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## Empirical assessment of equity and justice in climate adaptation literature: a systematic map

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E-mail: [coggins@ualberta.ca](mailto:coggins@ualberta.ca)**Keywords:** climate change adaptation, climate equity, climate justice, systematic map, literature reviewSupplementary material for this article is available [online](#)

## Abstract

The normative concepts of equity and justice are rising narratives within global climate change discourse. Despite growing considerations of climate equity and justice within the adaptation literature, the extent to which adaptation research has worked to empirically assess and operationalize concepts of equity and justice in practice remains unclear. We employ a systematic mapping approach to examine how equity and justice are defined and understood within empirical climate change adaptation research, and how extensively they are being assessed within adaptation literature. Structuring our work using a conceptual approach focusing on distributional, recognition, procedural, and capability approaches to justice, we document and review articles that included empirical assessments from searches performed in Web of Science™, Scopus®, and Google Scholar™ databases. Our results highlight that greater attention in the literature is given to certain aspects of justice (e.g. distributive and procedural justice concerns) on certain topics such as climate policy and adaptation finance. Most of the included papers scored highly according to our criteria on their empirical assessment of equity and justice. The lowest scores were found for the methodological rigor of assessments. We find limited research on empirical equity and justice assessment and call for a multiscale and holistic approach to justice to address this research gap.

## 1. Background

Climate change is widely regarded as one of the main threats to humanity this century, and considerable impacts are projected even if the ambitious goal of limiting global warming to 1.5 °C is achieved [1]. Reflecting these risks, the normative concepts of equity and justice increasingly appear within the guiding principles, key considerations, and outcome goals of global climate change discourse [2, 3]. For example, equity is a core guiding principle within the Paris Agreement, which highlights the importance of climate justice in responding to climate change [2]. Equity and fairness are emphasized as crucial when considering the unequal distribution

of climate change impacts as well as the disparity between different nations' ability to respond and adapt to these impacts (i.e. between developed and developing nations) [3], and is particularly important for highly vulnerable populations (e.g. indigenous communities, people who depend on agriculture or coastal and marine ecosystems, and inhabitants of small island developing states [3]).

Climate change is addressed through two major strategies: mitigation to stabilize and reduce greenhouse gas emissions, and adaptation to respond to the impacts of climate change [4]. The work of Paavola and Adger [5, 6] initially highlighted the role of justice in climate adaptation by 'bringing attention to the key nature of social vulnerability, broad participation,

and fairness in adaptation planning' [7]. Yet, in comparison to the extensive research on equity issues related to mitigation, the social justice components of adaptation have received limited attention, despite being a central focus in academic and political arenas for the improvement of climate change policy and practice [3, 5, 8].

This research gap is critical given the ethical issues that have arisen in adaptation planning, resilience planning [9], and the political economy of climate adaptation [10–12]. For example, processes that can occur during the implementation of adaptation initiatives (enclosure, exclusion, encroachment and entrenchment) have been found to result in unjust and inequitable outcomes [13]. Further complexity arises as different approaches to social justice 'can have quite different implications for adaptation measures and their outcomes' [5]. An interdisciplinary research agenda has been suggested by Byskov *et al* [9] for the incorporation of justice theories in adaptation planning, with emphasis on the 6th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) [9]. They argue that successful adaptation is not feasible or realistic unless the ethical issues around climate adaptation and resilience planning are addressed and resolved [9].

Despite growing consideration of climate equity and justice within the adaptation literature, it remains unclear as to what extent adaptation research has attempted to conceptually and empirically assess and operationalize concepts of equity and justice. To address this gap, we present a systematic map to characterize empirical assessment of equity and justice within climate change adaptation literature. We use a systematic mapping approach which allows us to undertake robust and transparent assessment guided by the following research questions: how are equity and justice defined and understood within existing empirical climate change adaptation research? How extensively are equity and justice being empirically assessed (qualitatively or quantitatively) within this literature, and how rigorous are these assessments?

## 2. Methods and design

### 2.1. Conceptual approach

In addressing the first research question—how equity and justice are defined and understood in climate adaptation literature—we begin by briefly summarizing different conceptions of justice in order to contextualize our review of how they have been incorporated into more empirically-focused climate literature. We draw on philosophical accounts of equity and justice theory, in particular Schlosberg's theoretical outline

for environmental justice<sup>5</sup> from *Defining Environmental Justice: Theories, Movements, and Nature* [14].

There are many ways to distinguish between different conceptions of justice, and specific philosophical views may combine elements of different conceptions or may be difficult to place within any particular classificatory system. Nevertheless, broad demarcations can be established between different families of views. In particular, we distinguish herein between distributive justice, recognition (or 'relational' equality) approaches, procedural justice, and capabilities approaches (though we note that capabilities can also be seen as a metric for distributive justice rather than a separate account in itself). Schlosberg [14] argues that in political practice, justice can be interpreted as a 'balance of numerous interlinked elements of distribution, recognition, participation, and capability', and that connections between these elements are required for a 'comprehensive' approach to justice [14]. There are numerous views and theories which intersect within these and between these categories.

Distributive justice addresses how welfare, goods, opportunities, and freedoms should be distributed [14]. In other words, distributive justice is about who gets what, or, as Scanlon puts it, 'what we owe to each other' [15]. In Rawls's *A Theory of Justice*, social justice is seen as 'a standard whereby the distributive aspects of the basic structure of society are to be assessed', and defined 'by the role of its principles in assigning rights and duties and in defining the appropriate division of social advantages' [16]. Within the climate context, distributive justice has also been discussed in terms of unjust and inequitable distributions of climate change impacts and vulnerabilities [5].

