REVIEW

Conservation Biology

A social network analysis of an epistemic community studying neoliberal conservation

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Article impact statement: Improved interdisciplinary collaboration addressing class, gender, and geographic dominance could improve research on neoliberal conservation.

Abstract

Researchers typically operate in epistemic communities: groups that share common approaches to research agendas and sociopolitical action and define areas of debate. Although productive in their own spheres, a lack of understanding among these communities can undermine scientific progress. Thus, analyzing epistemic communities is important for understanding the politics of knowledge production. Social network analysis sheds light on these dynamics by mapping the collaborative networks that shape academic output. We used 255 publications examined in Apostolopoulou et al.'s review of neoliberal conservation literature and 2135 additional publications in a social network analysis. We compiled a coauthorship network for 318 authors and found a dispersed and polycentric network with low connectivity and relatively small clusters of scholars collaborating within tightly knit groups. Although the structure is conducive to innovation and diversity, building new connections among dispersed coauthor groups could enrich knowledge sharing to drive novel approaches. We identified central actors in building collaborations among communities and communicating ideas across the network. We considered actor attributes, such as gender and geographic location, alongside centrality measures. We found that seventy percent of the 20 authors with the highest betweenness centrality were men, and only one male author was affiliated to an institution in the Global South. Our analysis of thematic clusters in the literature highlighted the spatial patchiness and partialness of the literature across different subfields. Scholars should undertake more work on identified themes in currently excluded geographic regions through effective interdisciplinary collaborations and with local communities of research and practice and grassroots movements. There is a need to strengthen the field's intellectual diversity and to have a deeper engagement with issues of class, gender, and race. This would allow neoliberal conservation to reimagine conservation in ways that are not only environmentally sustainable, but also socially just.

KEYWORDS
coauthorship network analysis, conservation social science, epistemic communities, neoliberal conservation, social network analysis

INTRODUCTION

Epistemic communities and their influence on conservation research and practice

Epistemic communities shape how knowledge about the environment and society is produced and so play a significant role in shaping scientific outcomes (Bodin & Prell, 2011; Corbera et al., 2021). Understanding how epistemic communities are constructed is important because of their influence on conservation research and, ultimately, on decision-making (Corbera et al., 2016; Scholfield, 2013). An epistemic community is a "network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to

policy-relevant knowledge within that domain or issue-area" (Haas, 1992, p. 3). They agree on what to disagree about, often sharing an approach to sociopolitical action (Desvallées et al., 2022). However, poor understanding between different communities can undermine scientific progress (Cross, 2013; Gough & Shackley, 2001; Haas, 1992; Toke, 1999).

Addressing the challenges of communication between different epistemic communities in conservation research requires effective interdisciplinary approaches (Chua et al., 2020; Howe et al., 2014). These approaches are essential to making different ontologies and epistemologies mutually intelligible, thereby facilitating meaningful knowledge exchange between communities. Such efforts are critical for improving the quality of data used in decision-making, aligning with the concept of an "extension of peer communities," which is central to enhancing the capacity of science to tackle global environmental challenges (Funtowicz & Ravetz, 1993, p. 22).

However, it is crucial to distinguish between interdisciplinarity and the unique characteristics of epistemic communities. Although interdisciplinarity involves collaboration across multiple disciplines to integrate diverse perspectives, epistemic communities are defined not merely by their disciplinary scope—whether in a single discipline or across several—but also by their shared beliefs, normative values, and collective approach to influencing debates, shaping knowledge production, and informing policy. Professionals from different disciplines may collaborate without necessarily forming an epistemic community because the latter requires a deep alignment of goals and shared frameworks for understanding and action. Focusing on epistemic communities is particularly significant in the context of neoliberal conservation because these communities critically examine and challenge the market-driven approaches dominating conservation science and policy. Their shared beliefs and values enable them to expose the limitations of neoliberal frameworks, highlighting how these often undermine equity and sustainability. By scrutinizing these epistemic communities, one gains valuable insights into how knowledge is mobilized to resist dominant and hegemonic paradigms and promote more transformative and just approaches to conservation.

In conservation specifically, several calls have been made to involve more social science expertise because conservation planning has traditionally drawn from natural sciences (Cowling & Wilhelm-Rechmann, 2007; Mabele et al., 2023; Mascia et al., 2003). The resulting conservation approaches—often top down—can lead to prioritizing ecological objectives and neglecting critical social factors, such as food security, livelihoods, and community governance, which could ensure more equitable and inclusive conservation planning (Fleischman et al., 2022). Global conservation initiatives, such as the Global Biodiversity Framework, call for enhanced knowledge sharing and collaboration between professionals from different disciplines, often belonging to disparate epistemic communities, to achieve its ambitious targets. For example, target 14 stresses the need to embed biodiversity values in policy across sectors, highlighting the role of the social sciences in promoting more inclusive and democratic decision-making (CBD, 2022). Understanding and bridging epistemic communities is not merely an academic endeavor; it is essential for enhancing real-world conservation outcomes. Improving interdisciplinary collaboration across epistemic communities deepens understanding of conservation challenges and tackles data justice issues, leading to more informed and effective decision-making (Bennett et al., 2017; Hicks et al., 2016).

At its most assiduous, social network analysis can reveal patterns of shared publications, academic specialization, collaborations on grants, author and institutional productivity, geographic location, and career histories. By identifying gaps in communication between different epistemic communities, social network analysis can foster stronger interdisciplinary collaboration (e.g., Corbera et al., 2021). Furthermore, it allows one to uncover biases related to geographic and gender disparities and determine how they reinforce inequalities in knowledge production. Recognizing these biases is a crucial first step to overcoming them and promoting more equitable and productive scientific interactions across conservation research.

Analyzing coauthorship patterns in neoliberal conservation

We also used social network analysis to explore patterns in the neoliberal conservation literature, a potent theme in conservation social science. Neoliberal conservation has emerged as a distinct and significant field of study, first gaining scholarly attention with the publication of Sullivan's (2005) seminal paper. This was followed by a series of key contributions (e.g., Büsher & Whande, 2007; Igoe & Brockington, 2007) that collectively laid the groundwork for an expanding body of literature. Today, the number of publications exploring neoliberal conservation continues to grow, reflecting the increasing relevance and complexity of the subject. The term *neoliberal conservation* encapsulates efforts by scholars—many of whom had previously been engaged in documenting models of *fortress* and *community-based conservation*—to describe profound shifts in conservation practices that align with neoliberal ideologies (Büscher et al., 2012; Büscher and Fletcher, 2020; Fletcher, 2020; Vaccaro et al., 2013).

These shifts are characterized by the integration of market-based mechanisms and private sector involvement in conservation strategies and underpinned by the belief that economic incentives are essential to saving nature. This core philosophy is summarized by Apostolopoulou et al. (2021, p. 237): "in order to 'save' nature, it is necessary to bring conservation to the market and attract private investment to it." At its heart, neoliberal conservation critiques how, under a capitalist mode of production, nature has come to be valued primarily for its utility in advancing capitalist growth. It emphasizes the pervasive notion among its proponents that the commodification of nature (transforming it into a resource subject to market logics and financial speculation) is the best way to preserve it (Arsel and Büscher, 2012; Büscher et al., 2012; Igoe et al., 2010). This approach raises critical questions about the implications of subsuming environmental stewardship under the imperatives of profit-making and the broader socioecological consequences of market-driven conservation initiatives. By engaging with these dynamics, the field not only examines the economic and

environmental dimensions of neoliberal conservation but also its social and spatial ramifications, offering a critical lens on the commodification and privatization of the natural world from the perspective of social, spatial, and environmental justice.

Scholarship on neoliberal conservation is important in part because a good deal of conservation social science falls within its remit. Many leading conservation social scientists write about neoliberal conservation and have built their careers doing so (summarized in Brockington [2017]). Neoliberal conservation is also vital substantively because it concerns a key division in conservation circles over the role of economic incentives and the market in conservation strategies (Büscher et al., 2012; McAfee, 1999; Pagiola et al., 2002; Sullivan, 2005; Wunder, 2005). The prominence of this debate reflects larger discussions in conservation about the rise of nature's economic valuation as a primary solution to the interconnected crises of biodiversity loss and climate change (Apostolopoulou & Adams, 2015; Sandbrook et al., 2019).

Neoliberal conservation scholarship has made crucial contributions to evaluating the effectiveness of market-inspired conservation initiatives and understanding the inequities markets can bring. By examining the epistemic community studying neoliberal conservation, one can gain deeper insights into how scholars are addressing critical concerns of justice, equity, and fairness in conservation practices. Through social network analysis, we sought to identify key actors, uncover collaboration patterns, and detect biases or gaps in research, all of which are essential for fostering more just and effective conservation policies.

