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How just and just how? A systematic review of social equity in conservation research

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TOPICAL REVIEW

How just and just how? A systematic review of social equity in conservation research

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Abstract

Background: Conservation decisions not only impact wildlife, habitat, and environmental health, but also human wellbeing and social justice. The inclusion of safeguards and equity considerations in the conservation field has increasingly garnered attention in international policy processes and amongst conservation practitioners. Yet, what constitutes an 'equitable' solution can take many forms, and how the concept is treated within conservation research is not standardized. This review explores how social equity is conceptualized and assessed in conservation research.

Methods/Design: Using a structured search and screening process, we identified 138 peer-reviewed studies that addressed equity in relation to conservation actions. The authors developed a coding framework to guide the review process, focusing on the current state of, definitions used for, and means of assessing social equity in empirical conservation research.

Review Results: Results show that empirical research on social equity in conservation is rapidly growing, with the majority of studies on the topic published only since 2009. Equity within conservation research is skewed toward distributional concerns and to a lesser extent procedural issues, with recognition and contextual equity receiving little attention. Studies are primarily situated in forested biomes of the Global South. Conservation interventions mostly resulted in mixed or negative impacts on equity.

Synthesis and Discussion: Our results demonstrate the current limitations of research on equity in conservation, and raise challenging questions about the social impacts of conservation and how to ameliorate equity concerns. Framing of equity within conservation research would benefit from greater transparency of study motivation, more explicit definition of how equity is used within the study context, and consideration for how best to assess it. We recommend that the empirical conservation literature more deeply engage with different notions of equity when studying, planning, and implementing actions to address potential trade-offs among equity and conservation objectives and beneficiaries.

1. Introduction

Social equity is an important societal aspiration across various spheres of public policy, including conservation and environmental management. Yet, conservation has been critiqued for adopting exclusionary methods, separating people from nature, and privileging certain values and worldviews (Agrawal and Redford 2009, Brockington and Igoe 2006, Cernea and Schmidt-Soltau 2006, Martin *et al* 2013, West *et al* 2006). This has led to concerns over both equity in the planning and implementation of conservation interventions, and equity as an outcome of those actions (Bennett *et al* 2017, Halpern *et al* 2013, Klein *et al* 2015, Luck *et al* 2012). While exclusionary governance and the injustices resulting from conservation and environmental management practices have been topics of discussion for nearly three decades (Brechin *et al* 2003, Schlosberg 2007), conservation research has only recently engaged more with a 'social equity' framing for understanding and overcoming these concerns.

In large part, this has coincided with the inclusion of equity language in global conservation policy documents. For example, international conservation policy organizations, such as the Convention on Biological Diversity (CBD) and the International Union for the Conservation of Nature (IUCN), have formally incorporated equity language and considerations into their respective mandates and policies (CBD 2011, IUCN 2016, Martin *et al* 2016, Zafra-Calvo *et al* 2017). Many conservation groups have also responded to current pressures from activists and practitioners by reorienting their missions and rhetoric to include the rights and wellbeing of local peoples (Sikor *et al* 2014). These policies and the practical engagement with these concerns and concepts has motivated increasing interest in equity within the conservation literature, for example in Payments for Ecosystem Services (Pascual *et al* 2014), REDD+ (Franks and Quesada-Aguilar 2014), and Protected Areas (Schreckenberg *et al* 2016). In support of these developments, here we seek to understand how equity has been defined and examined through a systematic review of the literature.

The formal concept of social equity arose from sociology during the latter half of the 20th century as an instrument to correct power imbalances between those with 'advantage' and those 'without' (Guy and Mccandless 2012). Contemporary theorizing on the topic, in relation to environmental issues and biodiversity conservation, concerns itself with questions of who decides how conservation will occur, at what cost, and who benefits (Brechin *et al* 2003). Other authors have defined the components of equity as consisting of three dimensions: *distribution* of costs, responsibilities, rights, and benefits; the *procedure* by which decisions are made and who has a voice; and *recognition*—acknowledgement of and respect for the equal status of distinct identities, histories, values, and interests (Franks and Schreckenberg 2015, Fraser 1996, Martin *et al* 2016, Schlosberg 2007, Sikor *et al* 2014). Some literature also considers *context*—the social, economic, environmental, and political history and circumstances—as a critical underlying factor (Sikor *et al* 2014), or even a fourth dimension of equity (McDermott *et al* 2013).

Uncovering the challenges associated with defining and studying a multi-faceted concept such as equity and applying it to conservation is one motivation behind and objective of this review. Thus, we seek to elucidate the rationales, definitions, methods, and relative levels of success for equity in conservation. There is also the risk of bias if research is not representative in terms of who leads the research efforts (Wilson *et al* 2016) and what themes or contexts are studied (Law *et al* 2017), themes we explore in the existing literature.

As a second objective, this review aims to show strengths and gaps in the rapidly burgeoning research on equity in conservation, to foster a better understanding of how it can be applied successfully in practice. Existing syntheses provide a foundation on related issues of the relationships between conservation and human wellbeing (McKinnon *et al* 2016, Milner-Gulland *et al* 2014) and empirical justice in ecosystem governance (Sikor *et al* 2014). Yet, despite growing interest in this area and the emerging imperative to explicitly incorporate equity concerns into goals for conservation programs, there appears to be no systematic review and appraisal of how equity has been empirically studied in conservation research. This review addresses this gap in the literature through examining how the concept of equity has been characterized and assessed thus far in research on conservation, and identifying critical gaps to address in future research. The aim is to better equip conservation scholars and practitioners seeking to define, study, or address equity issues in conservation

2. Methods

This review adopted a structured approach to capture the diversity of equity conceptualizations from a range of disciplines, methodologies, and regions, in order to synthesize commonalities and discrepancies. Such an approach provides a transparent and repeatable methodology, and aims to reduce bias in our selection of the literature (Haddaway *et al* 2015). The review was guided by the following questions:

1. In what contexts has equity research been conducted and by whom?
2. How is the notion of equity conceptualized and measured in conservation research?
3. How might the conceptualizations and assessment mechanisms affect the study conclusions about equity?

Table 1. Key terms and definitions.