The recognition (or 'relational') aspect of justice addresses issues of status and acceptance as all individuals should be equal members of a social, moral, and political community [14]. Emerging from the view that theories which focus solely on distribution fail to capture the essence of egalitarian political movements; Anderson [17] argues that egalitarian justice aims to eliminate 'socially imposed' oppression and ensure that individuals hold relative equality to one another [17]. Relational egalitarianism has emerged as a concern alongside distributive approaches in recent decades [18, 19]. As Arneson [18] writes, 'citizens might be unequal in wealth,

<sup>5</sup> We recognize the complex nature and history of philosophical literature surrounding justice and equity theory and acknowledge that there are a diverse range of interpretations, definitions and conceptualizations of equity and justice within this literature that do not necessarily fit neatly into these categories. For instance, corrective, restitutive, cosmopolitan, compensatory, and rights-based justice approaches.

resources, welfare, and other dimensions of their condition, yet be equal in status in a way that enables all to relate as equals' [18]. Taylor [20] and Honneth [21–23] have noted that recognition by others provides a foundation of self-worth, and as such they argue that a 'lack of recognition' is a form of injustice in itself [14].

Procedural justice addresses an individual's ability to participate fairly in equitable political and institutional processes [14]. In the context of environmental justice, Schlosberg argues that 'focus(ing) on the process of justice, including demands for more broad and authentic public participation, is often seen as the tool to achieve both distributive equity and political recognition' [14]. There are distinct connections between recognition and procedural justice in this context; as a lack of recognition adversely impacts an individual's participation within their community and broader political society [14], as discussed by various theorists (see Fraser, Gould, Honneth and Young) [21, 24–26].

The capability approach, developed by Sen and Nussbaum, addresses how distributions impact people's ability to 'function', their 'well-being' and their 'freedoms' [27–33]. Nussbaum's universal list of capabilities includes having: a normal length of life, good physical health, 'bodily integrity' (the ability to freely move and relocate, as well as being safe from assault or violence), the ability to engage socially with others, as well as being able to 'love', 'imagine', 'think', 'play', 'laugh', and 'reason' [31, 34]. It is commonly thought that the capabilities approach provides a metric for distributive justice rather than a distinct view in itself. Others have argued that the capabilities approach connects distributional elements to cultural and institutional aspects that are required for individuals to 'function', thereby allowing for a more broad and holistic approach to justice (see Schlosberg [14]).

Contextualized by this diversity of definitions and interpretations of justice, our systematic map interrogates how climate adaptation research articulates definitions of justice and/or equity and what elements of justice and/or equity are considered in the context of climate change. We further characterize how authors articulate the justice or equity 'problem': what is the explicit or implicit problem underpinning focus on justice or equity, and between whom are gradients in justice observed or presumed?

Our second research question seeks to explore the extent to which justice and equity are operationalized and empirically assessed in the literature. While there is an increasing body of literature contributing to justice and equity discourse in the context of climate change adaptation, we seek to assess the extent to which theoretical discourse is accompanied by empirical application and assessment. Our paper thus focuses exclusively on studies presenting empirical applications of justice and/or equity theory within an adaptation context; this includes

studies that apply social justice frameworks, examine distributions of adaptation finance, evaluate adaptation strategies, conduct analyses to determine how to develop just processes and outcomes, and/or empirically investigate the impacts of adaptation projects and initiatives.

We consider *a priori* that empirical assessment of justice and/or equity will be accompanied by at least some description of assessment methods (e.g. source(s) of data/information, methods or approaches to data collection, and approaches to assessment or analysis). This highlights the centrality of transparent documentation of methods in empirical literature (qualitative, quantitative, or mixed). Barrett argues that 'single scale analysis runs contrary to the subject of climate justice with numerous actors across scales', and that 'multiple interacting scales' need to be considered in order to undertake a more extensive and robust climate justice analysis [35]. Given the extent to which climate change impacts and adaptations interact across spatial and temporal scales, we thus additionally consider the scale(s) at which justice and equity are explored within the literature.

## 2.2. Search methodology

Systematic approaches to literature review involve formal methodological steps to ensure transparency and replicability of the review process, including what literature is considered, how literature is excluded or included, what approaches are used to assess or analyze the literature, and potential sources of bias in results [36]. Systematic maps (elsewhere referred to as scoping reviews) are used to identify knowledge gaps and explore evidence for a broad topic and diverse evidence base [37, 38]. This compares to systematic reviews, which are typically used to collate empirical evidence from a small number of studies for a focused research question. We sought to undertake an exploration of the broad and heterogeneous literature base on adaptation and ethics, with objectives focused on describing the landscape of publishing rather than a narrowly focused research question. Our assessment and scoring of the extent to which studies engage with empirical applications of equity and justice is intended as an exploratory description of the state-of-the-literature for a heterogeneous evidence base rather than a systematic review or meta-analysis [37]. As such, we undertook a systematic mapping approach guided by the ROSES protocol for systematic map reports, to characterize the landscape of literature in this particular field [39, 40].

We focused only on studies that explicitly articulated equity or justice in the context of climate change as their primary focus, and thus only included studies referring to constructs of equity, justice, equality, fairness, and adaptation (and related terminology such as 'rights') within their title. Our systematic map is thus restricted to assessment of literature

**Table 1.** Table of inclusion and exclusion criteria utilized for this systematic map.

| Inclusion criteria   | Exclusion criteria   |
|--|--|
| Articles and reviews   | Books, letters, editorials, reports, book chapters, literature reviews, conference papers, etc.  |
| Papers that include empirical applications and/or assessments of equity or justice. For example:   | Papers that do not include empirical applications and/or assessments of equity or justice. For example:                                      |
| (a) Papers that utilize or apply frameworks for equity/justice.  | (a) Papers that do not go beyond outlining or developing equity/justice frameworks.  |
| (b) Papers that demonstrate an application of philosophical perspectives on justice/equity e.g. through methods, approaches to data collection/assessment or analysis. | (b) Papers that solely discuss justice/equity theory or philosophical perspectives.  |
| (c) Papers that utilize data (qualitative or quantitative) from a novel case study.  | (c) Papers that do not include a novel case study, methodology or analytical approach.   |
| (d) Papers that conduct a review/literature review to support a novel case study, assessment, or empirical analysis.   | (d) Literature reviews or reviews that are not followed by a novel case study or empirical analysis (i.e. are not a primary research study). |
| (e) Reviews that meet any of the above criteria and/or are a primary research study (e.g. analyze/assess adaptation policy or government reports).                     |  |
| All years  | N/A  |
| All countries  | N/A  |
| All languages  | N/A  |