We built on a comprehensive review of the literature on neoliberal conservation by Apostolopoulou et al. (2021). Apostolopoulou et al. (2021) used descriptive statistics and a thematic content analysis to describe the key characteristics of the neoliberal conservation literature, including its concepts, methods, and coauthorship patterns. They highlighted the significant novelty in the application of theories and the topics explored and some fundamental gaps and limitations. Some of their criticism concerns how scholars from the Global North dominate the field despite a common articulation of decolonial praxis; a lack of focus on Global North case studies and urban areas; a lack of attention to the dynamics of class, gender, and race; and limited engagement with quantitative methods, community social sciences, and social movements. They also conducted some limited social network analyses based on the country of authors' institutional affiliations.

We extended the findings of Apostolopoulou et al. (2021) by examining the collaborative networks and thematic orientations of researchers studying neoliberal conservation and those who cite them. We sought to highlight the key influencers and intellectual frameworks that drive contemporary debates. We asked, what are the patterns of collaboration in scholarship; what are their implications for conducting research equitably; what substantive differences appear in the different communities working in this field, and in the wider literature drawing on this work; and what opportunities are apparent for broadening the reach and attention of this work?

Use of social network analysis in conservation

Social network analysis was developed in the 1950s by researchers from a diverse set of academic disciplines, including sociology, psychology, anthropology, and business (Borgatti et al., 2009; Moreno, 1953). It explores "patterns of connections between the group or network elements" (Corbera et al., 2016, p. 7). It requires data that capture the specific ways various actors (people, institutions, countries, etc.), which are referred to as *nodes*, interact and are related through what are referred to as ties or edges (Hennig et al., 2012). A number of individual- and network-level measurements are commonly investigated in social network analysis (Newman, 2003) (Table 1).

The use of social network analysis in conservation is growing and has 2 potentially useful applications for conservation social science: describe and analyze or intervene. The first examines how structures of social relations affect the status of conservation (Crona & Bodin, 2011; Isaac & Dawoe, 2011), and the second engages various stakeholders in social learning and other participatory processes (Mills et al., 2014; Prell et al., 2011; Ramirez-Sanchez, 2010).

Social network analysis can be used to identify particular stakeholders who might be critical in influencing conservation practice or policy (Weiss et al., 2012). For example, measures, such as in-degree, can be used to track how many times a particular actor is mentioned by others in a social network. Betweenness centrality can illustrate which of these actors play an important role as bridge builders, connecting otherwise disconnected actors across a social network (Prell, 2012). Coauthorship analyses can reveal cases in which authors affiliated with institutions in the Global North play dominant roles in epistemic communities in certain fields of study (Corbera et al., 2016; Kumar, 2015; Melin & Persson, 1996; Newman, 2004; Yan & Ding, 2009). This can be further investigated by illustrating patterns of connection between various countries, as we have attempted (Figure 3; Appendix S1), or to track key institutions connecting authors in a network with betweenness scores (Corbera et al., 2016).

It is important that inferences about a social network are not based solely on the presence or absence of a connection between stakeholders. Investigating the structural characteristics of these networks and the patterns of relationships embedded in them can strengthen analysis. Therefore, as well as network-level data, studies often make use of actor attribute data (i.e., data on gender, class, education, race, ethnicity, nationality, etc.) (Appendix S2), biophysical data, ethnographic data, and other kinds of qualitative data to build a more complete picture (e.g., Isaac & Dawoe, 2011; Ramirez-Sanchez, 2011) and to anchor the analysis in strong conceptual frameworks.

METHODS

Data collection

We used a database compiled by Apostolopoulou et al. (2021), which includes articles that explicitly use the term *neoliberal*

TABLE 1 Social network analysis measures used in the analysis of coauthor networks researching neoliberal conservation.

Level of network and social measure	Key research question	Explanation
Network level		
Network density	How well connected is the network?	Actual number of edges in the network relative to the total possible number of edges (ties); 1, completely connected network; 0, no connected nodes
Network modularity	How are the actors in the network further connected within various communities or smaller groups?	Division of a network into smaller groups or communities; high modularity indicates connections among the nodes in a community are much denser than outside of the community; on a nodal level, modularity class can be applied to each node, which detects the community of that specific actor
Average path length and diameter	How cohesive is the network (i.e., how close together are the actors)?	Diameter measures longest geodesic (shortest path between 2 nodes) in a network; small diameter, relatively cohesive network (nodes close together); average path length, average of all the geodesics in a network
Individual level		
Degree centrality	How many connections does an actor have to others in a network and what is their involvement in a network?	Number of direct links a node has to other nodes in the network; higher degree of centrality refers to more links; centrality can therefore be used to measure the importance, influence, or popularity of a particular node in a network
Eigenvector centrality	Who holds influence and power in a network because of their connections to other power actors?	Influence of a node in a network, building on degree centrality; central actor considered the one connected to other nodes with high-degree centralities; "the sum of an actors connections to other actors, weighted by those other actors degree centrality" (Prell, 2011, p. 34); relative scores assigned to each node in a network based on the concept that connections to high-scoring nodes contribute more to the score of a specific node than equal connections to low-scoring nodes
Closeness centrality	How close is an actor to other actors in the network? Who is more independent in their ability to connect to other actors in a network (without the need for intermediaries)?	Distance between actors, taking into consideration whether the node (i.e., actor) needs to pass through intermediaries to reach other nodes in a network; captures average distance between each node and every other node in a network; nodes considered to have a low closeness centrality if they are directly connected to most others in a network or are only short distances from other nodes (through fewer intermediary nodes); highlights relative independence of a node and its accessibility to others in the network
Betweenness centrality	Who are the important bridge builders or intermediaries connecting actors in a network? Which actors are important for communicating across the network?	Extent to which a node lies among the various other nodes and therefore how much a node contributes to linking others across a network (also known as bridge building); score increases based on the number of times it is located on the geodesic (shortest path) between 2 nodes

Note: Based on Corbera et al. (2021), Dunn et al. (2023), Fonseca et al. (2016), Hansen et al. (2010), and Prell (2011, 2012).

conservation or very similar terms but not literature on the neoliberalization of nature. The database contains 255 peer-reviewed articles published from January 2005 to April 2020 by 318 authors. Apostolopoulou et al. (2021) conducted their search of the literature in Web of Science, Scopus, and Google Scholar and restricted their search to articles in English.

We extended on Apostolopoulou et al.'s (2021) analysis by constructing a full coauthorship network and employing additional network measures and through a closer examination of coauthorship patterns, attributes of authors, and the thematic context of each coauthorship community. This analysis allowed us to identify gaps in the literature and to make the case for promoting more just, feminist, and decolonial conservation practices. In addition to reanalyzing their database, we analyzed additional papers to explore how neoliberal conservation literature intersects with and informs adjacent disciplines (e.g., the natural science contributions citing this literature documented in Appendix S3), reveals the evolution of epistemic communities, and provides new insights into the dynamics shaping the broader research landscape.

To explore the broader impact of this literature, we examined citations of works by the authors Bram Büscher and Robert Fletcher because they stood out clearly as having the highest betweenness centrality (Appendix S4). This provided us with a further 2135 peer-reviewed articles published from 2008 to 2024, which we gathered through Web of Science. Most of these publications were in English, but a few other languages were represented (Spanish, French, Norwegian, Portuguese, and Turkish) (Appendix S5).

The focus on citation analysis (i.e., the number of citations received by an author, article, or journal [Appendix S2] or 'who cites whom', [Figure 5]) introduced a different set of bibliometric tools to our analysis. These tools differed from coauthorship network analysis, which allows for the interrogation of researchers' collaborative patterns. Cocitation and coword occurrence analyses are instead used to identify "research fronts" (Boyack & Klavans, 2010; Kumar, 2015).

Data analyses

We constructed a full coauthorship network (Figure 1) based on the individual authors (nodes) and explored the ties they had to others through copublications (edges). To conduct the analysis, we constructed adjacency tables based on the coauthorship data obtained from Apostolopoulou et al.'s (2021) database and analyzed these with Gephi 0.10 to examine the construction of various coauthorship communities in this broader network.