Term	Definition
Justice[a]	Justice is predicated on (1) equal right to most basic liberty compatible with that of others, (2) equalizing opportunity, and (3) aimed at benefiting least advantaged
Fairness[b]	A subjective or perception-oriented notion of what is "fair", shaped by a range of principles and considerations (e.g. representativeness, pro-poor). Also considered the absence of envy. Sometimes used synonymously with equity.
Equity[c]	A multi-dimensional concept of ethical concerns and social justice based on the distribution of costs and benefits, process and participation, and recognition, underpinned by the context under consideration. Sometimes used synonymously with fairness or justice.
Equality[d]	Egalitarian ideal, often in the context of distribution (e.g. Gini coefficient)
Distribution[e]	Division of costs and responsibilities versus rights and benefits.
Procedure[a]	Process by which decisions are made and who participates.
Recognition[a]	Acknowledgement of and respect for distinct identities, histories, values, interests, and knowledge systems.
Context[c]	The broader social, governance, economic and cultural context, both past and present (e.g. power dynamics, gender, education, ethnicity, age), that influence an actors' ability to gain recognition, participate in decision-making, and lobby for fair distribution.

[a] Guy and Mccandless 2012.
[b] Narloch *et al* 2013, Wilson and Howarth 2002.
[c] McDermott *et al* 2013, Sikor *et al* 2014.
[d] Franks and Quesada-Aguilar 2014, Syme 2012.
[e] Franks and Schreckenberg 2015, Martin *et al* 2016, Sikor *et al* 2014.

First, we conducted a structured search and review of the literature related to equity in conservation as summarized in figure 1. The Thomson Reuters (formerly ISI) Web of Science™ Core Collection and Elsevier's Scopus bibliographic databases, and Google Scholar (retrieving the first 200 results) were searched on the 4th and 5th of October 2016, using variants of the keywords: equity, equality, fairness, justice, conservation, biodiversity, and ecosystem services (see supplemental material S1 available at stacks.iop.org/ERL/13/053001/mmedia for complete methodology and other filters applied). Studies were screened to meet the inclusion criteria—empirical research, focused on at least one conservation action (Salafsky *et al* 2007), and implicating equity-related principles (see table 1)—resulting in a final list of 138 studies (see supplemental material S2 for full list). During the 'eligibility' phase (figure 1), papers were primarily excluded based on the title and abstract for one or more reasons, including that studies: (1) were not actually targeting social equity as a topic; (2) didn't relate equity-related issues to the conservation action; (3) did not include any conservation actions (often species studies or sustainable development implications broadly); (4) did not conduct empirical analysis (often review or comment-type papers); or (5) employed the search terms in an unrelated context (e.g. equitability of mite communities in soil plots). If reviewers were uncertain about the applicability, the full-text was reviewed and then a decision on inclusion made.

Second, a codebook (see supplemental material S3) for data extraction was designed iteratively based on an initial library of indicative literature (see supplemental material S4), from which the search terms and inclusion/exclusion criteria were also developed. Six co-authors trialled the coding frame on sample studies, discussed discrepancies, ambiguities, and challenges through repeated online consultation prior to completing data extraction, and revised the scope, content, and structure of the coding ('data extraction' phase, figure 1). Topics covered in the coding included basic descriptors (e.g. geography, biome, conservation action), the stated or interpreted rationale for considering equity, the depth and characteristics of equity dimensions studied, what variables were assessed and methods used, and outcomes of how conservation activities affect equity. Rationale was primarily classified as *instrumental*—for utilitarian value, such as increased conservation success—or *fundamental*—equity considered for its inherent importance—as well as auxiliary options, such as for *legitimacy* of the study. The dimensions of equity studied included contextual, recognitional, procedural and distributional concerns, as defined above and in table 1. To indicate the level of focus on each of these dimensions, the codebook also applied the following categories: *analyzed* (i.e. empirical data on the dimension examined to draw conclusions; assumed inclusion in the discussion), *discussed* (i.e. only included as a discussion point or underlying factor, and not empirically analyzed), or *not included*.

Synthesis of the data included quantifying trends in published studies, geographic variables, dimensions of equity studied, and types of methods employed. Many of these were cross-tabulated (e.g. frequency of dimensions by geography or conservation action). Graphic spatial analysis employed QGIS mapping software (QGIS Development Team 2017) to map locations of studies and authors. Chi-square analyses were run in R Studio (R Core Development Team 2017) to test for significant differences between studies based on their conclusions (i.e. negative, positive, mixed,

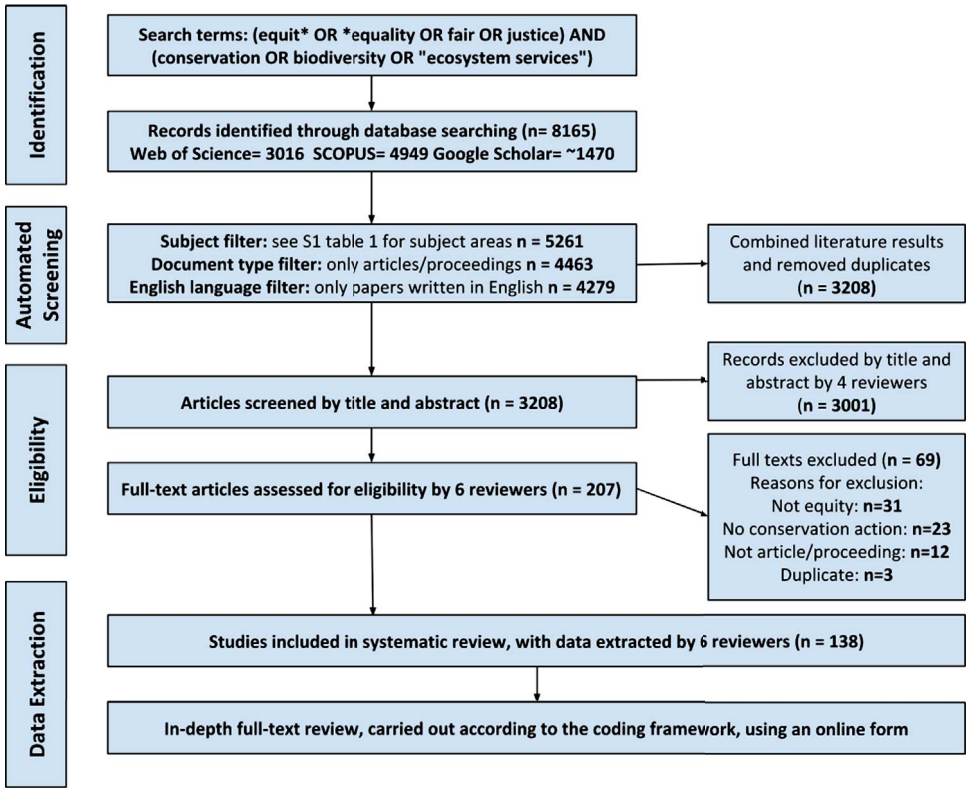

Figure 1. Flow diagram for the overview of article screening and inclusion in the review. Note that only the first 200 google scholar search results were examined. For full details of inclusion and data extraction, see supplemental methods (S1). (adapted from Preferred Reporting Items for Systematic Reviews and Meta-analyses [PRISMA]).

excluding unclear), both for the whole dataset and disaggregated by geography.