**Table 2.** Search strings developed for this systematic map.

| Search strings  |  |   |
|---|--|---|
| Web of Science™   | Scopus®  | Google Scholar™   |
| TITLE: (*equit* OR *just* OR *equal* OR *fair* OR *right* OR *capabilit* OR *recogni* OR *distribut* OR *procedur*) AND TITLE: (*adapt*) AND TOPIC: (climat*) Refined by: DOCUMENT TYPES: (ARTICLE OR REVIEW) | (TITLE (*equit* OR *just* OR *equal* OR *fair* OR *right* OR *capabilit* OR *recogni* OR *distribut* OR *procedur*) AND TITLE: (*adapt*) AND TITLE-ABS-KEY (climat*) AND DOC-TYPE (ar OR re) | Allintitle: adapt OR adaptation OR adapting climate OR climatic equality OR inequality OR injustice OR justice OR equity OR inequity OR equities OR inequities OR fair OR fairness OR unfair OR unfairness OR right OR rights OR/capabilities OR capability/recognition OR recognize/distribution OR distribute OR distributional/procedure OR procedural |

directly and explicitly relevant to empirical justice-equity-adaptation research, excluding indirectly or tangentially relevant literature. It also excludes the large body of literature focused on equity and justice in climate change mitigation. We limited the search to peer-reviewed articles and reviews. Other types of literature (books, literature reviews, editorials, reports, and conference papers) were excluded to allow for a more focused and in-depth qualitative analysis [36].

Papers that included empirical applications, measurements, or assessments of equity and justice within the context of climate change adaptation literature were included. In addition, articles that demonstrated the application of normative perspectives on equity and justice within climate literature and papers that applied existing equity and justice frameworks

were also included. In order to ensure that consistency and transparency were maintained, a table of inclusion and exclusion criteria guided the selection process (table 1).

Unique search strings were developed to search documents in Web of Science™, Google Scholar™, and Scopus® databases (tables 2 and 3). These three databases are highly recognized databases and have been widely used for systematic reviews. Web of Science™ and Scopus® were selected as they cover a broad range of natural, health, social, and interdisciplinary science articles. In addition to these databases, Google Scholar™ was also used because it covers a broad range of peer-reviewed literature that might not be available elsewhere. Only electronic databases were searched, as most published articles on the intersection of equity and justice in

**Table 3.** Breakdown of the search strings and number of search results for each database. The number of hits for Google Scholar™ represents the total number of unique references captured by the four separate searches (i.e. ‘capabilities OR capability’/‘recognition OR recognize’/‘distribution OR distribute OR distributive’/‘procedure OR procedural’ each at the end of the core search string).

| Database        | Inequality/injustice  | And/or | Adaptation                                  | And/or | Climate                         | Document type     | # of hits |
|-----------------|---|--------|---|--------|---------------------------------|-------------------|-----------|
| Web of Science™ | TITLE: ( *equit* OR *just* OR *equal* OR *fair* OR *right* OR *distribut* OR *capabilit* OR *recogni* OR *distribut* OR *procedur* (TITLE *equit* OR *just* OR *equal* OR *fair* OR *right* OR *capabilit* OR *recogni* OR *distribut* OR *procedur* )  | AND    | Title: (*adapt*)                            | AND    | Topic: (climat*)                | Article or review | 452       |
| Scopus®         |   | AND    | Title: (*adapt*)                            | AND    | Title-Abstract-Key: (climat*)   | Article or Review | 299       |
| Google Scholar™ | Allintitle: equality OR inequality OR injustice OR justice OR equity OR inequity OR equities OR inequities OR fair OR fairness OR unfair OR unfairness OR right OR rights OR/capabilities OR capability/recognition OR recognize/distribution OR distribute OR distributive/procedure OR procedural | AND    | Allintitle: adapt OR adaptation OR adapting | AND    | Allintitle: climate or climatic | All               | 640       |