We applied a number of network- and individual-level social network measures (Tables 1 & S4). For example, we calculated the network's density by measuring the actual number of ties relative to the total possible number of ties. We calculated several individual-level measures, such as eigenvector centrality, which expresses "an intuitive notion of being 'in the thick of things'" (Brass & Borgatti, 2020). Hence, having ties with a few very well-connected people is likely more valuable than having a large number of connections who have few social ties themselves. Degree centrality is a proxy for collaboration with other

authors and tells one about the extent of each author's activity or involvement in the network (Prell, 2012) (Figure 2a). Degree centrality simply counts the number of connections an author has with others, whereas betweenness captures the idea that "it is not so important how many people you know in a network, but rather where you are placed within that network" (Prell, 2012, pp. 103–104) (Figure 2b). We combined these with a thematic analysis of the papers' content to determine how social networks reflected theoretical and conceptual differences.

We identified central coauthor networks based on centrality measures (Figure 2a,b) and then further investigated these networks through authors' institutional location (Figure 3; Appendix S1). These more central coauthor networks were visualised by filtering out some of the authors on the periphery based on modularity class. This allowed us to visualize complete coauthor networks surrounding the most central authors.

Among these central coauthor networks, we identified the 20 authors with the highest betweenness centrality scores (Appendix S4). We used betweenness centrality to identify these authors because it is considered the most accurate indicator of important actors (leaders or influential figures) in a network and because it tends to display higher rates of variance among actors relative to other centrality measures (Prell, 2012; Wasserman & Faust, 1994). We then explored their attributes, including gender identity (use of personal pronouns), geographic location, institutional affiliation, and academic productivity (*h*-index, publications, and citations) (Appendix S2). These data were gathered through their Scopus, Web of Science, LinkedIn, and institutional and personal webpages and helped us examine the patterns of collaboration in scholarship and their implications for conducting research equitably.

We investigated the substantive differences in the different communities working in this field and in the wider literature through thematic analyses, co-occurrence of author keywords, and cocitation analyses. A cocitation network (Figure 5) "is formed between 2 documents if they together appear in the reference list of a referring paper" (Kumar, 2015, p. 57), and a coword network (Figure 6) represents cases where 2 words (predominantly author keywords) "appear together in the same document" (Kumar, 2015, p. 57).

We analyzed the citation data (details in the Supporting Information) of our additional publications with the bibliometrix package in R, Python, and the NetworkX library. We constructed co-occurrence matrixes and network graphs from the publication data (Appendices S6 & S7). We analyzed countries' coauthorship patterns with a network visualization that focused on the 50 countries with the highest level of scientific production (Figure 4). For author cocitation analysis, we used degree centrality to create a network of the 100 most cited authors (Figure 5). We identified clusters of authors based on their cocitation patterns and incorporated keywords used by each cluster to provide thematic context to each author community (cf. Desvallées et al., 2022; Manyani et al., 2024). To disentangle the specific meanings and thematic distinctions of each cluster, we removed common keywords, adjusted term frequency and inverse document frequency parameters, built a topic model with latent Dirichlet allocation, performed keyword co-occurrence analysis, and used hierarchical clustering.

We built on the analysis shown in Figure 5 by further examining keyword co-occurrence focusing on the 50 most used keywords to show how different research themes are interconnected (Figure 6). Each node in the graph represented an author keyword, and the edges between nodes reflected the frequency of co-occurrence. Nodes were clustered in different thematic communities with the greedy modularity optimization algorithm. We considered the 3 key thematic themes that emerged, drawing on discourse analysis of the key texts. Finally, to analyze thematic evolution, we created keyword co-occurrence networks for 2 periods (2008–2016 and 2017–2024) based on the 20 most used keywords identified through their frequency (Figure 7). This provided a visual representation of the evolving research landscape over the 2 periods.

Limitations of the study

The approach for compiling the larger cocitation database of 2135 peer-reviewed papers based on citations of works by the authors Bram Büscher and Robert Fletcher has its limitations. It is meant to be illustrative rather than exhaustive because the latter would require compiling a much larger cocitation database of all the central authors in neoliberal conservation.

A key limitation of the database compiled by Apostolopoulou et al. (2021) is that it only included papers written in English. As such, this may influence our findings regarding the geographic foci of the literature, particularly the domination of Global North institutions in coauthorship networks, the geographic focus of case studies (Global South), and how authors from these case study countries are rarely included as coauthors. However, Apostolopoulou et al. (2021) note that despite this possible bias, similar observations about neoliberal conservation literature, including how coauthors from case study sites are rarely included in publications, have been made by Bigger and Dempsey (2018), Holmes and Cavanagh (2016), and Smessaert et al. (2020).

As well as having influenced our findings, we also acknowledge that although we have called for more decolonial conservation practices, our methodology may have inadvertently reinforced the very dynamics we are critiquing. To address this, our additional database included several publications in other languages, although the search terms used were in English and thus would have also limited the results retrieved. Their numbers are marginal compared with English publications (Appendix S5), which highlights significant limitations in accessing literature written in other languages, which is driven by structural factors beyond our control.

RESULTS

Network of coauthors studying neoliberal conservation

Figure 1 shows the entire coauthorship network (including single-authored publications). There were a few central coau-

thor networks with relatively more ties to other authors and higher betweenness scores. These networks were (highlighted in Figure 2a,b) surrounded by several single authors and smaller coauthor networks with no ties to the wider network. Less than 1% of the potential ties this coauthor network could have had were present.

The more central coauthor networks contained 80 authors (Figure 2a,b). Figure 2a shows the centrality of Fletcher and Büscher (highest degree centrality of 31 and 30, respectively). The next highest degree centrality was for Apostolopoulou (centrality of 14). Fletcher also had the highest score for eigenvector centrality (1), indicating that the high number of ties he had with other authors also reflected connections to authors who were themselves connected to other high-scoring authors. Büscher's eigenvector centrality was 0.893. Dressler had the next highest eigenvector centrality (0.245).

It is important to consider centrality measures in the context of other actor attributes, for example, gender and geographic location, to understand the politics of knowledge production. Seventy percent of the 20 authors with the highest betweenness centrality scores were men, and only one male author was affiliated with an institution in the Global South (ninth in eigenvector centrality) (Appendices S2 & S4).

Figure 2b indicates that the highest betweenness centrality belonged to Büscher (175,738), followed by Fletcher (122,305). Neves was third with 114,095. In the network, Büscher was a key intermediary or bridge builder and was a central link in collaborations between 2 communities (shown as red and green in Figure 2b). Among each community, there were key authors who brought together authors who would otherwise have been disconnected. In one community (green), Neves played a key role and had the highest betweenness score. In other communities, Benjaminsen (pink) and Maganga (purple), for example, played key roles.

The different coauthor networks did not constitute distinct epistemic communities. They shared common scholarly roots. For example, the different networks demonstrated an adoption of "Marxist-influenced political ecology and geography literatures" (Apostolopoulou et al., 2021) in, for example, Büscher and Fletcher's (2015) use of the concept "accumulation by conservation" or Dunlap and Sullivan's (2020) "accumulation-by-alienation." There was also evidence of the use of Foucauldian concepts to describe neoliberal conservation, in terms of the "governmentality of economic incentives," "green governmentality," and "environmentality" (Fletcher, 2010; Fletcher & Breitling, 2012; Sullivan, 2013).

