retrospective reflection of the stakeholders. As it is a stage in the stakeholder analysis process that can be easily and cheaply included, this could significantly alter the success and equitability of participatory research. Therefore, it is essential that support tools such as MAPTkit are put in place to aid the process of identifying and mapping stakeholders and ensuring that the whole process of stakeholder analysis is reflective.

There may be differences between the ideal list of stakeholders identified, and those engaged with during a project due to practical and resource constraints of the environmental management scenario. However, these constraints cannot be used to justify the ostracism of stakeholders who have been historically excluded or ignored in environmental management. Researchers should take time to evaluate the stakeholders they are including in their research (or environmental management programmes), consciously using methods to overcome barriers to representation and report where methods have failed to do so. Ensuring that stakeholder inclusion is representative, fair and just is paramount for effective and successful environmental management: this is what MAPTkit has been designed to overcome. The tool ensures that there is a definitive opportunity for Stakeholder Identification and Mapping to be representative, fair and just.

AUTHOR CONTRIBUTIONS

Victoria Hoare, Caitlin E. Hinson, Bethany M. Reyniers, Ryan O'Shea and Caroline Howe conceived the ideas and designed methodology; Victoria Hoare, Caitlin E. Hinson, Bethany M. Reyniers and Ryan O'Shea collected the data; Victoria Hoare, Caitlin E. Hinson, Bethany M. Reyniers, analysed the data; Victoria Hoare and Caitlin E. Hinson led the writing of the manuscript, with support from Bethany M. Reyniers. Victoria Hoare was the primary creator of the tool developed for this research. All authors contributed critically to the drafts and gave final approval for publication.

ACKNOWLEDGEMENTS

The authors would like to thank the two reviewers for their time, effort and input into the paper.

CONFLICT OF INTEREST STATEMENT

None to declare.

PEER REVIEW

The peer review history for this article is available at <https://www.webofscience.com/api/gateway/wos/peer-review/10.1002/2688-8319.12235>.

DATA AVAILABILITY STATEMENT

The manuscript does not include any data.