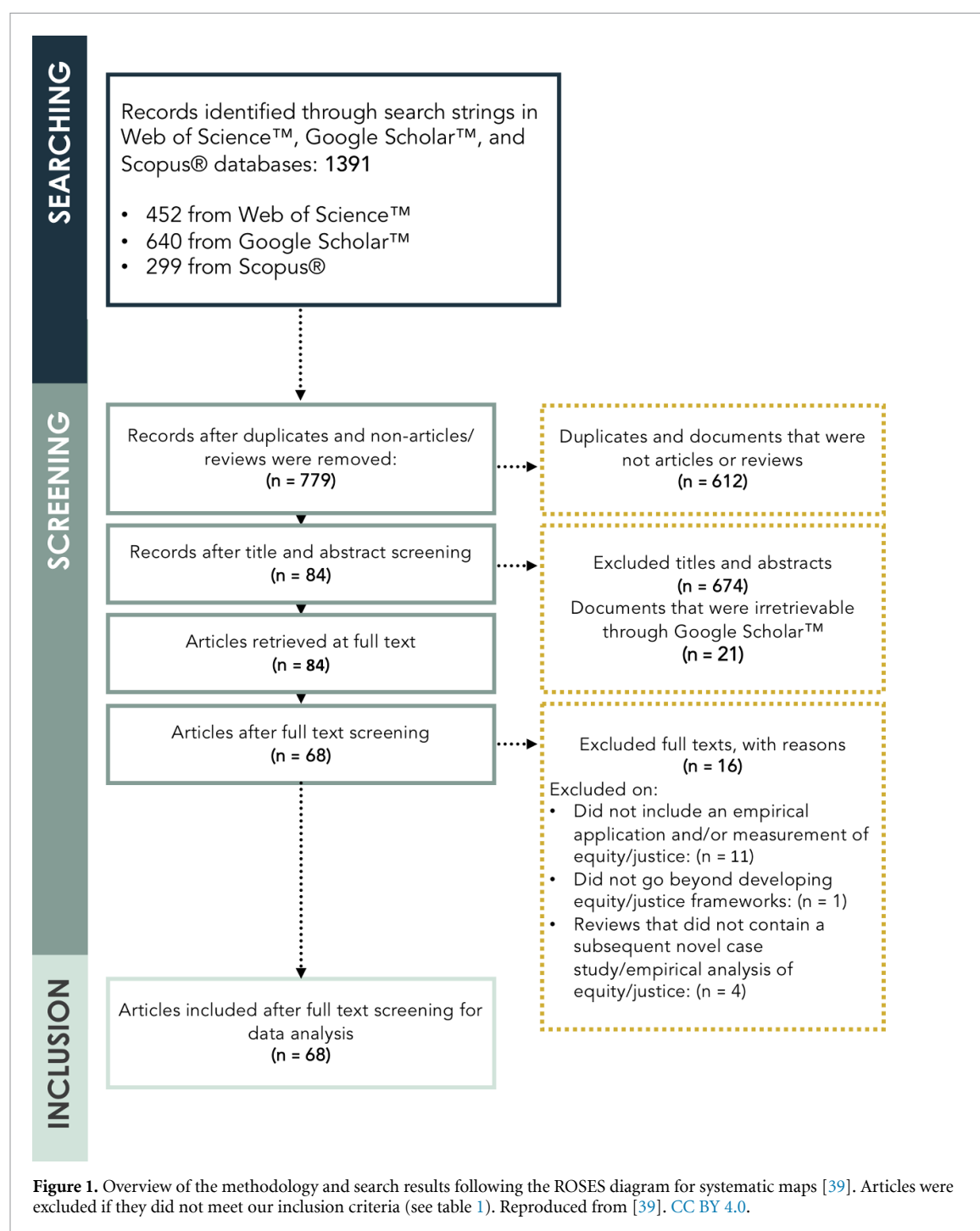
the context of climate change adaptation have been published during time periods when journal articles have been available online. We were not aware of any specialist databases for our topic. The search strings outlined in tables 2 and 3 were developed to capture articles within climate change adaptation literature by selecting for documents with 'adapt'/'adaptation'/'adapting', 'equality'/'inequality', 'justice'/'injustice', 'equity'/'inequity'/'equities'/'inequities', 'fair'/'unfair'/'fairness'/'unfairness', 'right'/'rights', 'capability'/'capabilities', 'distribution'/'distribute'/'distributional', 'recognition'/'recognize', and/or 'procedure'/'procedural' in the titles. For our searches conducted in Google Scholar™, we also searched for 'climate' or 'climatic' terms within the titles of articles as searching by 'topic' was not an option. As Google Scholar™ places restrictions on the length of search strings, we used four separate search strings to accommodate our search terminology (table 2). Articles that were retrieved in more than one of these searches were only added to our reference library once. Google Scholar™ does not permit users to limit the search criteria to specific types of documentation, so additional documents retrieved via Google Scholar™ that were not articles or eligible reviews were removed throughout the screening process.

Searches were conducted in Web of Science™, Scopus®, and Google Scholar™ with each corresponding search string (table 2) on 12 January 2021. A total of 1391 documents were retrieved from the three databases. Seven hundred and seventy-nine documents remained after duplicates and types of documents that did not meet our inclusion criteria were removed using EndNote® ( $n = 612$ ) [41]. The inclusion and exclusion criteria were then applied to screen the titles and abstracts of the remaining documents ( $n = 695$  were excluded). Articles that were captured by our search strings based on their inclusion of 'rights', 'capabilities', 'distribution', 'recognition', or 'procedural' terminology in their title needed to incorporate terms related to 'equity', 'justice', 'fairness' and/or 'equality' within their abstract in order to be included for full-text screening. A total of 84 documents were retrieved for full text screening. References were managed through EndNote® throughout the screening process [41]. Following full text screening, 68 articles met the final inclusion criteria and were included for data analysis and synthesis. Articles that were not in English or Spanish were translated via Google Translate™. At this stage, articles were analyzed by two independent reviewers who recorded data with Microsoft Excel [42]. References that met our inclusion criteria were managed with Mendeley™ Desktop software [43]. A general overview of the methods and search results is depicted in figure 1.

Additional searches were carried out in Web of Science™, Scopus®, and Google Scholar™ (table 4) in order to contextualize our focused review and estimate the extent to which the broader literature engages in discourse on equity and justice in climate adaptation. In contrast to the search strings that were utilized for this systematic map (tables 2 and 3), these additional searches were not restricted to the title or document type, thus capturing documents engaging in climate adaptation and justice/equity discourse, but less likely to focus primarily on this topic. The general and less restrictive search strings outlined below in table 4 resulted in over two million hits, illustrating an approximation of how extensive equity and justice discourse in climate adaptation is within the literature.