There was also disagreement among them. For example, the diverse views held about payment for environmental services were represented in the dialogue between Fletcher and Büscher (2018) (red community) and Van Hecken et al. (2018) (orange community) about the validity of conceptualizing payments for ecosystem services (PES) as a neoliberal conservation paradigm. A similar example of dialogue between different communities can be seen in the critiques of Matulis (2015) (yellow community) and Corbera (2015) (orange community), again over conceptualization of PES.
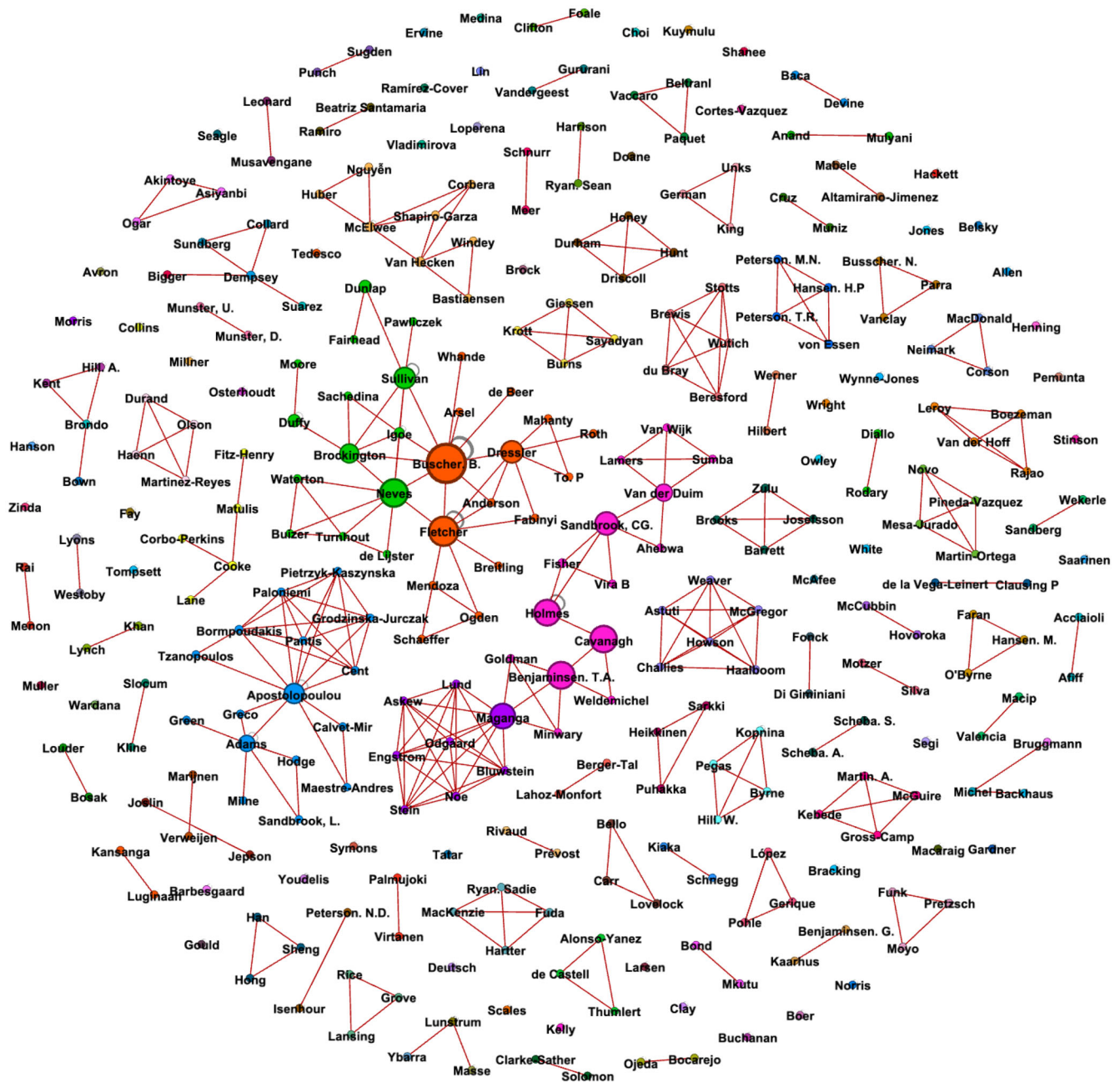
FIGURE 1 Coauthor network of researchers studying neoliberal conservation based on 255 publications by 318 authors (colors, different modularity classes [i.e., Louvain community detection algorithm of cooccurrence of authors in Gephi]; node size, betweenness centrality; modularity score, 0.912; number of communities detected, 130; average path length, 2.4 [indicates on average nodes are approximately 2.4 connections away from any other node]; diameter of network, 7 [meaning the longest geodesic in the network is 7 connections away]).

Where the literature on neoliberal conservation is being produced

The United States had the highest betweenness centrality (109.474), followed by the Netherlands (90.322), Spain (39.745), and United Kingdom (37.483) (Figure 3). Scholars in the United States were placed between several otherwise disconnected actors and were thus important in controlling the flow of information in this network. Two key communities were detected: Global North countries of the Netherlands, the United King-

dom, Australia, Canada, Spain, Poland, Greece, Finland, and Germany and Global South countries of Kenya, South Africa, Uganda, and Costa Rica (purple) and Global North countries of the United States, Belgium, Norway, Denmark, Sweden, and Switzerland and Global South countries of Vietnam, Tanzania, and Chile (green).

Netherlands (where Büscher and Fletcher are affiliated) had the highest degree centrality (85), followed by the United Kingdom (77), the United States (44), and Spain (35) (Appendix S1). Eigenvector centrality followed a similar pattern for these
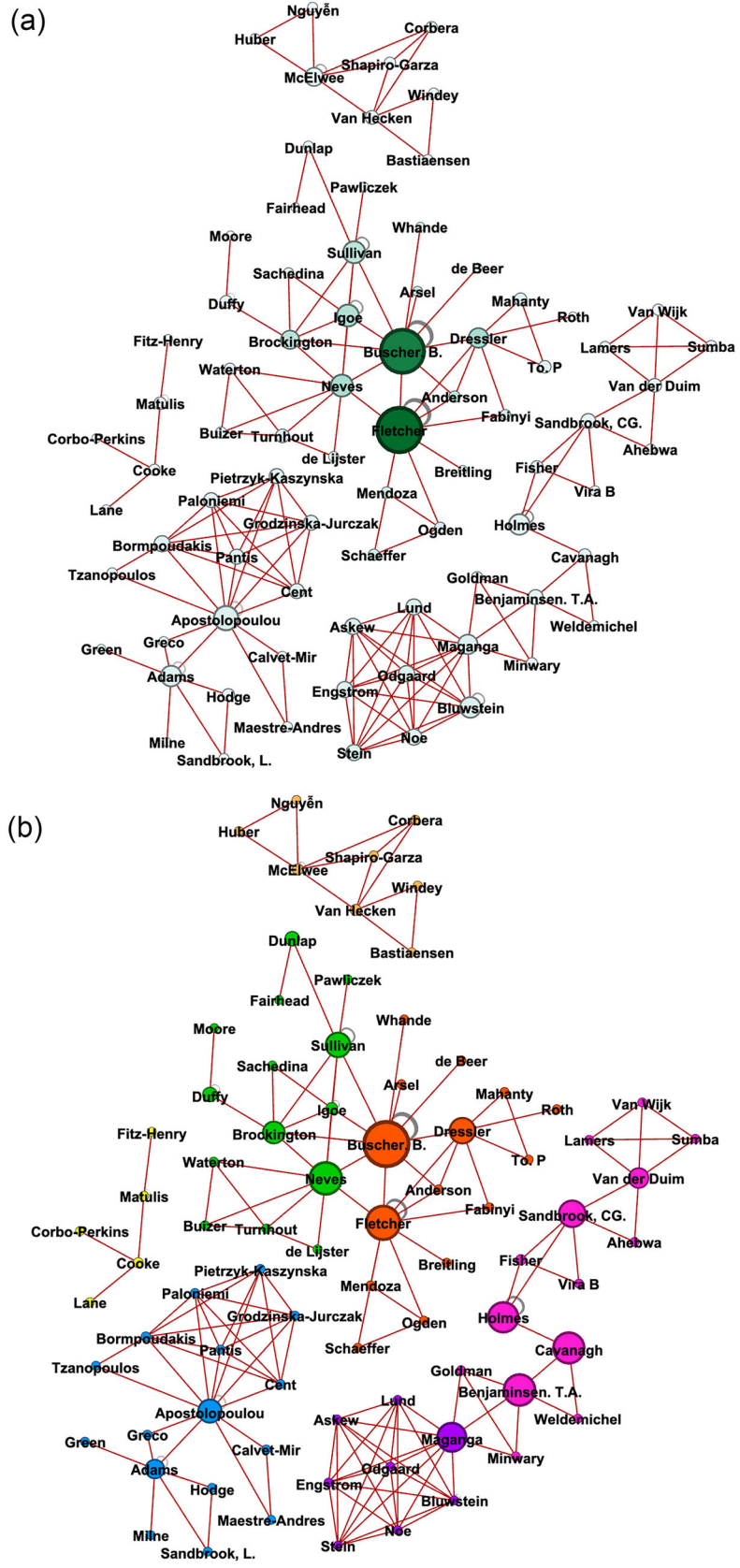
FIGURE 2 (a) Five central coauthor networks of researchers studying neoliberal conservation (the darker the node color, the greater the eigenvector centrality; node size, relative degree centrality) and (b) 7 communities of researchers writing on neoliberal conservation (node color, different modularity classes based on the community detection algorithm; node size, relative betweenness scores).
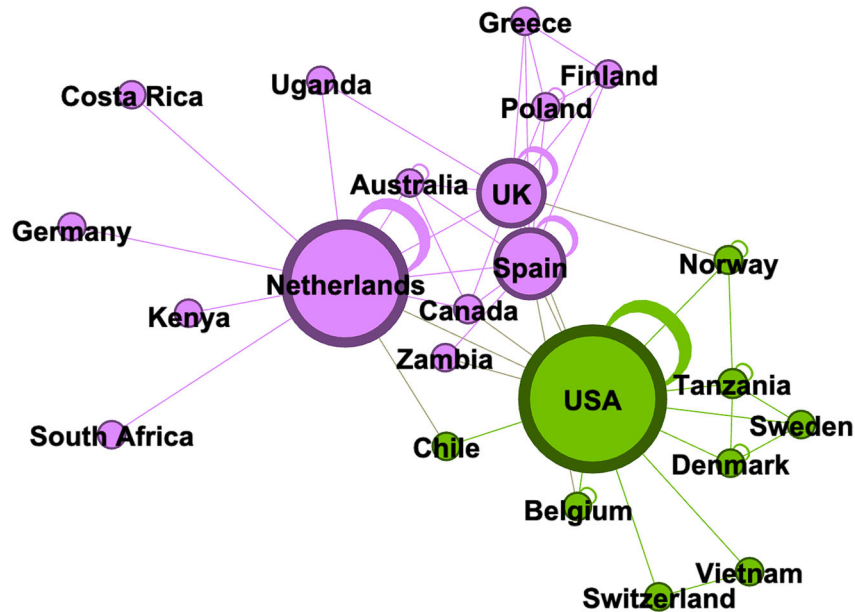
FIGURE 3 Affiliated countries of researchers in a coauthorship network of 80 central authors studying neoliberal conservation (node size, relative betweenness centrality; color, different modularity classes based on the community detection algorithm; edges have source node color; halfmoon shapes, instances of coauthorship between authors from the same country; UK, United Kingdom; USA, United States).