3. Results

3.1. State of the science of conservation equity

The number of studies considering social equity in conservation has increased over the last twenty years, with the majority undertaken in the last nine years (figure 2). Of the 138 studies reviewed, most studies focused on three regions of the world—Asia (31%, $n = 46$), Sub-Saharan Africa (27%, $n = 39$), and Latin America and the Caribbean (17%, $n = 25$) (figure 3). Studies conducted in North America (10%, $n = 15$), Europe (7%, $n = 11$), Oceania (6%, $n = 9$), and the Middle East (1%, $n = 2$) made up smaller percentages. In contrast to the regions where studies were undertaken, first authors of the reviewed studies were based largely at institutions in the United States (30%, $n = 41$), United Kingdom (16%, $n = 22$), Australia (8%, $n = 11$), and Canada (7%, $n = 10$). The number of studies that included authors with affiliations solely *outside* the country of study varied across region: Asia (50%, $n = 23$), Latin America and the Caribbean (48%, $n = 12$), Sub-Saharan Africa (59%, $n = 23$), and Oceania (67%, $n = 9$). In contrast, 93% of studies in North America ($n = 14$) and all studies in Europe ($n = 11$) were conducted by authors at institutions in those countries. The gender breakdown of first authors was 58% male ($n = 80$) and 42% female ($n = 58$).

Forest ecosystems comprised the largest proportion (61%, $n = 84$) of study systems, with the second and third most prominent being coastal and marine ecosystems (24%, $n = 33$) and grasslands (13%, $n = 18$). A total of 22 studies took place in inland water, cultivated, mountain, dryland, urban, or undefined ecosystems (some studies covered more than one ecosystem type). Types of conservation activities were evenly distributed across land/water protection (38%, $n = 53$), land/water management (29%, $n = 40$), and livelihoods and incentives (33%, $n = 45$), with an additional 9 studies (7%) on species conservation and one on law and policy (some studies included more than one conservation action). This breakdown is also geographically distinct: two-thirds of studies in Latin America (64%, $n = 16$) focused on livelihoods and incentives interventions; nearly half of studies in Africa (49%, $n = 19$) targeted land/water protection; and both protection (37%, $n = 17$) and management (41%, $n = 19$) were well-represented in Asia. Studies primarily took place at single levels—local (57%, $n = 79$) and subnational (25%, $n = 34$) scales. When considering 'equity for whom', this centered on groups of people (40%, $n = 55$), individual actors (32%, $n = 44$), and a combination of individuals and groups (22%, $n = 30$), rather than considering larger scales (e.g. regions or nations, 2%, $n = 3$) or generations (4%, $n = 5$).

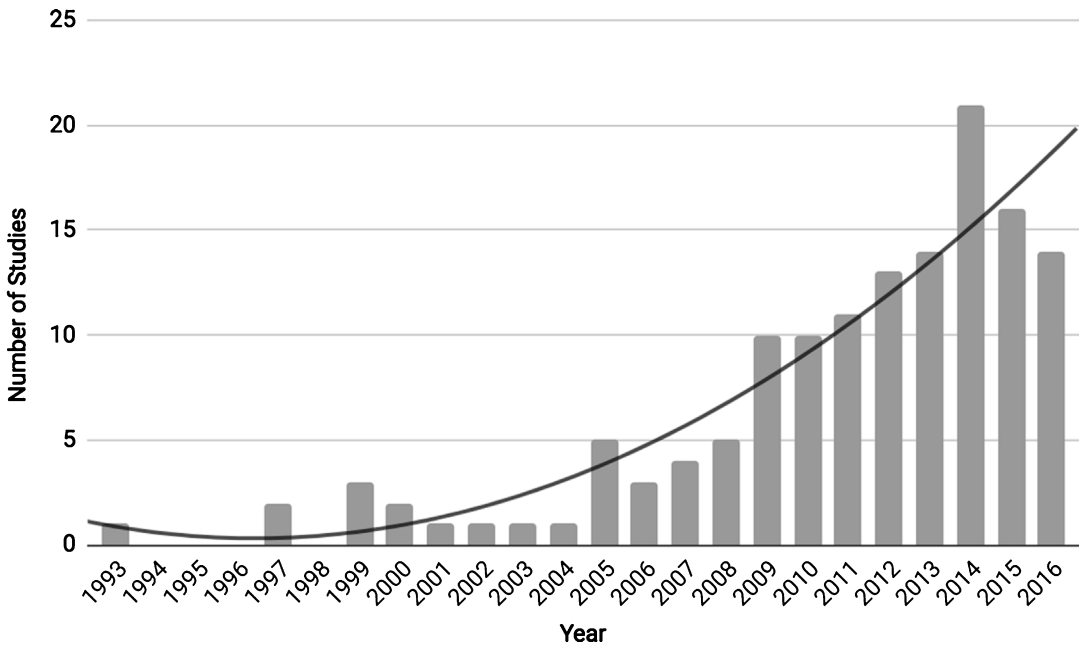

Figure 2. The number of peer-reviewed studies relating social equity to conservation included in the review, with trend of publication over time through October 2016 (trendline $R^2 = 0.896$).