### 2.3. Analysis

The 68 included articles were assessed and scored by two reviewers using a rubric of eight questions. These were designed to examine how equity and justice are defined within empirical climate adaptation research and the extent that studies engaged with empirical applications or assessments of equity and justice (table 5). Articles were analyzed in accordance with scoring and assessment guidelines to ensure consistency (see appendix for full codebook (available online at [stacks.iop.org/ERL/16/073003/mmedia](https://stacks.iop.org/ERL/16/073003/mmedia))). Half of the articles were coded by both reviewers where conflicting scores were discussed and resolved and the final assessments and scores were agreed upon by both reviewers. Questions 1.2 and 2.2 in the rubric (table 5) are structured around elements of justice in order to help determine which conceptions of equity/justice are most commonly being engaged with. Question 2.4 (table 5) was designed to reflect upon the scales at which each article addressed equity and/or justice. The questions in the rubric (table 5) are structured as either open-ended responses, categorical responses, or a scored evaluative response. Each of the included papers was reviewed and given a final indicative score between 0 and 10 based on four evaluative questions (questions 1.1, 1.3, 2.1, and 2.3 in table 5). We did not attempt to weight questions' respective scores as to their relevance or importance. Our scoring implies and assumes that robust empirical assessment of justice and/or equity within climate adaptation research will: (a) clearly define what is meant by equity and/or justice, (b) articulate the equity and/or justice problem or goal, (c) apply an empirical assessment that goes beyond provision of examples, and (d) clearly articulate methods of assessment (though not necessarily included as a distinct methods section). Our scores provide a heuristic and preliminary perspective on the extent to which justice and equity theories are considered



within the reviewed papers. Descriptive statistics were used to analyze the article scores as well as our results from the open-ended and categorical questions in our scoring rubric (i.e. questions 1.1–1.3 and 2.1–2.4 in table 5) using Microsoft Excel [42]. In addition, open-coding and memo-writing were used to identify common themes and illustrative examples across articles for the open-ended rubric questions (i.e. questions 1.2, 1.4, 2.2, and 2.4 in table 5). This process was also used to identify general themes or topics for each article.

### 3. Results

#### 3.1. There is limited literature focused on robust empirical assessment of justice and/or equity in the context of climate adaptation

Out of the extensive body of climate adaptation research that takes equity or justice into consideration (table 4), 1391 documents met our search criteria, of which 68 articles (4.9%) met our inclusion criteria. Most of the included papers scored highly according to our criteria by articulating or demonstrating:



**Table 4.** Search strings utilized to demonstrate the larger body of research that addresses equity and justice in climate adaptation literature. The key distinction of this search compared to the initial search (table 2) is that here, we search for all terms within the topic (title, abstract, and keywords) in Web of Science™ and Scopus®, and ‘anywhere in the article’ in Google Scholar™ (where searching by topic is not an option).

| Database        | Web of Science™   | Scopus®  | Google Scholar™  |
|-----------------|---|--|--|
| Search strings  | TOPIC: (*equit* OR *just* OR *equal*)<br>AND TOPIC: (climat*)<br>AND TOPIC: (*adapt*) | (TITLE-ABS-KEY (*equal* OR *just* OR *equit*) AND TITLE-ABS-KEY (climat*) AND TITLE-ABS-KEY (*adapt*)) | Adapt OR adaptation OR adapting climate OR climatic equality OR inequality OR injustice OR justice OR just OR unjust OR equity OR inequity OR equities OR inequities |
| Search criteria | Topic   | Topic  | Anywhere in article  |
| Results         | >12 900   | >7500  | >2450 000  |

an explicit definition of equity and/or justice, the equity/justice problem or goal, an empirical measure or assessment of equity/justice to a major extent, and/or rigorous methodology (table 5). These articles thus reflect a relatively small number of papers that clearly articulated an assessment or measurement of equity and/or justice. The publication dates of these articles ranged from 2010 to 2020. The greatest number of articles were published in 2020 ( $n = 13$ ), followed by nine articles in 2019 and nine articles in 2017. In the included articles, equity and justice were empirically assessed or measured at various scales across 54 countries, in addition to two studies that spanned central Europe and Africa [44, 45].

### 3.2. The justice and equity problems, goals, and where/whom the injustice or inequality existed between varied substantially across articles

The articles addressed a diverse range of equity and justice issues. Examples include: the potential for climate change to exacerbate existing health inequities [46], the ability of communities to respond to both current and projected climate change impacts equitably [8], how the severity of climate impacts and responses to them are influenced by social inequalities [47], how the poor are most vulnerable to climate change [48], inequalities in the governance of water [49], and how the least-developed states experience the greatest impacts from climate change, while developed countries have historically been larger emitters of carbon [50].

The goals of the included articles also varied. For example, one article aimed to ‘assess the health protection potential of selected European climate change adaptation strategies from a critical policy appraisal perspective’ using a social justice lens [46]; while others sought to assess gender inequalities with respect to food security [51] or identify underlying causes of urban adaptation injustice [48]. Other papers aimed

to address research gaps, for instance, one paper investigated the distribution of adaptation finance at the subnational level ‘as a justice issue’, which had not yet been examined [50].

There was substantial variation in the articles regarding whom justice and equity issues existed between and where these issues were present. Six articles considered equity and justice issues between developed or ‘donor’ countries and developing countries or states [52–57]. Other articles examined inequities or injustices between: vulnerable and non-vulnerable districts [50], members of the community and adaptation policies [58], what is addressed within the Paris Agreement and people who are considered as most vulnerable [59], cost and water allocation between river basin stakeholders [60], inequalities between genders (e.g. [61–64]) and inequalities pertaining to vulnerable populations and ethnic or minority groups (e.g. [13, 46, 48, 59, 61, 65–71]).

### 3.3. Engagement with theories of justice and/or equity is mixed

Each article was analyzed and given a final score between 0 and 10 based on our four questions (1.1, 1.3, 2.1, and 2.3 in table 5) that evaluated if papers: (a) defined what is meant by equity and/or justice, (b) articulated the equity and/or justice problem or goal, (c) included an empirical assessment, and (d) clearly articulated methods of assessment. Assessment scores ranged from 5 to 10, with an average score of 8.40 out of 10 for the whole sample of 68 articles (figure 2). The majority of articles defined or articulated what they meant by equity and/or justice explicitly and extensively ( $n = 37/68$ ; 54.4%), followed by articles that defined or described equity and/or justice to some extent ( $n = 28/68$ ; 41.2%).