highest scoring nodes, with the Netherlands (1) scoring highest, followed by the United Kingdom (0.869), Spain (0.396), and the United States (0.244) (Appendix S1).

The 20 most influential authors writing about neoliberal conservation

For some of the most prolific and well-cited conservation social scientists, writings on neoliberal conservation were but one aspect of their scholarship (e.g., Adams, W. M.) (Appendices S2 & S4). They built their reputation on this and writings in other fields. They were relatively unimportant in terms of neoliberal conservation publications but demonstrated higher h-indexes and total productivity.

Only one author, Maganga, had a primary institutional affiliation in a country in the Global South (Appendix S2). Only 3 other authors had a secondary affiliation with an institution in the Global South (Büscher in South Africa, Cavanagh in Kenya, and Van Hecken in Nicaragua). Thirty percent of the most influential authors identified as female.

Key characteristics of the wider literature citing neoliberal conservation research
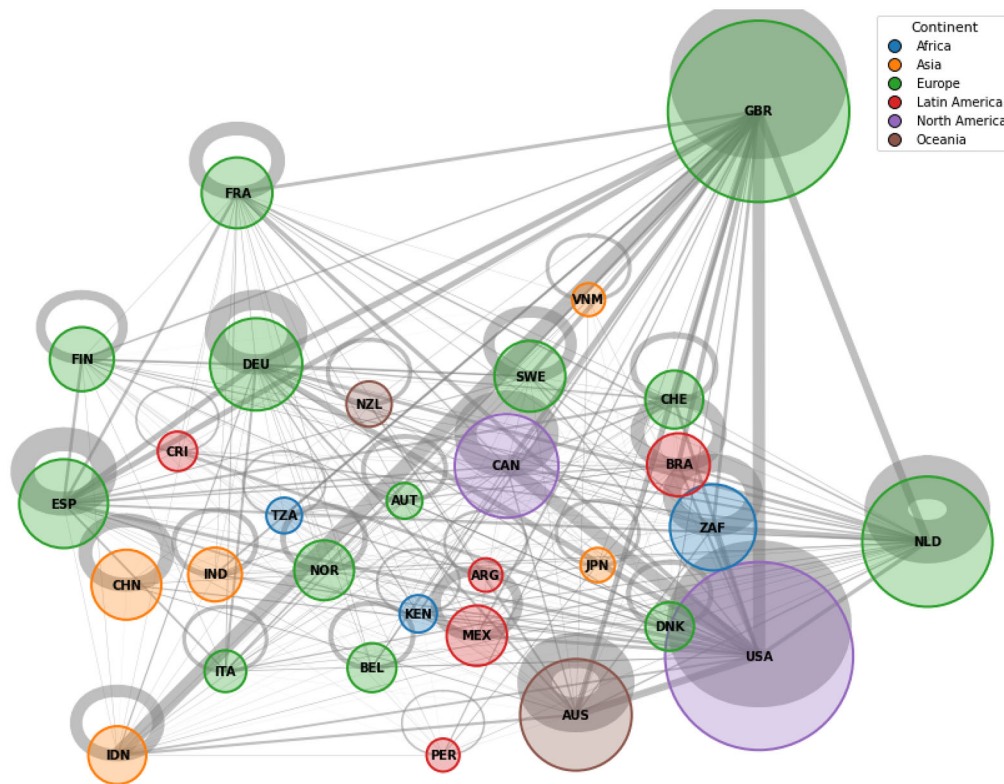
The range of countries' scientific production and the global networks of coauthorship collaborations among the 2135 papers showed considerable variation (Figure 4). There were significant disparities in collaboration frequencies. Some country pairs exhibited high co-occurrence values, whereas others remained weakly connected or disconnected (particularly among Global South countries). The strongest international co-occurrence (edge weight) was between Great Britain and Indonesia with a value of 394, followed by the United States and Canada with a value of 347, indicating well-established research collaborations (Appendix S6; Figure 4).

The United States and the United Kingdom were particularly dominant. They had identical measures of degree centrality and eigenvector centrality, indicating the highest number of direct connections and links to other influential nodes (Figure 4). They also exhibited the highest internal co-occurrence values, with the United States (2716) and the United Kingdom (2541) demonstrating the most extensive domestic research collaboration (Appendix S6). Parts of the world were completely absent in the production of this scholarship, including large parts of Africa (particularly northern and central Africa), the Middle East, Eastern Europe, and central Asia (Figure 4; Appendices S8 & S9).

The 10 most cited journals in the neoliberal conservation literature (Appendix S3) reflected the key publishing outlets with scopes that accommodate the key themes and conceptual frameworks employed by the neoliberal conservation literature. Small numbers of papers were published in leading natural science journals (*Biological Conservation*, *Conservation Biology*, *Oryx*, and *Environmental Conservation*). These represented <5% of all the articles included in our analyses.

An initial examination of the cocitation network revealed significant similarities among the clusters, as indicated by common author keywords used by the authors who cited the authors in each cluster (Figure 5). These common keywords, such as *conservation*, *neoliberalism*, *political ecology*, *ecosystem services*, *protected areas*, and *governance*, centered around foundational themes. They reflected a shared focus on critiquing neoliberal approaches to

FIGURE 4 Network of 50 countries with the highest level of scientific production and collaboration related to neoliberal conservation based on 2135 publications (node size, relative frequency; thickness of edges between countries, frequency of collaboration; overlapping gray circles, coauthorship between authors from the same country; GBR, Great Britain; FRA, France; FIN, Finland; ESP, Spain; DEU, Germany; NOR, Norway; AUT, Austria; NLD, Netherlands; DNK, Denmark; ITA, Italy; BEL, Belgium; CHN, China; IDN, Indonesia; VNM, Vietnam; IND, India; JPN, Japan; CAN, Canada; USA, United States; BRA, Brazil; ARG, Argentina; MEX, Mexico; PER, Peru; CRI, Costa Rica; ZAF, South Africa; TZA, Tanzania; KEN, Kenya; AUS, Australia; NZL, New Zealand).

conservation, exploring the political and economic dimensions of environmental governance, and examining the role of ecosystem services and development policies. This finding aligned with our observation from the coauthor networks (Figures 2a,b). The co-citation analyses further confirmed that scholars in neoliberal conservation do not form distinct epistemic communities, but rather contribute to a broader, interconnected discourse.

The blue cluster is characterized by scholars such as Bram Büscher, Rosaleen Duffy, and Arun Agrawal and includes institutions such as the World Bank. Distinctive keywords such as *institutional change, enjoyment, cultural politics, conservation social science, Instagram,* and *development* highlighted the emphasis on how social engagement, media platforms, and development initiatives influence conservation efforts (Figure 5). The inclusion of the World Bank and the presence of *development* as a keyword suggested this cluster also focused on the intersection of neoliberal conservation and international development policies. This cluster explored the impact of societal factors, international organizations, and development agendas on environmental policies and the ways in which public participation and perception shape conservation outcomes.