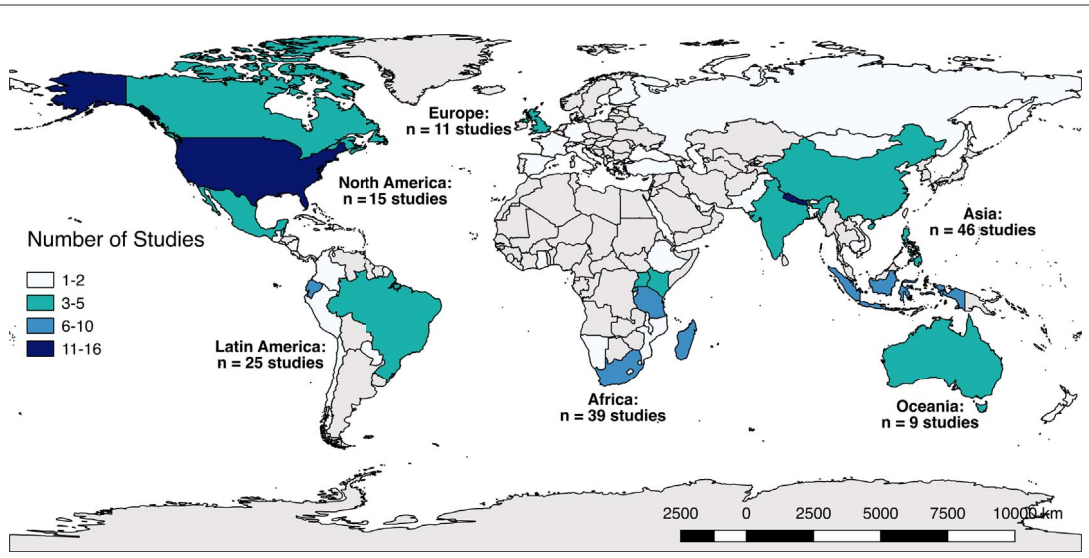

Figure 3. Map of the location of studies ($n = 138$; some studies included multiple countries). Dark blue indicates the countries with the greatest representation. Regional totals are indicated in text.

3.2. Notions of equity

Utilitarian approaches were often taken in studies (62%, $n = 85$), with instrumental rationales for considering equity most commonly cited. These related to whether equitability helps reach tangible goals—e.g. equity considerations reduce poverty or conflict, with the assumption that this is critical for long-term conservation success. More fundamental motivations, which are less outcome-oriented, surfaced in just over one-third of the studies (36%, $n = 50$). These framed equity as a moral obligation or the right and ethical thing to do. Some studies cited both instrumental and fundamental rationales for including equity (16%, $n = 22$). Over half of the studies reviewed (53%, $n = 74$) did not implicate any theoretical or conceptual framework guiding the equity conceptualization. Of those that discussed an existing theory (39%, $n = 55$) or developed their own conceptual framework (6%, $n = 9$), the environmental justice (e.g. Martin *et al* 2014), political ecology (e.g. Gezon 2014), and social equity (e.g. Poudel *et al* 2015) literatures were most commonly cited.

While fewer than one-quarter (23%, $n = 31$) of studies stated their operational definition of equity prior to analyzing it, more often the way authors conceptualized equity was implicitly demonstrated by the choice of dimensions and variables examined. Studies that primarily or solely focused on equity

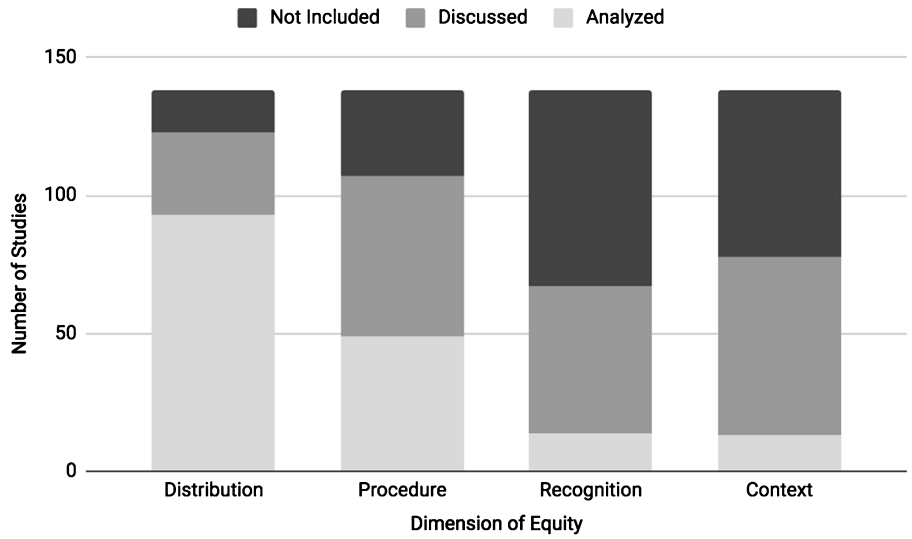

Figure 4. Proportional representation of dimensions of equity in studies reviewed, and the level to which they are examined in the studies. Dimensions comprise: *distribution* of costs, responsibilities, rights, and benefits; the *procedure* by which decisions are made and who has a voice; *recognition*—acknowledgement of and respect for the equal status of distinct identities, histories, values, and interests; and *context*—the social, economic, and political history and circumstances. Where the dimension is measured and assessed, it is classified as *analyzed*. Where included as a discussion point or an underlying contributor, the dimension is classified as *discussed*.

in conservation more often supplied an explicit definition (43%, $n = 23/53$), in contrast to studies with a partial (11%, $n = 7/62$) or minimal focus (4%, $n = 1/23$). In the review, distributional equity surfaced most frequently as the topic of analysis (67%, $n = 93$) or discussion only (22%, $n = 30$) (see figure 4). Procedural equity was less frequently analyzed (36%, $n = 49$) but often a topic of discussion (42%, $n = 58$). Recognitional equity was often not included (51%, $n = 71$), or simply discussed (38%, $n = 53$), while only analyzed in a handful of studies (10%, $n = 14$). Although context mostly provided a preface to studies (only discussed in the article 47%, $n = 65$), contextual equity rarely was a topic of analysis itself (8%, $n = 13$).

Information on additional characteristics was collected for three of the equity dimensions (see supplemental results S5 for figures; percentages may exceed 100 when individual studies included multiple variables). Studies analyzing or discussing distributional equity ($n = 123$) most frequently considered financial resources (67%, $n = 82$), livelihoods (56%, $n = 69$), access (37%, $n = 45$), or wellbeing (35%, $n = 43$). The criteria used to determine equitability were most frequently the evenness of distribution (57%, $n = 70$), need (29%, $n = 36$), and fairness (20%, $n = 24$). Procedural equity ($n = 107$) primarily considered general involvement in decision-making (40%, $n = 43$). Although, in terms of points in the decision-making process, the implementation stage of conservation actions was most frequently studied (44%, $n = 47$), rather than earlier stages of establishment of conservation activity (30%, $n = 32$), objective setting (22%, $n = 24$), initiation (13%, $n = 14$), or monitoring (6%, $n = 6$). The nature of 'participation' was mostly not specified (52%, $n = 56$), while the more explicit collaboration (22%, $n = 24$), consultation (21%, $n = 23$), or grassroots participation (3%, $n = 3$) were raised less frequently. Finally, of the studies considering recognitional equity to any extent ($n = 67$), most looked at the recognition of rights (57%, $n = 38$), followed by livelihoods (34%, $n = 23$), perceptions (33%, $n = 22$), culture (33%, $n = 22$), knowledge (27%, $n = 18$), and values (13%, $n = 9$).