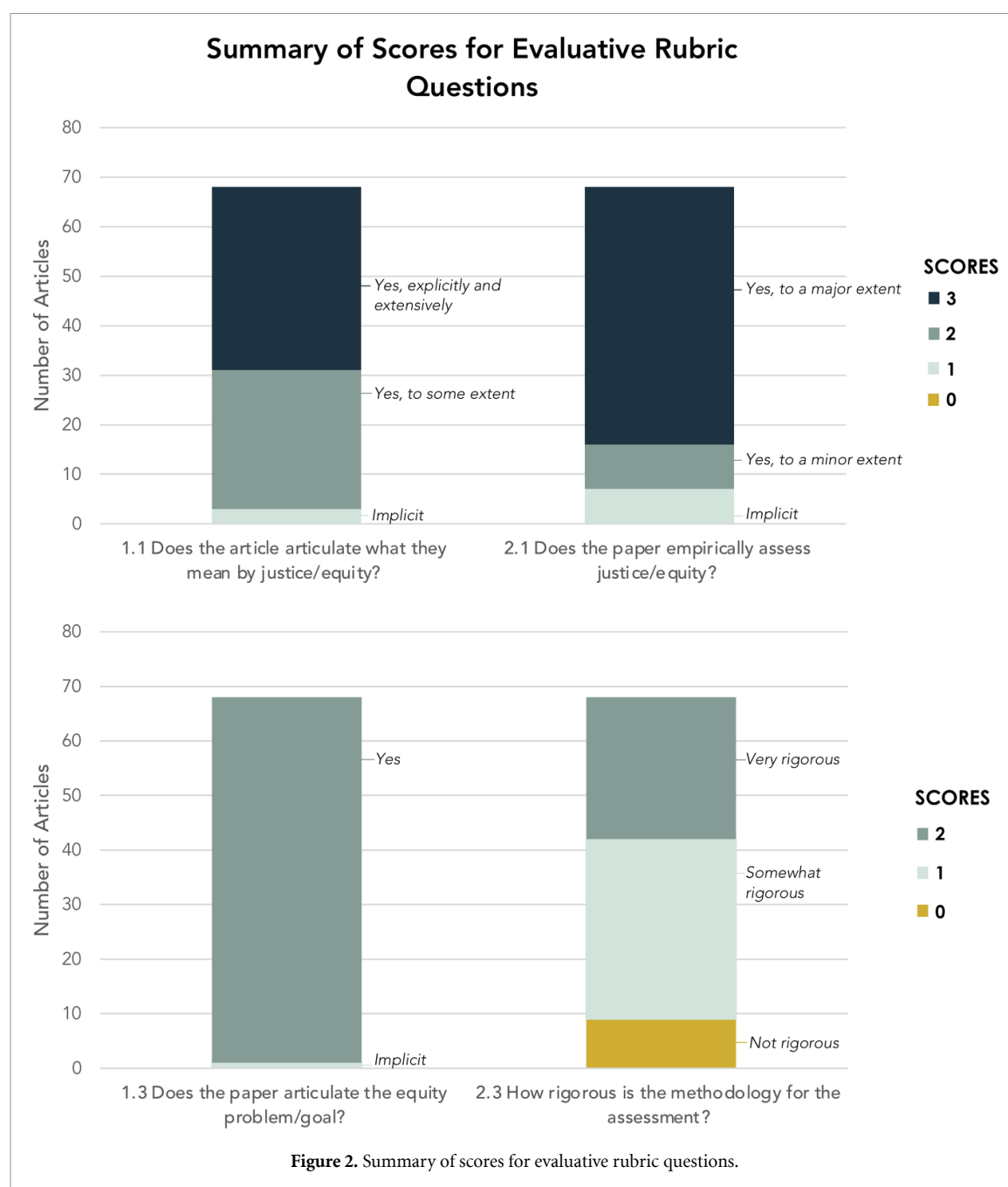
The large majority of articles (52/68; 76.5%) articulated a qualitative or quantitative empirical

**Table 5.** Assessment rubric designed to examine how equity and justice are defined and the extent to which equity and justice are applied or assessed within empirical climate change adaptation literature.

| 1. How is justice/equity defined and understood?  |  | Score |
|---|--|-------|
| 1.1 Does the paper define or articulate what they mean by equity and/or justice? <sup>a</sup> (Select one)  |  |       |
| Yes, explicitly and extensively   | Author(s) explicitly discuss/describe their use of equity/justice.   | 3     |
| Yes, to some extent   | Author(s) define and describe their use of equity/justice to some extent.  | 2     |
| Implicit  | The author(s) imply what they mean by equity/justice.  | 1     |
| Negligible or not at all  | The author(s) do not articulate what they mean by equity/justice.  | 0     |
| 1.2 If so, what does the paper mean by equity and/or justice? <sup>b</sup> (Select all that apply)  |  |       |
| Procedural  | Open ended   | —     |
| Distributional  | Open ended   | —     |
| Capabilities  | Open ended   | —     |
| Recognition   | Open ended   | —     |
| 1.3 Does the paper articulate what the equity/justice problem and/or goal is? (Select one)  |  |       |
| Yes   | Author(s) explicitly state what the equity problem and/or goal is.   | 2     |
| Implicit  | Author(s) implicitly describe what the equity problem and/or goal is.  | 1     |
| Negligible or not at all  | Author(s) do not articulate what the equity problem and/or goal is.  | 0     |
| 1.4 If so, where, between whom, and what?   |  |       |
| Where does the inequality exist?  | Open ended   | —     |
| Between whom?   | Open ended   | —     |
| What does it consist of?  | Open ended   | —     |
| 2. How is justice/equity empirically assessed?  |  |       |
| 2.1 Does the paper empirically (quantitatively or qualitatively) assess justice and/or equity? (Select one)   |  |       |
| Yes, to a major extent  | Author(s) explicitly articulate an empirical measure or assessment of equity and/or justice to a major extent within the paper (i.e. substantial methods or analysis section, or if the empirical analysis is the primary purpose of the article). | 3     |
| Yes, to a minor extent  | Author(s) explicitly articulate an empirical measure or assessment of equity and/or justice to a minor extent within the paper (i.e. a small section is dedicated to the empirical measure/assessment).  | 2     |
| Implicit  | Author(s) describe or mention an empirical measure or assessment of equity and/or justice within the paper to some extent.   | 1     |
| Negligible or not at all  | Author(s) do not articulate an empirical measure or assessment of equity and/or justice within the paper.  | 0     |
| 2.2 If so, what is/are the metric(s) used? (Select all that apply)  |  |       |
| Distributional  | Explicit; implicit   | —     |
| Procedural  | Explicit; implicit   | —     |
| Recognition   | Explicit; implicit   | —     |
| Capabilities  | Explicit; implicit   | —     |
| Comments  | Open ended   | —     |
| 2.3 How rigorous is the methodology for the assessment of equity and/or justice within the paper? (Select one)  |  |       |
| Very rigorous   | The assessment is thorough and highly detailed. i.e. Identifies data sources, data collection mechanisms/strategies, and a detailed methodology or analytic approach.  | 2     |
| Somewhat rigorous   | The assessment is somewhat thorough and detailed. i.e. papers that stated or described what they do, but missing one of the components above, or mention all three components but are not as detailed.   | 1     |
| Not rigorous (limited or negligible methodology)  | The assessment is general and not very detailed. i.e. methods are implied or have very limited detail, implied, or difficult to identify what they did but know they 'did' something.  | 0     |
| 2.4 What scale(s) of inequity does the paper examine/address?—e.g. Between individuals, communities, regions, countries, etc? (Choose all that apply) |  |       |
| Individuals/households; communities/cities; regions/subnational; countries; other.  |  |       |
| Comments  | Open ended   |       |