ORCID

Victoria Hoare  <https://orcid.org/0000-0003-3933-342X>

Caitlin E. Hinson  <https://orcid.org/0000-0003-0555-7396>

Caroline Howe  <https://orcid.org/0000-0002-0989-1634>

REFERENCES

- Achterkamp, M. C., & Vos, J. F. J. (2007). Critically identifying stakeholders—Evaluating boundary critique as a vehicle for stakeholder identification. *Systems Research and Behavioral Science*, 24(1), 3–14. <https://doi.org/10.1002/sres.760>
- Achterkamp, M. C., & Vos, J. F. J. (2008). Investigating the use of the stakeholder notion in project management literature, a meta-analysis. *International Journal of Project Management*, 26(7), 749–757. <https://doi.org/10.1016/j.ijproman.2007.10.001>
- Ballejos, L. C., & Montagna, J. M. (2008). Method for stakeholder identification in interorganizational environments. *Requirements Engineering*, 13(4), 281–297. <https://doi.org/10.1007/s00766-008-0069-1>
- Banerjee, S. B. (2003). The practice of stakeholder colonialism: National interest and colonial discourses in the management of indigenous stakeholders. In A. Prasad (Ed.), *Postcolonial theory and organizational analysis: A critical engagement*. Palgrave Macmillan.
- Beery, T. B., & Lekies, K. S. (2021). Nature's services and contributions: The relational value of childhood nature experience and the importance of reciprocity. *Frontiers in Ecology and Evolution*, 9(1), 251. <https://doi.org/10.3389/fevo.2021.636944>
- Bendtsen, E. B., Clausen, L. P. W., & Hansen, S. F. (2021). A review of the state-of-the-art for stakeholder analysis with regard to environmental management and regulation. *Journal of Environmental Management*, 279(1), 279. <https://doi.org/10.1016/j.jenvman.2020.111773>
- Berdejo-Espinola, V., Suárez-Castro, A., Amano, T., Fielding, A. S., Oh, R. R. Y., & Fuller, R. A. (2021). Urban green space use during a time of stress: A case study during the COVID-19 pandemic in Brisbane, Australia. *People and Nature*, 3(3), 597–609. <https://doi.org/10.1002/pan3.10218>
- Blackstock, K. L., Kelly, G. J., & Horsey, B. L. (2007). Developing and applying a framework to evaluate participatory research for sustainability. *Ecological Economics*, 60(4), 726–742. <https://doi.org/10.1016/j.ecolecon.2006.05.014>
- Bodin, O. (2017). Collaborative environmental governance: Achieving collective action in social-ecological systems. *Science*, 357(6352), 2–7. <https://doi.org/10.1126/science.aan1114>
- Casaló, L., Flavián, C., & Guinaliu, M. (2008). The role of perceived usability, reputation, satisfaction and consumer familiarity on the website loyalty formation process. *Computers in Human Behaviour*, 24(2), 325–345. <https://doi.org/10.1016/j.chb.2007.01.017>
- Chatzimentor, A., Apostolopoulou, E., & Mazais, A. (2020). A review of green infrastructure research in Europe: Challenges and opportunities. *Landscape and Urban Planning*, 198(1), 103775. <https://doi.org/10.1016/j.landurbplan.2020.103775>
- Collins, A. M., Coughlin, D., Miller, J., & Kirk, S. (2015). The production of quick scoping reviews and rapid evidence assessments: A how to guide. <http://nora.nerc.ac.uk/id/eprint/512448>
- Colvin, R. M., Witt, G. B., & Lacey, J. (2016). Approaches to identifying stakeholders in environmental management: Insights from practitioners to go beyond the 'usual suspects'. *Land Use Policy*, 52(1), 266–276. <https://doi.org/10.1016/j.landusepol.2015.12.032>
- Colvin, R. M., Witt, G. B., & Lacey, J. (2020). Power, perspective, and privilege: The challenge of translating stakeholder theory from