The red cluster, featuring, for example, Karen McAfee and Robert Fletcher, as well as institutions, such as the Organisation for Economic Co-operation and Development (OECD), the Food and Agriculture Organization (FAO), and the European Commission, delves into economic critiques and governance structures in conservation. Although it included some proponents of neoliberal conservation instruments, these authors and institutions were frequently cited by scholars who critiqued their work, highlighting ongoing debates about market-based approaches and their implications for ecological justice. Distinctive keywords, such as *commodification markets, political ontology, biodiversity governance,* and *ecological justice,* reflected the cluster's focus on examining and challenging the commodification of nature and the effectiveness of neoliberal policies in achieving conservation goals (Figure 5).

The green cluster comprises authors, for example, David Harvey, Noel Castree, and Dan Brockington, and is centered on a critical analysis of the political and economic structures that influence conservation and environmental management. Distinctive keywords, such as *capitalism, commodification, political ecology,* and *accumulation by dispossession,* indicated a focus on how capitalist systems and neoliberal policies affect natural resources, ecosystems, and the communities that depend on them. This cluster emphasized the complexities of conservation in the context of global capitalism and explored themes, for example, the commodification of nature, socioeconomic

Conservation Biology
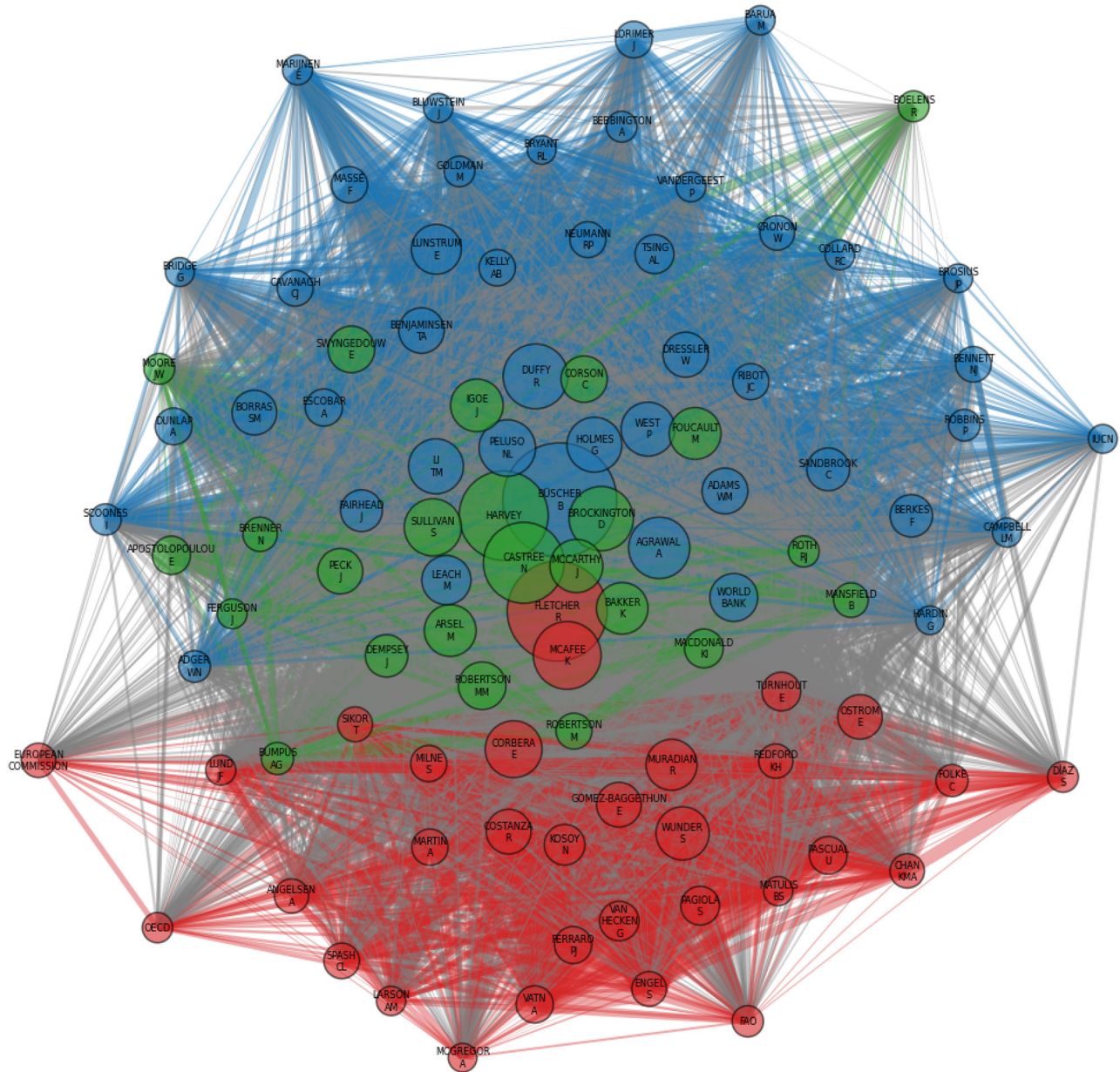
FIGURE 5 Cocitation network of 100 authors with the highest degree centrality cited in the database of 2135 publications (color, Louvain community; nodes, authors; node size, relative frequency of citations; lines, edges between nodes; cocitation links, how often 2 authors are cited together in the same work). With the Fruchterman–Reingold layout, nodes are spaced based on the strength of their cocitation links. The keywords associated with clusters are not graphically represented in the figure but have been analyzed alongside the cocitation network.

inequalities, and the critique of market-based conservation strategies (Figure 5).

Our word co-occurrence network of the 50 most used keywords (Figure 6) showed important patterns in the literature by depicting cases where 2 author keywords co-occurred in the same document (Desvallées et al., 2022; Kumar, 2015). In this network, 3 different clusters were identified. The cluster of *neoliberal environmental governance and market mechanisms* focused on the neoliberalization of nature through governance tools, such as PES, REDD+, offsetting, and other market-driven conservation strategies. The cluster labeled *sociopolitical impacts and*

conflicts of neoliberal conservation focused on the political economy of conservation, emphasizing the sociopolitical conflicts arising from the implementation of neoliberal policies. The cluster labeled *protected areas, local communities, and participation* focused on alternative conservation models that prioritize the role of local communities, Indigenous knowledge, and participation in managing protected areas (Figure 6).

Another important observation was that among the 50 most frequently used keywords in the database were the names of countries or regions situated in the Global South (Costa Rica and Indonesia in cluster 1; South Africa, Tanzania, and Africa in
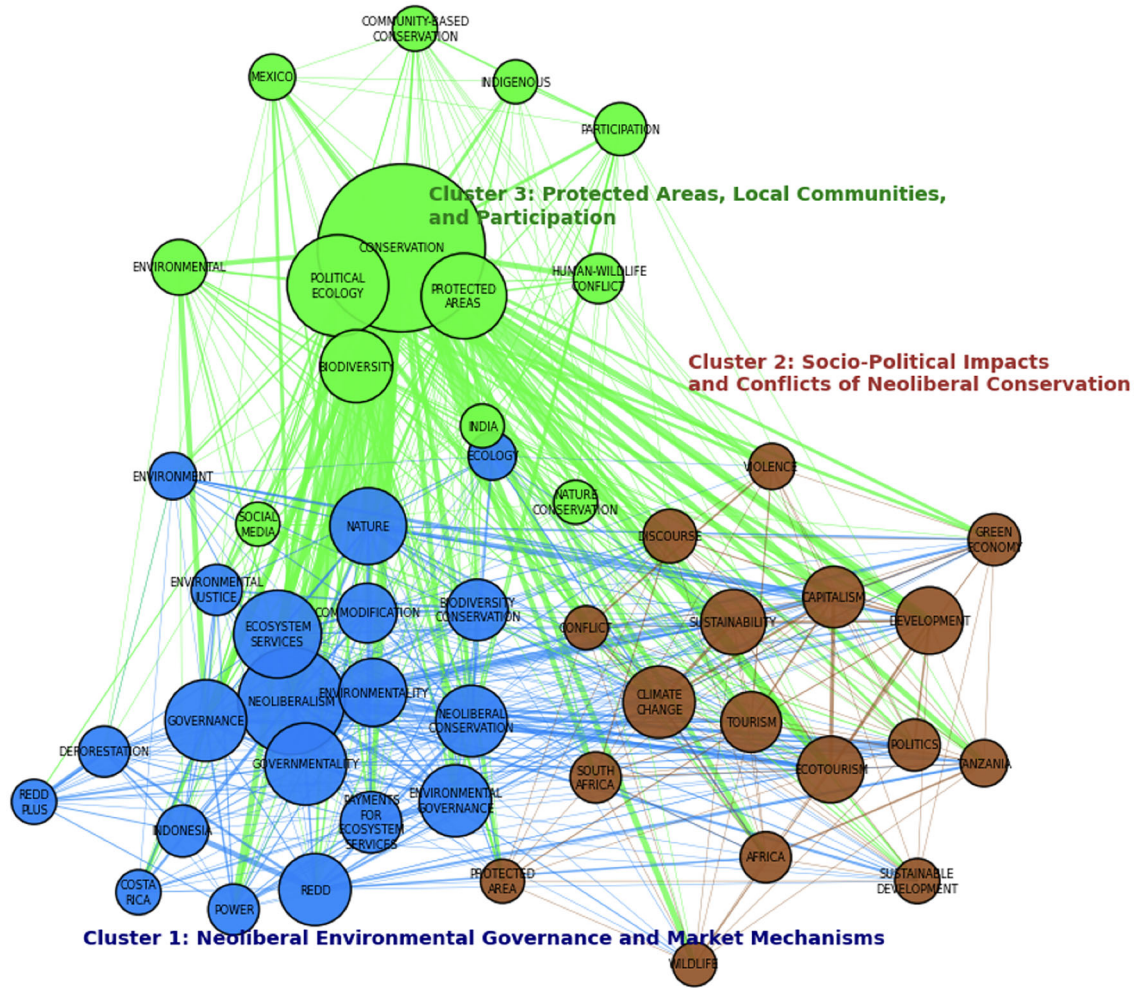
FIGURE 6 Fifty most used keywords (nodes) in the neoliberal conservation database of 2135 publications visualized in a co-occurrence network (node size, degree centrality [frequency of keyword occurrence]; colors, modularity class; lines, edges between nodes [i.e., thickness represents frequency of co-occurrence]).