3.3. Assessment of equity

The temporal focus and methods applied to equity assessments varied widely. Retrospective (35%, $n = 48$), present (34%, $n = 47$), and both past and present time periods in tandem (12%, $n = 17$) made up the majority of studies. Whereas 16 studies (12%) only adopted a future-orientation, another eight studies combined present and future (6%), and only two studies spanned past, present, and future. Studies using qualitative only (38%, $n = 52$) or mixed (39%, $n = 54$) methods were the most prevalent, and those only using quantitative methods were less frequent (20%, $n = 27$) (figure 5). The mixed methods studies usually employed a combination of quantitative and qualitative techniques, and participatory and spatial techniques we infrequently included.

While, studies generally included socio-demographic (73%, $n = 100$; e.g. gender, ethnicity) and economic (58%, $n = 80$; e.g. income) measures of social condition, environmental variables were much less well-represented (ecosystem services, 20%, $n = 27$; biophysical variables, 20%, $n = 27$; and biodiversity, 4%, $n = 6$). Importantly, nearly two-thirds (61%, $n = 84$) of all the studies did not include any measurement of environmental variables (figure 6). Overall, few studies found wholly positive implications of conservation actions for social equity

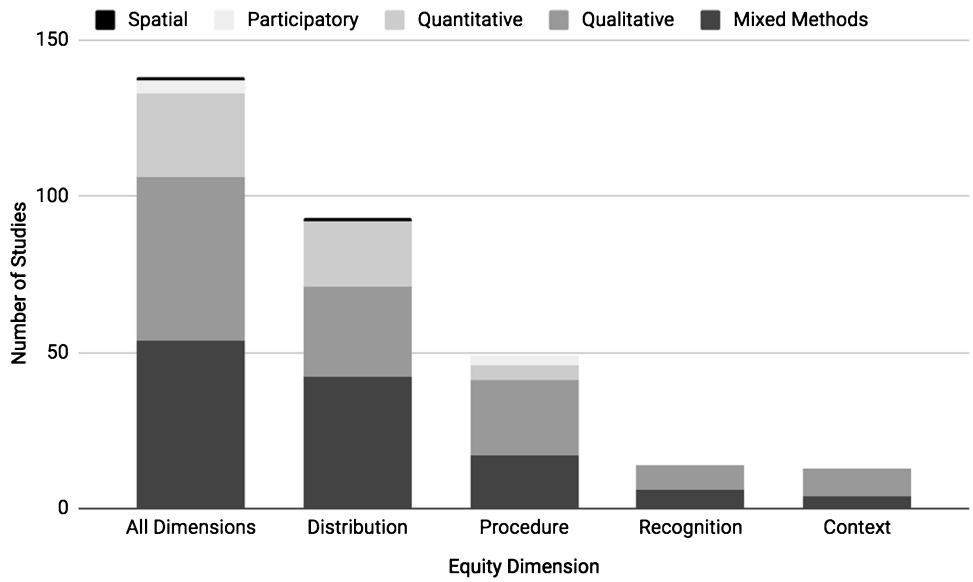

Figure 5. Breakdown of types of method by dimension(s) of equity under scrutiny.

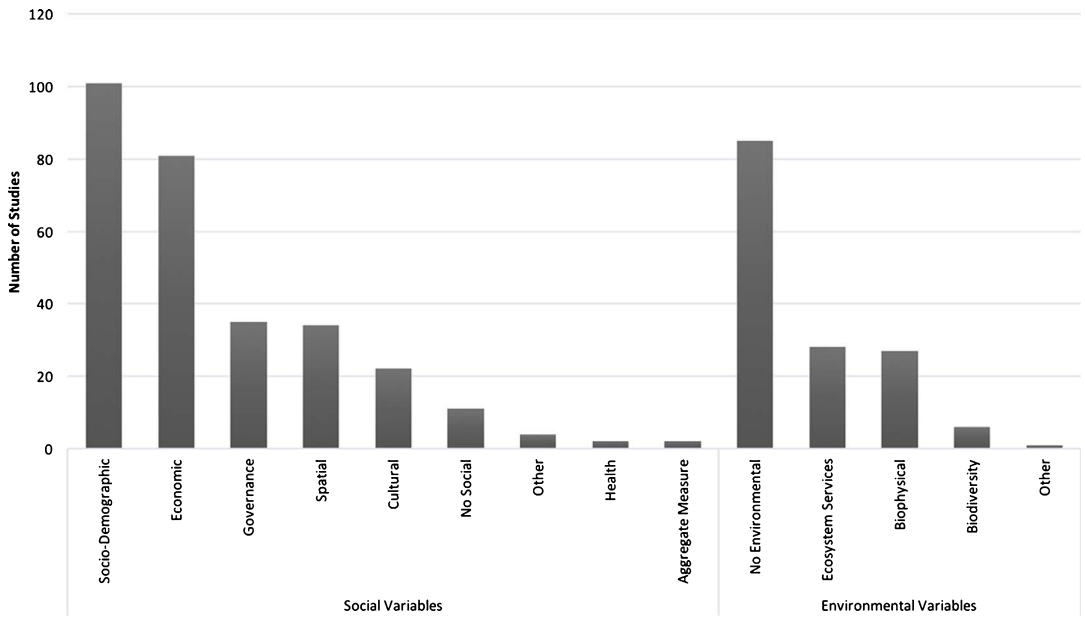

Figure 6. social and environmental variables collected in the reviewed studies. The most prominent were socio-demographic and economic variables, while no environment variable was most frequent.

(13%, $n = 18$), with most resulting in negative (40%, $n = 55$) or mixed equity outcomes (36%, $n = 50$), and the remaining unclear (11%, $n = 15$) (figure 7). This distribution of outcomes is significantly different from random ($\chi^2 = 19.66$, df = 2, $p < 0.005$). Of those studies that find a definite positive or negative equity result, more are reporting negative results ($\chi^2 = 18.75$, df = 1, $p = 0.0002$). Broken down by dimension analyzed, conclusions follow the same pattern of greater representation of negative and mixed results (figure 8(*a*)).