- business management to environmental and natural resource management. *Journal of Environmental Management*, 271(1), 110974. <https://doi.org/10.1016/j.jenvman.2020.110974>
- Curşeu, P. L., & Schrujier, S. G. L. (2017). Stakeholder diversity and the comprehensiveness of sustainability decisions: The role of the collaboration and conflict. *Current Opinion in Environmental Sustainability*, 28(1), 114–120. <https://doi.org/10.1016/j.cosust.2017.09.007>
- De Lopa, T. T. (2001). Deforestation in Cambodia: A stakeholder management approach. *International Journal of Sustainable Development and World Ecology*, 8(4), 380–394. <https://doi.org/10.1080/13504500109470095>
- de Vente, J., Reed, M. S., Stringer, L. C., Valente, S., & Newig, J. (2016). How does the context and design of participatory decision-making processes affect their outcomes? Evidence from sustainable land management in global drylands. *Ecology and Society*, 21(2), 24. <https://doi.org/10.5751/ES-08053-210224>
- Derak, M., Cortina, J., Taiqui, L., & Aledo, A. (2017). A proposed framework for participatory forest restoration in semiarid areas of North Africa. *Restoration Ecology*, 26(1), 18–25. <https://doi.org/10.1111/rec.12486>
- dos Muchangos, L. S., Tokai, A., & Hanashima, A. (2017). Stakeholder analysis and social network analysis to evaluate the stakeholders of a MSWM system—A pilot study of Maputo City. *Environmental Development*, 24, 124–135.
- Elias, A. A. (2012). A system dynamics model for stakeholder analysis in environmental conflicts. *Journal of Environmental Planning and Management*, 55(3), 387–406. <https://doi.org/10.1080/09640568.2011.604191>
- Freeman, R. E. (2010). *Strategic management: A stakeholder approach*. Cambridge University Press.
- Fritz, M. M. C., Rauter, R., Baumgartner, R. J., & Dentchev, N. (2018). A supply chain perspective of stakeholder identification as a tool for responsible policy and decision-making. *Environmental Science and Policy*, 81(1), 63–76. <https://doi.org/10.1016/j.envsci.2017.12.011>
- Grimble, R., & Wellard, K. (1997). Stakeholder methodologies in natural resource management: A review of principles, contexts, experiences and opportunities. *Agricultural Systems*, 55(2), 173–193. [https://doi.org/10.1016/S0308-521X\(97\)00006-1](https://doi.org/10.1016/S0308-521X(97)00006-1)
- Harrington, C., Curtis, A., & Black, R. (2008). Locating communities in natural resource management. *Journal of Environmental Policy and Planning*, 10(2), 199–215. <https://doi.org/10.1080/15239080801928469>
- Heidrich, O., Harvey, J., & Tollin, N. (2009). Stakeholder analysis for industrial waste management systems. *Waste Management*, 29(2), 965–973. <https://doi.org/10.1016/j.wasman.2008.04.013>
- Holifield, R., & Williams, K. (2019). Recruiting, integrating, and sustaining stakeholder participation in environmental management: A case study from the Great Lakes areas of concern. *Journal of Environmental Management*, 230(1), 422–433. <https://doi.org/10.1016/j.jenvman.2018.09.081>
- Hull, R. B., Richert, D., Seekamp, E., Robertson, D., & Buhyoff, G. J. (2003). Understandings of environmental quality: Ambiguities and values held by environmental professionals. *Environmental Management*, 31(1), 1–13. <https://doi.org/10.1007/s00267-002-2812-6>
- Ikram, M., Zhou, P., Shah, S. A. A., & Liu, G. Q. (2019). Do environmental management systems help improve corporate sustainable development? Evidence from manufacturing companies in Pakistan. *Journal of Cleaner Production*, 226(1), 628–641. <https://doi.org/10.1016/j.jclepro.2019.03.265>
- James, K. L., Andall, N. P., & Haddaway, N. R. (2016). A methodology for systematic mapping in environmental sciences. *Environmental Evidence*, 5(1), 7. <https://doi.org/10.1186/s13750-016-0059-6>