<sup>a</sup> Definitions and descriptions of equality were scored as equivalent to definitions of equity and justice.

<sup>b</sup> There are many interpretations, definitions, and conceptualizations of equity and justice within the philosophical literature. We categorized conceptions of justice based on the elements of justice outlined in Schlosberg's *Defining Environmental Justice: Theories, Movements, and Nature* [14].



assessment of equity or justice to a major extent (figure 2). For instance, the meetings that occurred during the negotiations for the Kyoto Protocol Adaptation Fund were qualitatively evaluated based on how well they aligned with distributive and procedural justice theories [52]. In another article, interview responses were ‘measured against the criteria for justice and potential mechanisms of injustice’ [48]. Yet, another article examined how adaptation strategies ‘challenged and simultaneously re-entrenched gender and caste norms and practices’ by utilizing data collected during interviews and group discussions [61]. Other qualitative measures included assessing the justice implications of frameworks for an agricultural study in Jamaica [72], using text analytics software to identify concerns of climate

adaptation plans and community groups [7], and utilizing the capabilities approach as a lens to analyze the likelihood of the Paris Agreement to protect capabilities and ‘avert the climate disasters which fundamentally destroy capabilities’ [59]. Some articles also measured equity and/or justice quantitatively. For example, one article used the theory of a global cap and trade regime and integrated assessment models to calculate emissions allowance schemes that equalize climate change costs [56]. Another article used the Country Index of the Notre Dame Global Adaptation Initiative and a framework ‘to measure vulnerability and readiness at the country level’ and explore if equity and efficiency have been accounted for in decisions relating to the distribution of adaption investment [73].

A few articles engaged empirically with equity and/or justice only to a minor extent ( $n = 9/68$ ; 13.2%) (a limited portion of the article was dedicated to the assessment), while seven articles had an implicit rather than explicit assessment ( $n = 7/68$ ; 10.3%). The lowest scores were found for the methodological rigor of assessments. A total of 42 papers out of 68 (61.8%) lacked detail or did not report information sources, data collection methods, and/or analytic approaches (scored as ‘not rigorous’ or ‘somewhat rigorous’, see figure 2).

### 3.4. There is a strong focus on distributional and procedural justice, with less consideration of capabilities and recognition approaches to justice

The greatest proportion of articles included three concepts of justice in their definition(s) of equity and justice ( $n = 23/68$ ; 33.8%), followed by four ( $n = 18/68$ ; 26.5%) and two aspects ( $n = 17/68$ ; 25.0%). The greatest proportion of articles empirically assessed three components of justice implicitly or explicitly ( $n = 21/68$ ; 30.9%). However, it was uncommon for more than two concepts of justice (i.e. distribution, recognition, capabilities and/or procedural approaches) to be assessed explicitly (question 2.2, table 5). For instance, five articles explicitly addressed three aspects of justice in their assessments ( $n = 5/68$ ; 7.4%) while only four articles included all four concepts explicitly in their assessments ( $n = 4/68$ ; 5.9%).

Equity and justice were most commonly defined in terms of distributional concepts of justice (62/68; 91.2%). Distributional justice was also the theory of justice that was most often included in the empirical assessments of equity and justice ( $n = 59/68$ ; 86.8%), where 27 articles addressed distributional justice explicitly ( $n = 27/68$ ; 39.7%) and 32 articles assessed it implicitly ( $n = 32/68$ ; 47.1%). For example, one article addressed issues of distributional justice implicitly by discussing how ‘proportionately fewer funds’ were distributed to people most at risk to climate change impacts [50]. Other articles explicitly defined distributional justice in terms of ‘who experiences harms or benefits’ [74] or as ‘requir(ing) stronger parties to assist weaker ones harmed by climate impacts as a means to achieve greater equality and to lessen injustice ...’ in the context of adaptation funding [52].

Procedural justice was the second most commonly used approach to define equity/justice ( $n = 50/68$ ; 73.5%) and to empirically assess or measure equity/justice ( $n = 46/68$ , 67.6%; implicit:  $n = 25/68$ , 36.8%; explicit:  $n = 21/68$ , 30.9%). For instance, procedural justice is explicitly discussed in one article as being ‘a construct deeply entwined with the idea that a just process is the prerequisite of any legitimate authority’ [52].