Chi-square analyses were also performed with data disaggregated by region (figure 8(*b*)), which showed Asia, Sub-Saharan Africa, and Latin America skewed toward more negative results and was not random ($\chi^2 = 8.167$, df = 1, $p = 0.004$; $\chi^2 = 9.8$, df = 1, $p = 0.002$; $x^2 = 4.571$, df = 1, $p = 0.033$). Similar analysis carried out based on the conservation action (figure 8(*c*)) found that, of those studies with definite conclusions, land/water protection ($\chi^2 = 7.539$, df=1, $p = 0.006$) and livelihoods/markets ($\chi^2 = 16.2$, df = 1, $p = 0.0006$) both skewed toward negative conclusions. However, land/water management did not exhibit the same significant discrepancy in outcomes ($\chi^2 = 0.2$, df = 1, $p = 0.655$). Species management was not tested, due to low sample size.

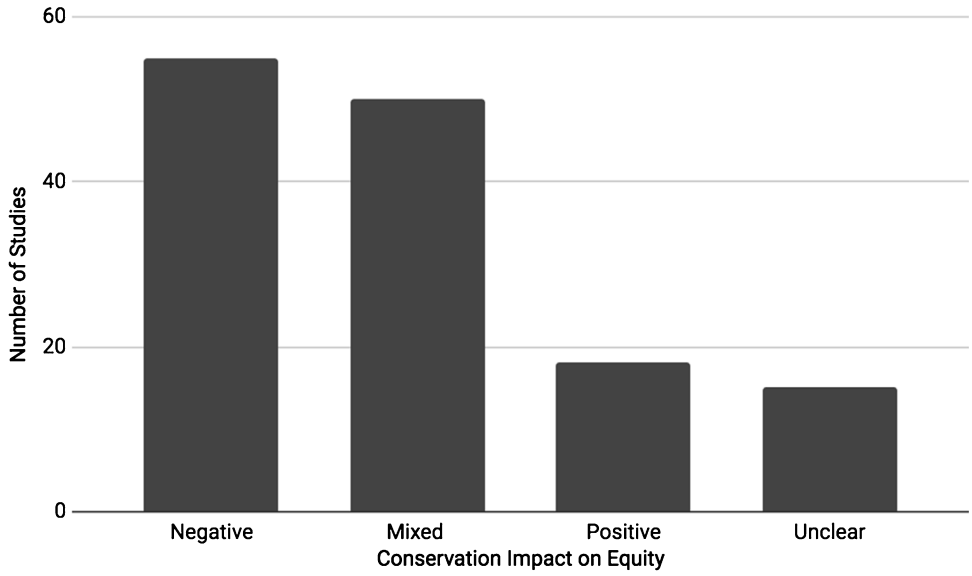

Figure 7. Conclusions of studies reviewed. Determination of direction of outcomes were based on statements by the author(s) in the results and discussion of the studies: (1) negative—where either there was stated inequity or the outcomes were only portrayed as negative/detrimental; (2) positive—where there was stated equity or the outcomes were only portrayed as positive/beneficial; (3) mixed—this is primarily when dimensions of equity have been shown to have different equity implications, but could also be if there were steps being made toward improving the equity of the situation; 4) unclear—no clear directionality of impact is expressed. Conclusions were only assessed for analyzed dimensions.

4. Discussion

4.1. Key gaps

The review identified themes and concepts that are currently not fully addressed in the empirical literature on equity and conservation. These include potential bias in the context of studies, dominance of specific equity dimensions, and the implications of employing certain methods of analysis. The context of a study influences how equity is defined and success assessed, for instance in achieving the Aichi biodiversity target for social equity in protected areas (Zafra-Calvo *et al* 2017). Further, the choice of equity dimensions under scrutiny and methodologies by which they are assessed can affect the identification of successful long-term conservation solutions and aligning conservation efficacy with the needs and desires of people affected (Dawson *et al* 2017, Pascual *et al* 2014). As such, addressing these limitations of the current literature has the potential to advance the application of equity in conservation research and practice.

4.1.1. Contextual bias

Research on equity has focused on the 'global south', and particularly countries considered to have lower levels of governance, indicating a bias towards cases that are more likely to expose injustices and inequities, and therefore have negative equity outcomes (figure S5.4 in supplemental material S5). Moreover, at least in the peer-reviewed literature, researchers from institutions based in Europe, North America, and Australia seem to be driving the research agenda, and many studies have no authors affiliated with institutions located in the country of study. While out of the scope of this study, disciplinary background of the authors influences how conservation and equity is perceived, framed, and which variables are assessed, which ultimately affect the outcome of studies (Brosius 2006). As such, the relationship between equity and conservation may be as much an artifact of researcher perceptions around justice in conservation and the 'global south', as reflecting locally or regionally relevant understandings of the concept and true reflections on conservation interventions (Karlsson *et al* 2007, Wilson *et al* 2016). Interdisciplinary authorship could provide an important balance in perspectives and help integrate social and environmental aspects, but the mechanisms of funding and publishing of research still serve as barriers to realising this potential (Bromham *et al* 2016, Hicks *et al* 2010).

4.1.2. Dominant dimensions

While existing theoretical literature has identified and elaborated on multiple dimensions of equity, in practice challenges arise from the case specificity of equity and what dimensions authors choose to examine. For instance, differences between studies may not be a product of varying levels of equity, but where the meaning of 'equity' in one context might not reflect that of another. There is evidence in the behavioral sciences that people are more concerned with 'fairness' than equality (Starmans *et al* 2017). In contrast, one study in this review found that egalitarian incentive distribution was considered the most equitable for a payment for ecosystem services program in Nyungwe National Park in Rwanda (Martin *et al* 2014). Equity may also