- Khan, M. K., Abbas, F., Godil, D. I., Sharif, A., Ahmed, Z., & Anser, M. K. (2021). Moving towards sustainability: How do natural resources, financial development, and economic growth interact with the ecological footprint in Malaysia? A dynamic ARDL approach. *Environmental Science and Pollution Research*, 28(1), 55579–55591. <https://doi.org/10.1007/s11356-021-14686-9>
- Koure, F. K., Hajjarian, M., Zadeh, O. H., Alijanpour, A., & Mosadeghi, R. (2022). Ecotourism development strategies and the importance of local community engagement. *Environment, Development and Sustainability*, 24(5), 1–29. <https://doi.org/10.1007/s10668-022-02338-y>
- Leventon, J., Fleskens, L., Claringbould, H., Schwilch, G., & Hessel, R. (2016). An applied methodology for stakeholder identification in transdisciplinary research. *Sustainability Science*, 11(1), 763–775. <https://doi.org/10.1007/s11625-016-0385-1>
- Luyet, V., Schlaepfer, R., Parlange, M., & Buttler, A. (2012). A framework to implement stakeholder participation in environmental projects. *Journal of Environmental Management*, 111(1), 213–219. <https://doi.org/10.1016/j.jenvman.2012.06.026>
- Mannetti, L. M., Göttert, T., Zeller, U., & Esler, K. J. (2019). Identifying and categorizing stakeholders for protected area expansion around a national park in Namibia. *Ecology and Society*, 24(2), 5. <https://doi.org/10.5751/ES-10790-240205>
- MAPTkit. (2023). Transdisciplinary Centre for Nature and People. <https://www.transdisciplinarycentre4natureandpeople.org/maptkit>
- Mbaru, E. K., & Barnes, M. L. (2017). Key players in conservation diffusion: Using social network analysis to identify critical injection points. *Biological Conservation*, 210, 222–232. <https://doi.org/10.1016/j.biocon.2017.03.031>
- Melloni, G., Turetta, A. P. D., Bonatti, M., & Sieber, S. (2020). A stakeholder analysis for a water-energy-food nexus evaluation in an Atlantic forest area: Implications for an integrated assessment and a participatory approach. *Water (Switzerland)*, 12(7), 1997. <https://doi.org/10.3390/w12071977>
- Mercer-Mapstone, L., Rifkin, W., Louis, W., & Moffat, K. (2019). Power, participation, and exclusion through dialogue in the extractive industries: Who gets a seat at the table? *Resources Policy*, 61, 190–199. <https://doi.org/10.1016/j.resourpol.2018.11.023>
- Microsoft Corporation. (2018). *Microsoft excel*. Retrieved from <https://office.microsoft.com/excel>
- Mills, M., Álvarez-Romero, J. G., Vance-Borland, K., Cohen, P., Pressey, R. L., Guerrero, A. M., & Ernstson, H. (2014). Linking regional planning and local action: Towards using social network analysis in systematic conservation planning. *Biological Conservation*, 169, 6–13. <https://doi.org/10.1016/j.biocon.2013.10.015>
- Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, 22(4), 853–886. <https://doi.org/10.5465/amr.1997.9711022105>
- Mushove, P., & Vogel, C. (2005). Heads or tails? Stakeholder analysis as a tool for conservation area management. *Global Environmental Change*, 15(3), 184–198. <https://doi.org/10.23960/jsl29252-268>
- Ouyang, Z., Wei, W., & Chi, C. G. (2019). Environment management in the hotel industry: Does institutional environment matter? *International Journal of Hospitality Management*, 77(1), 353–364. <https://doi.org/10.1016/j.ijhm.2018.07.015>
- Prell, C., Hubacek, K., & Reed, M. (2009). Stakeholder analysis and social network analysis in natural resource management. *Society and Natural Resources*, 22(6), 501–518. <https://doi.org/10.1080/08941920802199202>
- Raum, S. (2018). A framework for integrating systematic stakeholder analysis in ecosystem services research: Stakeholder mapping for forest ecosystem services in the UK. *Ecosystem Services*, 29(1), 170–184. <https://doi.org/10.1016/j.ecoser.2018.01.001>
- Raum, S., & Rawlings-Sanaei, F. (2022). WCM: A web content-based method of stakeholder analysis. *MethodsX*, 9(1), 101635. <https://doi.org/10.1016/j.mex.2022.101635>