cluster 2; and Mexico and India in cluster 3). No countries from the Global North appeared as keywords (Figure 6).

Keywords referring to intersectionality and gender studies were absent in this network (Figure 6). This topic is also underrepresented in Apostolopoulos et al.'s (2021) database of neoliberal conservation. This pattern changed over time, and keywords related to gender studies increased slightly (Appendix S10), particularly after 2022. The emergence of the terms *feminist political ecology*, *ecofeminism*, and *intersectionality* in recent years (2023–2024) showed a growing recognition of the importance of gender perspectives in the field and an ongoing shift in literature that addressed what was previously a significant gap in the discourse around neoliberal conservation. However, these keywords appeared in only a small fraction of the 2135 papers in the database, and feminist-related keywords only began appearing in 2013, despite our database covering publications since 2008. There remains substantial room for further integration of feminist and gender-focused approaches in this area of study.

The literature also underwent a thematic evolution over time (Figure 7a,b). The focus and complexity in the field shifted. During 2008–2016, the terms *conservation*, *neoliberalism*, *political*

ecology, and *ecosystem services*, for example, were strongly interconnected, highlighting the field's early emphasis on examining how conservation efforts were increasingly intertwined with market mechanisms and the commodification of nature. Keywords, such as *commodification*, *protected areas*, and *ecotourism*, highlighted concerns around the transformation of natural resources into marketable commodities, particularly in Global South contexts like South Africa, where neoliberal policies were being implemented (Büscher and Dressler, 2012). This period also saw significant engagement with the concepts of, for example, *capitalism* and *governmentality*, indicating the strong influence of neoliberal ideologies in shaping conservation governance during this time (Figure 7a; Appendix S11).

By 2017–2024, the thematic structure of neoliberal conservation expanded, with *climate change* emerging as a central focus, reflecting the growing integration of global environmental challenges with conservation strategies. Although *political ecology* and *conservation* remained key, new connections to *REDD, sustainability*, and *environmentality* signaled a broader interdisciplinary approach. The rise of *REDD* and *environmental governance* during this period highlighted how neoliberalism further permeated
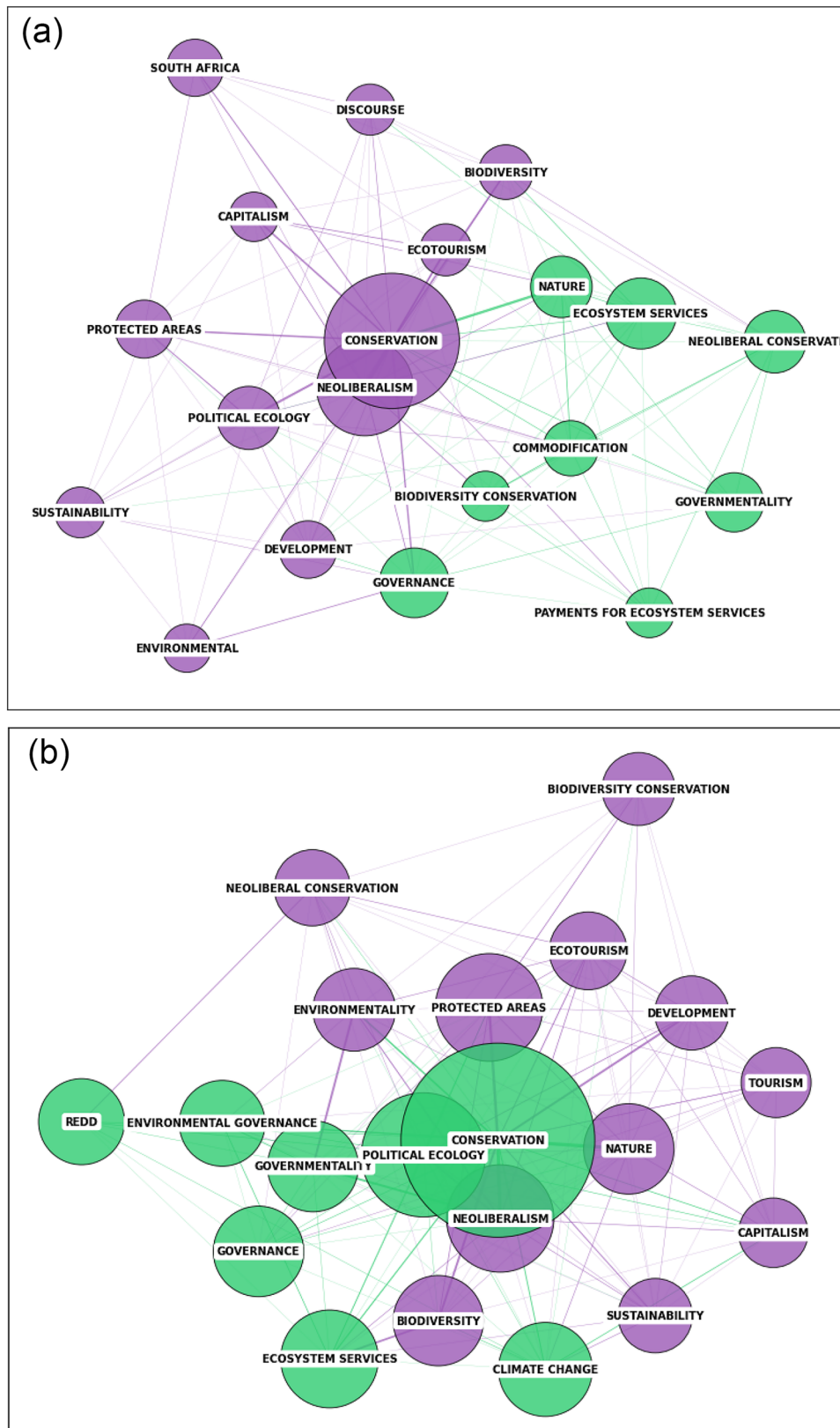
FIGURE 7   (a) Keyword network for articles published from 2008 to 2016 citing neoliberal conservation papers from the database of 2135 papers. The keyword co-occurrence network for 2 periods is based on the 20 most used keywords (i.e., their frequency and [b] keyword network for articles published from 2017 to 2024) (nodes, keywords; node size, degree centrality; colors, modularity class).

conservation, particularly through the expansion of carbon markets as a mechanism for commodifying ecosystems. Despite these thematic shifts, the ongoing prominence of neoliberalism and capitalism showed that market-based approaches still shape the field, echoing critiques about the persistence of capitalist governance in conservation (Figure 7b; Appendix S12).