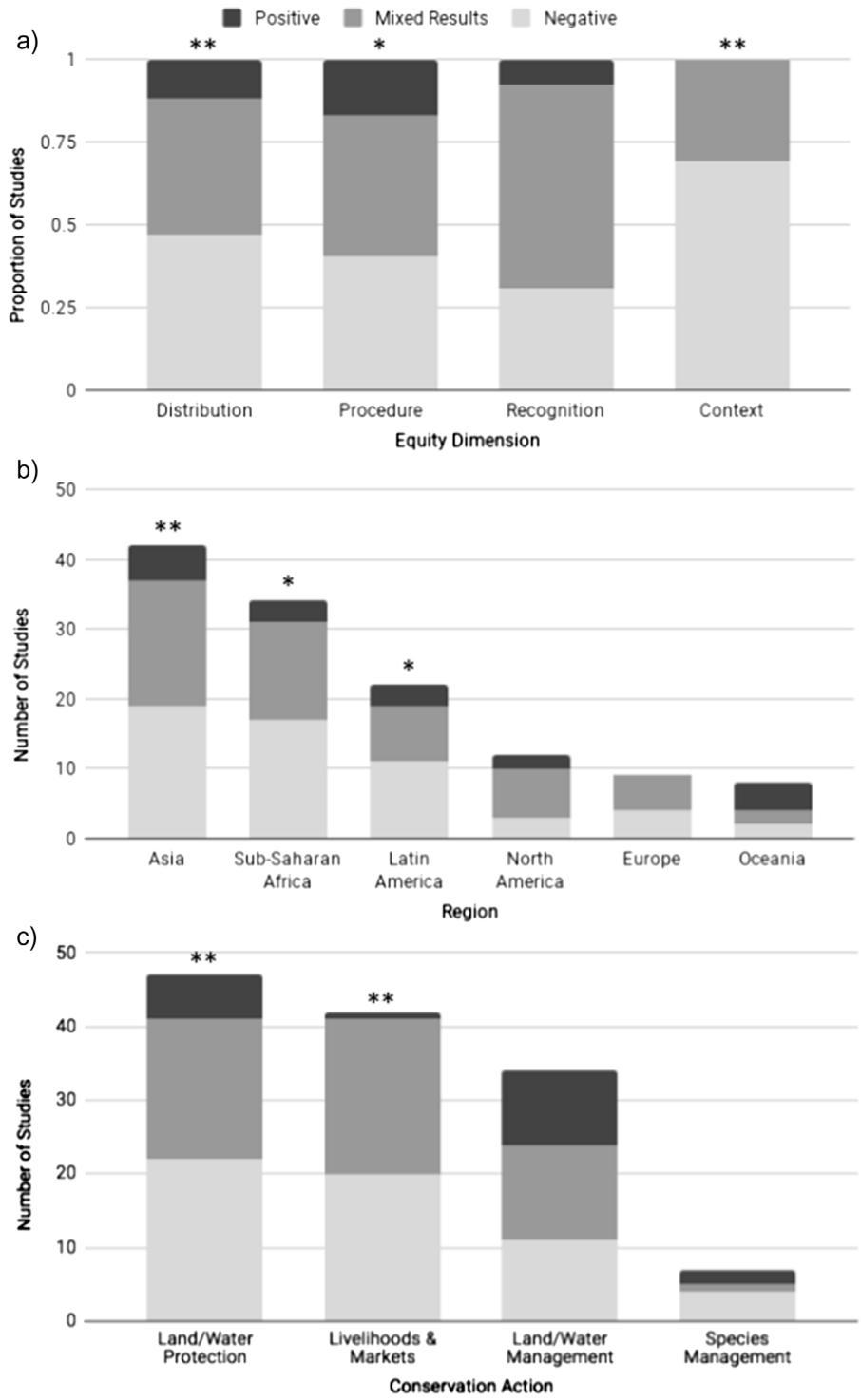

Figure 8. (*a*) conclusions of studies based on which equity dimensions were analyzed. (*b*) conclusions of studies based on geographic region. (*c*) conclusions of studies based on conservation action under study. The asterisk denotes a significant ($* p < 0.05$; $** p < 0.01$) skew toward negative outcomes, rather than equal positive and negative.

be a product of decisions in developing and depicting a study. For instance, the treatment of equity in conservation research seems to have adopted only a fraction of what theoretical frameworks depict as social equity. The majority of literature is framed in terms of distributional equity, reflecting a classical understanding of equity as egalitarian or fair allocation of costs and benefits. This allows for capitalizing on concrete or easily measured indicators, similar to fields of study like ecosystem services assessment (e.g. Martinez-Harms *et al* 2015, Thorn *et al* 2016). Consequently, this review corroborates other observations related to equity within the conservation literature, such as an over-reliance on the monetary and other tangible variables used to assess distributional equity (e.g. Dawson *et al* 2017), which are the easiest to obtain for analysis. Dimensions of equity other than distribution also face disproportionate complications from the

heterogeneous notions of what 'equitable' means in these contexts, making standardization of definitions and measures challenging.

4.1.3. Methodological implications

The multi-faceted nature of equity promotes a variety of approaches to capturing social equity in conservation, yet this also complicates developing standardized indicators and comparing across studies. The inclusion of multiple methodologies in reviewed studies is perhaps indicative of the utility of interdisciplinary approaches to studying conservation and social issues, like equity, in tandem (Hicks *et al* 2010). Single methodology studies more often used qualitative methods, highlighting the need to consider how quantitative data can provide complementary analyses in equity studies, and ensure (where possible) participation of local people to provide further insight particularly for procedural and recognitional dimensions (Bennett 2016). Many studies were retrospective on past conservation interventions, which exhibited a greater proportion of negative outcomes than studies of current phenomenon, raising the question of bias in the critical reflection of past or present studies. Finally, insufficient integration of environmental and social variables makes it more challenging to elaborate on the relationship between equity and conservation (Thorn *et al* 2016), one that has been stated as a primary motivation. While the different results in studies may reflect actual equity circumstances and outcomes, they could also stem from the methods and metrics used to frame and analyze the outcomes.

4.2. Moving the field forward

In order to fill in some of these gaps and move the field forward, we recommend that conservation researchers considering equity should engage with three primary topics: explicitly defining how equity is used in particular studies, clearly stating rationale for considering equity, and better understanding and accounting for trade-offs related to equity in conservation.

4.2.1. Provide clear operational definitions

Studies examining equity in conservation often lack explicit definition of what constitutes equitable distribution, procedure, and recognition. This makes it difficult to determine on what basis to judge success or how to weigh trade-offs between objectives or among stakeholders. Obscured presentation of criteria for 'what is equitable' contributes to this difficulty with definitions and assessment. Clearly supplying definitions upfront in studies is perhaps even more crucial because of the range of ways in which equity is conceptualized. For example, a study of Ecuador's Socio-Bosque program considered two different criteria for distributing incentive payments (evenness and need) as the benchmark for equity (Krause and Loft 2013). The study's transparency in defining equity enabled clear conclusions that the incentive structure did not serve its poverty alleviation objective ('need' criteria) and therefore entrenched local inequities, despite conserving the largest tracts of forest (successful conservation objective). Definitions of equity should reflect the perspectives of multiple stakeholders (Dawson *et al* 2017), the blurred line between human well-being and social equity (Martin *et al* 2016, MEA 2005), and what is considered equitable, may alter over time with changing objectives and shifting baselines in conservation (Mace *et al* 2012, Papworth *et al* 2009).