- Raum, S., Rawlings-Sanaei, F., & Potter, C. (2021). A web content-based method of stakeholder analysis: The case of forestry in the context of natural resource management. *Journal of Environmental Management*, 300(1), 113733. <https://doi.org/10.1016/j.jenvman.2021.113733>
- Reed, M. (2022). Should we banish the word "stakeholder?" Fast track impact. 2 August. <https://www.fasttrackimpact.com/post/why-we-shouldn-t-banish-the-word-stakeholder>
- Reed, M. S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C. H., & Stringer, L. C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, 90(5), 1933–1949. <https://doi.org/10.1016/j.jenvman.2009.01.001>
- Reed, M. S., Vella, S., Challies, E., de Vente, J., Frewer, L., Hohenwallner-Ries, D., Huber, T., Neumann, R. K., Oughton, E. A., del Ceno, J. S., & van Delden, H. (2018). A theory of participation: What makes stakeholder and public engagement in environmental management work? *Restoration Ecology*, 26(1), 7–17. <https://doi.org/10.1111/rec.12541>
- Reyes-García, V. (2019). A road to conflict: Stakeholder's and social network analysis of the media portrayals of a social-environmental conflict in Bolivia. *Society and Natural Resources*, 32(4), 452–472. <https://doi.org/10.1080/08941920.2018.1539199>
- Shackleton, R. T., Adriaens, T., Brundu, G., Dehnen-Schmutz, K., Estévez, R. A., Fried, J., Larson, B. M., Liu, S., Marchante, E., Marchante, H., & Moshobane, M. C. (2019). Stakeholder engagement in the study and management of invasive alien species. *Journal of Environmental Management*, 229(1), 88–101. <https://doi.org/10.1016/j.jenvman.2018.04.044>
- Sharfstein, J. M. (2016). Banishing "stakeholders". *The Milbank Quarterly*, 94(3), 476–479.
- Sharpe, L. M., Harwell, M., & Jackson, C. (2021). Integrated stakeholder prioritization criteria for environmental management. *Journal of Environmental Management*, 282(1), 111719. <https://doi.org/10.1016/j.jenvman.2020.111719>
- Shim, J. P., Warkentin, M., Courtney, J. F., Power, D., Sharda, R., & Carlsson, C. (2002). Past, present, and future of decision support technology. *Decision Support Systems*, 33(2), 111–126. [https://doi.org/10.1016/S0167-9236\(01\)00139-7](https://doi.org/10.1016/S0167-9236(01)00139-7)
- Stanghellini, L. P. S., & Collentine, D. (2008). Stakeholder discourse and water management—Implementation of the participatory model CATCH in a northern Italian alpine sub-catchment. *Hydrology and Earth System Sciences*, 12(1), 317–331. <https://doi.org/10.5194/hess-12-317-2008>
- UNECE. (1998). Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters. <https://www.unece.org/fileadmin/DAM/env/pp/documents/cep43e.pdf>
- Vogler, D., Macey, S., & Sigouin, A. (2017). Stakeholder analysis in environmental and conservation planning. *Lessons in Conservation*, 7(7), 5–16. ncep.amnh.org/linc/
- Walton, S., & Rivers, C. (2011). A missed opportunity: Understanding community stakeholders' perspectives. *Australasian Journal of Environmental Management*, 18(3), 155–169. <https://doi.org/10.1080/14486563.2011.591521>
- Xu, W. Y., Zhou, C., Cao, A., & Luo, M. (2016). Understanding the mechanism of food waste management by using stakeholder analysis and social network model: An industrial ecology perspective. *Ecological Modelling*, 337, 63–72. <https://doi.org/10.1016/j.ecolmodel.2016.06.006>
- Zetina-Rejón, M. J., Zepeda-Domínguez, J. A., Rodríguez-Fuentes, M., & Fumero-Andreu, C. M. (2020). Stakeholder diversity correlates with governance network performance in two artisanal fisheries in Northwest Mexico. *Ocean & Coastal Management*, 196(1), 105313. <https://doi.org/10.1016/j.ocecoaman.2020.105313>
- Zingraff-Hamed, A., Hüesker, F., Lupp, G., Begg, C., Huang, J., Oen, A., Vojinovic, Z., Kuhlicke, C., & Pauleit, S. (2020). Stakeholder mapping to co-create nature-based solution: Who is on board? *Sustainability*, 12(20), 8625. <https://doi.org/10.3390/su12208625>

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Table S1. Inclusion and exclusion criteria for evidence screening of papers within the scoping review.

Table S2. Inclusion and exclusion criteria for full text screening, including definitions for categories.

Table S3. The frequency of the methods used by the Case Studies to identify their relevant stakeholders.

Table S4. The number of initial stakeholder identification (SH ID) methods used across the Case Studies.

Table S5. Different stages of stakeholder identification were evident in several papers, with papers having different combinations of the stages used within the study.

Table S6. The frequency of different attributes across the papers extracted that were used within the studies to map the stakeholders.

How to cite this article: Hoare, V., Hinson, C. E., Reyniers, B. M., O'Shea, R., & Howe, C. (2023). MAPTkit: An environmental management decision-tool for inclusive, equitable and representative stakeholder attribute mapping. *Ecological Solutions and Evidence*, 4, e12235. <https://doi.org/10.1002/2688-8319.12235>