DISCUSSION

Writings on neoliberal conservation were virtually nonexistent 2 decades ago. Since then, this scholarship has proliferated, giving rise to hundreds of publications that have significantly contributed to the development of conservation social science as a field and to the careers of some of the leading conservation social scientists. The scholarly communities writing on neoliberal conservation were disparate, and many engaged with the topic through diverse arguments and case studies. This breadth demonstrates the vigor of the topic and is reflected in the diversity of the field. Authorship was fragmented and varied, with low connectivity between authors (a network density of 0.009) and relatively small clusters of scholars who collaborate within tightly knit groups. In contrast, a network of similar scope, such as a coauthorship network on payment for ecosystem services, involved 401 authors and exhibited a density of 0.0287, indicating "a modest but significant number of ties between authors" (Corbera et al., 2021, p. 5).

Analyzing the overall structure of the network provided valuable insights into its potential to support critical social processes, such as problem solving, consensus-building, and mobilizing for collective action. For example, highly centralized networks can be effective for planning processes and rapidly disseminating information but may struggle to manage complex and dispersed conservation and social challenges, where more decentralized networks often prove more effective (Bodin & Crona, 2009; Bodin et al., 2006; Ernstson et al., 2010). Similarly, although highly connected networks may excel at communicating ideas, they risk inhibiting innovation and fostering stagnation (Mills et al., 2014). Polycentric networks, with multiple centers of influence, are thought to strike a balance between centralized and decentralized governance, fostering environments conducive to generating new ideas and knowledge (Hahn et al., 2006). This makes the depiction of a dispersed and polycentric network in neoliberal conservation particularly significant. Such a structure could encourage innovation and the development of diverse approaches within the discipline. Yet, the observed low density of the network highlights untapped opportunities. By creating new collaborations and connections among dispersed actors, the network could stimulate even more constructive debates, enrich knowledge-sharing, and drive the integration of novel approaches (Fonseca et al., 2016), including more emphasis on intersectionality, decoloniality, social–environmental movements, and pathways to radically different futures (Apostolopoulou et al., 2021).

In theory, the authors with high betweenness centrality scores (Figure 2b; Appendix S4) would be important in efforts to increase collaboration among these communities and for com-

municating ideas across the network. However, betweenness scores on their own cannot reveal how influence is used. Actors could act as either bridge builders or gatekeepers, and central actors require the trust of others in the network to be able to make use of their influential position (Dunn et al., 2023; Hahn et al., 2006; Olsson, 2003).

Beyond network structure, the intellectual leadership in neoliberal conservation was characterized by pronounced hierarchies and imbalances. As Apostolopoulou et al. (2021) noted, this is ironic given that many contributors to neoliberal conservation are motivated by a desire to foster a more egalitarian society. The field disproportionately favored northern and male authorship, and our results also indicated that these authors tended to have the highest centrality scores (Appendices S2 & S4). Other research combining eigenvector centrality with actor attribute data also shows how underrepresented groups (racial minorities, women, etc.) tend to have lower eigenvector centrality and to be structurally marginal in networks (e.g., Mehra et al., 1998). Our results further underscored this inequality, revealing how even ostensibly progressive scholars were embedded in networks and institutions that mirrored broader global disparities. A striking contrast emerged between the frequency of collaborations among institutions in the Global North and those in the Global South, highlighting the persistent need for deliberate efforts to redress these imbalances in academic collaboration.

Apostolopoulou et al. (2021) already identified several substantive gaps in the neoliberal conservation literature, pointing to the need for greater attention to urban contexts, quantitative methods, and the humanities, as well as deeper engagement with issues of class, gender, and race. Our results suggest an additional dimension: neoliberal conservation remains primarily a discussion among social scientists. Only a small proportion of the papers citing the leading neoliberal conservation authors appeared in natural science journals (Appendix S3). This suggests that neoliberal conservation largely serves as a conceptual framework for social scientists to conceptualize and communicate conservation issues within their own disciplinary boundaries. Extending and bridging epistemic communities across disciplinary boundaries can improve the quality of data used in decision-making for conservation policy and practice to address complex global environmental challenges (Funtowicz & Ravetz, 1993).

By linking this evolving literature more closely with the core of conservation science, there is an opportunity to push the boundaries of both fields. Neoliberal conservation offers a critical lens through which to scrutinize mainstream conservation practices, yet it remains somewhat siloed in social science circles. Greater integration with natural science and interdisciplinary collaboration could strengthen the field's practical relevance, bridging the gap between critical theory and on-the-ground conservation work. This would not only link the literature more with praxis but also ensure that its critiques and insights reach a wider audience and have a greater impact on conservation policy and practice.

Our analysis of thematic clusters in the neoliberal conservation literature showed that the neoliberal conservation literature

has been instrumental in revealing deep-seated inequalities—whether through its critiques of market-driven conservation practices or its examination of how these practices exacerbate socioenvironmental injustices. Over time, this field evolved to embrace new and increasingly complex topics, reflecting a growing recognition of the need to address class, race, gender, and geographic disparities in conservation efforts. Despite these advancements, our results highlighted persistent and significant gaps and imbalances. For example, our review of thematic clusters (Figure 6) showed that much of the scholarship focused on analyzing market-driven conservation mechanisms and the sociopolitical conflicts they engender and tended to overlook grassroots resistance and social–environmental movements. A deeper exploration of these resistance strategies is crucial for understanding how neoliberal conservation is contested on the ground and how these movements can offer alternative models of conservation rooted in social and environmental justice.

The thematic evolution of the field over time reflects its responsiveness to emerging global challenges and highlights the persistent need for more intersectional and decolonial perspectives to address enduring biases and gaps. Intersectionality feminism, for example, offers a critical framework for grappling with the complexity of how different aspects of social difference (class, gender, race, etc.) are produced and continually reproduced in a dynamic relationship with each other (Ferguson, 2016). By understanding how these intersecting forms of oppressions and privilege are experienced and politically mobilized in conflicts over natural resources, scholars can enhance their ability to understand and engage with social movements effectively.

Presumably, addressing the twin imbalances in the scholarly networks of neoliberal conservation, the dominance of Northern perspectives and gender bias, could facilitate more socially just and transformative research. However, the politics of knowledge production and the structural limitations these scholars face in terms of what types of research are funded and how the market drives what kinds of epistemologies are considered valid must also be considered and strategically navigated through engagement with the broader scientific community. In this respect, social network analysis provides a valuable tool for mapping relationships within and between epistemic communities and highlighting paths for engagement for more effective collective action.

If these imbalances are addressed, and more diverse voices are included, the already valuable contributions of neoliberal conservation could become even more important. This would not only deepen understanding of how neoliberal policies influence conservation but also foster a more inclusive and globally representative discourse. The negative impacts of a pervasive gender bias on innovative and just solutions to conservation challenges in professional and scholarly sectors of conservation have been well documented (James et al., 2021; Liévano-Latorre et al., 2020). However, addressing these issues requires more than simply increasing female representation; it necessitates a deeper critical engagement with feminist literature and its transformative implications for conservation. Framing gender concerns solely as a matter of participation risks tokenistic involvement that often exploits women's labor while perpetuating or even exacerbating existing gender inequalities (Agarwal, 1998).

Feminist research underscores the urgency of safeguarding women's access to vital common property resources such as rangelands, forests, ecosystem services, communal lands, and water (Agarwal, 2021). In the ranks of neoliberal conservation, several authors make use of intersectionality feminism and ecofeminist perspectives, but there is still much to do to engage policy effectively through these analytical lenses and to mainstream gender transformative approaches in conservation practices and policies. Integrating such perspectives could challenge entrenched power dynamics and address systemic inequalities, offering a more radical and just approach to conservation. Neoliberal conservation could help move the field of conservation beyond superficial commitments to gender parity and to a meaningful transformation of the structures that sustain gender inequality in conservation.

An additional opportunity is to expand the geographic reach of neoliberal conservation scholarship. Our results highlighted the spatial patchiness and partialness of the literature across different subfields. Yet, the reach of neoliberal policies and innovations is considerable. It would be productive for scholars to undertake more work on these themes in countries where little research currently exists (Appendix S13) and to do so through effective collaborations across social and natural science and with local communities of research and practice.

In this light, the gaps and imbalances we identified should be seen not as inherent limitations but as challenges for future growth and development. Strengthening the field's intellectual diversity and fostering greater collaboration across disciplines and regions would enhance its ability to address the global inequalities it seeks to challenge. Ultimately, by addressing these gaps, neoliberal conservation can become a more powerful tool for reimagining conservation in ways that are not only environmentally sustainable but also socially just.

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SUPPORTING INFORMATION

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