4.2.2. Clarify rationale for including equity

Study rationale influences how equity is defined, the methods used, and the metrics chosen to assess equitability. Providing clear and explicit motives for considering equity within conservation can facilitate identifying where important objectives (equity or otherwise) might conflict (Law *et al* 2017), and can reveal biases or assumptions implicit in the study. Instrumental motivations (see supplemental material S5) included equity contributing to long-term conservation success (e.g. Bremer *et al* 2014, Timko and Satterfield 2008), building support for conservation (e.g. Baral 2012), or avoiding conflicts (e.g. Clarke and Jupiter 2010). However, data was infrequently presented within studies to support these connections, with a result similar to other studies looking at links between human well-being and conservation (Bennett *et al* 2015, McKinnon *et al* 2016). Furthermore, there was little assessment of causal links between aspects of equity and conservation outcomes, which could provide evidence for the rationales commonly applied to the field (e.g. Miteva *et al* 2015). This may reflect a real gap in our understanding of the connection between social equity and conservation success, and thus an area of future research on social and ecological interactions.

4.2.3. Understand and account for equity trade-offs

The tendency toward mixed results in studies hints at the possible trade-offs resulting from conflicts between dimensions of equity (e.g. Jewitt *et al* 2014, Nieratka *et al* 2015), differing stakeholder perspectives (e.g. McClanahan and Abunge 2016), contrasts between different case studies (e.g. Halpern *et al* 2013), or changes over time (e.g. Poudel *et al* 2015). For example, Myers and Muhajir (2015) made the connection in the case of Bukit Baka Bukit Raya National Park that acceptance of compensation (e.g. distribution of benefits) could legitimize ignoring traditional rights (e.g. recognition). Thus, seemingly equitable benefit distribution might come into conflict with recognition of rights and identity, which were sought and valued more than income from timber harvests. Considering a broader set of equity dimensions and subjects can help make these trade-offs more apparent, and treating equity on a spectrum of getting 'more/less' rather than an absolute 'is/is not' may add nuance for pinpointing areas of improvement for conservation interventions.

Furthermore, explicitly analysing trade-offs can highlight where conflicts or complementarities exist, and help deal with the complexity and multiple perspectives in social-ecological systems (Brown 2004, Hirsch *et al* 2013).

4.3. Linking to policy and practice

Research on social equity and conservation cannot be isolated from the related policy environment and practical applications, which both motivate research and can benefit from lessons arising in studies. For instance, some of the equity in conservation literature has mirrored broad trends of integrating social considerations into conservation policy. The upswing in number of studies in 2009 coincides with elevated attention generally around the UN Framework Convention on Climate Change Conference of the Parties (UNFCCC COP15), and the discussions on social safeguards and equitability emerging at that time with regards to Reducing Emissions from Deforestation and Degradation (REDD+) and other mitigation efforts (Okereke and Dooley 2010). Further, the Aichi targets and the Nagoya Protocol, developed in 2009 and 2010 as part of the Convention on Biological Diversity also implicate social equity and benefits sharing as part of biodiversity conservation efforts (Zafra-Calvo *et al* 2017). Finally, the spike in 2014 aligns with the lead-up to developing the 2015 Sustainable Development Goals, which include considerations for wellbeing and equality (Sachs 2012). Referencing these policies and targeting research for decision-makers and practitioners can help ensure that research results are applied. Further, integrating the results of research on equity back into management is essential for the long-term legitimacy of conservation interventions (Dawson *et al* 2017, Kaplan-Hallam and Bennett 2017).

4.3.1. Future research directions

The results of this review highlight areas for further research on social equity and conservation. Possible future research questions include:

- What are the trade-offs and synergies between different equity dimensions? Under what circumstances or contexts are different dimensions important or necessary to consider?
- How do methods used to study equity introduce bias? What environmental metrics can be incorporated into studies on equity?
- What types of bias are introduced in equity studies based on the experience, background, education of the researchers?
- In what ways do practitioner perceptions of equity differ from stakeholders affected by conservation interventions? What are the external drivers and mechanisms through which equitable or inequitable outcomes are produced?
- What mechanisms can encourage locally driven (nationally-based) research on equity in conservation research?
- What might plausible diverse scenarios to promote social equity in conservation look like? What methods can be used to predict the future impacts of conservation initiatives on equity?

A few caveats to this review also present areas for future exploration on the topic of equity and conservation. Engagement with the grey literature and project evaluations could improve our understanding of how equity is approached by conservation practitioners. Motivations of a study were not always easy to discern; and where rationales of published articles must be taken at face value, it can be unclear whether equity is included to appease the readership or field of study or whether it has actually driven the research. An approach other than systematic review of existing literature may be necessary to understand when and why researchers include equity in studies on conservation. Finally, while we attempted to carry out as thorough and systematic literature search, screening, and review as possible, we recognize there is still an element of subjectivity in determining whether studies met inclusion criteria and interpretation of studies in answering some of the questions posed in our coding framework.

6. Conclusion

This review explored how social equity has been conceptualized and assessed in conservation research, motivated by the recent increase in attention to the topic in conservation policy and practice. While the literature on social equity in conservation is still restricted geographically and means of defining and assessing equity still limited, it is clearly a growing area of research. The review highlights potential bias stemming from who is driving the research on equity in conservation, which can influence how equity is framed, conceptualized, and evaluated. Thus, improving the clarity and explicitly defining what equity means and for whom will improve transparency of claims around the relationship between conservation and equity. Clear definitions will also facilitate constructing studies in ways to best address the equity definition, employing appropriate methods and collecting adequate data. Despite considerable theoretical work on developing these definitions, it appears not to translate yet to applied research. Stating rationales will provide insight into whether studies might focus on certain aspects of equity or tend toward particular types of results. These additions can help indicate how conservation interventions may result in different equity implications, which may complement or conflict with one another, and why.

The push in the international policy space makes the opportunity to develop means of measuring and

evaluating equity outcomes timely and pressing. Yet, it is also critical for studies to be clear from the start about their motivation for considering equity. If studies try to make the case that socially equitable conservation yields more successful conservation, there must be better integration of appropriate ecological/environmental evidence and social measures. More interdisciplinary methods and research teams may provide balance to these perspectives, as well. Overall, it is evident that more attention to defining equity, as well as accounting for what underlies that definition and critically considering whether that best reflects what is equity in context, are valuable and necessary steps forward in linking conservation and social equity, both in research and in practice.

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