Articulation of recognition ( $n = 45/68$ ; 66.2%) and capability ( $n = 28/68$ ; 41.2%) approaches

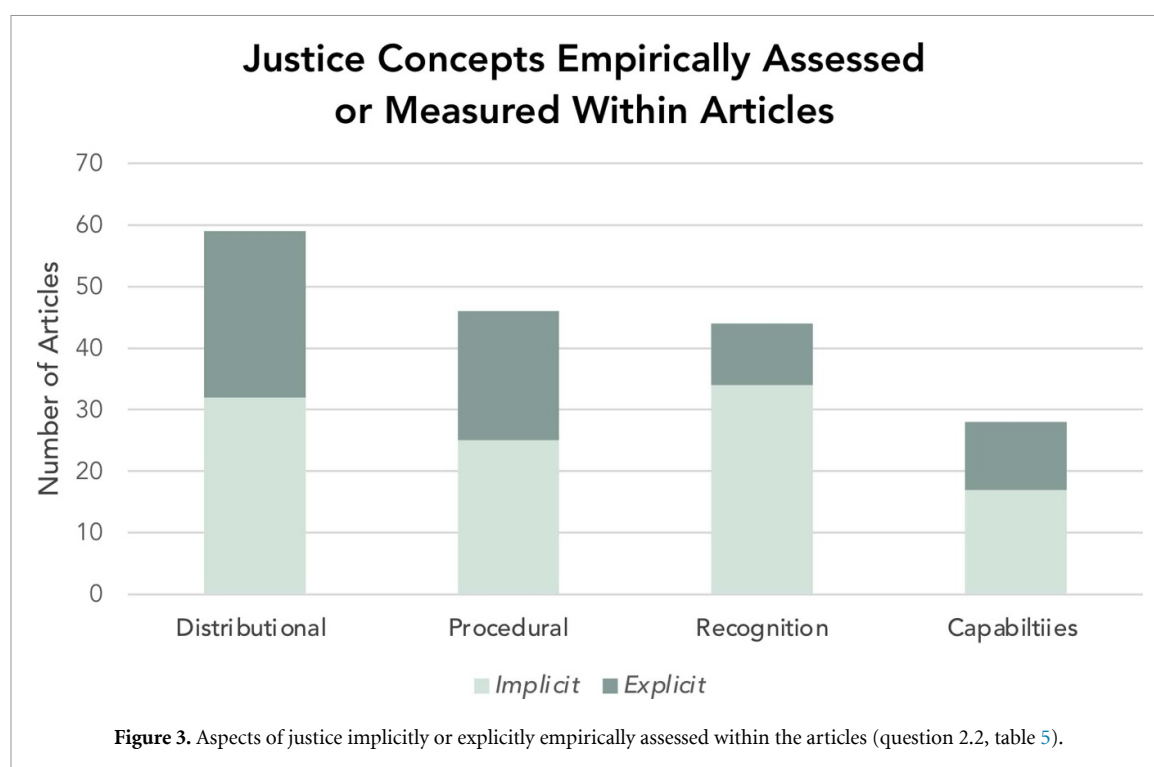
appeared less often in the articles. Recognition was the most common approach implicitly measured or assessed ( $n = 34/68$ ; 50.0%) and inversely, was the aspect that was explicitly measured or assessed the least ( $n = 10/68$ ; 14.7%). The capabilities approach was empirically assessed in 28 articles ( $n = 28/68$ , 41.2%; implicit:  $n = 17/68$ , 25.0%; explicit:  $n = 11/68$ , 16.2%). The capabilities approach was explicitly discussed in one of the articles as the ‘provision of a range of basic needs and processes necessary for citizens to construct a functioning life’ [7]. Another article explicitly referred to recognition in a definition of environmental justice [75], while other articles implicitly considered recognition in terms of gender equality and caste stratification [61], consideration of low-income or disadvantaged communities [65, 66], and prioritizing the needs of vulnerable populations [48]. These results are presented below in figure 3.

### 3.5. Most studies were concerned with justice and equity at the individual/household and community/city level. The majority of studies addressed equity and/or justice at a single scale

Articles most often addressed equity and justice at the community/city ( $n = 42/68$ ; 61.8%), and individual/household ( $n = 20/68$ ; 29.4%) level. The regional/subnational level ( $n = 16/68$ ; 23.5%), country level ( $n = 14/68$ ; 20.6%) and ‘other’ scales ( $n = 8/68$ ; 11.8%) were addressed more seldom. For instance, an article in the ‘other’ category examined the equity of cost allocation across stakeholders at the river basin scale in France [60]. The majority of articles ( $n = 42/68$ ; 61.8%) were concerned with justice at a single scale. A smaller proportion of articles had a multiscale approach ( $n = 26/68$ ; 38.2%): 20 of which addressed two scales of justice ( $n = 20/26$ ; 76.9%) and six articles addressed three scales ( $n = 6/26$ ; 23.1%). It should be noted that two articles written by the same author were both part of a ‘multi-scalar climate justice analysis’; however, they were evaluated as separate articles in alignment with our methodology [50, 71]. The first article focused on the distribution of adaptation finance at the subnational level in Malawi [50] and the second focused on the effectiveness of ‘adaptation finance once it reaches vulnerable communities’ in the context of distributive and procedural justice approaches [71].

### 3.6. Justice/equity assessment is most frequent in studies on adaptation policy, community-level adaptation, and adaptation finance. The definitions of equity and justice varied depending on the topic

The most common topics include: adaptation policy ( $n = 30$ ), community adaptation ( $n = 28$ ), adaptation finance ( $n = 14$ ), adverse impacts of adaptation initiatives ( $n = 13$ ), international adaptation ( $n = 11$ ), gender inequality ( $n = 10$ ), racial, ethnic



and minority groups ( $n = 9$ ), human health ( $n = 5$ ) and other topics ( $n = 6$ ). Most articles addressed more than one topic.

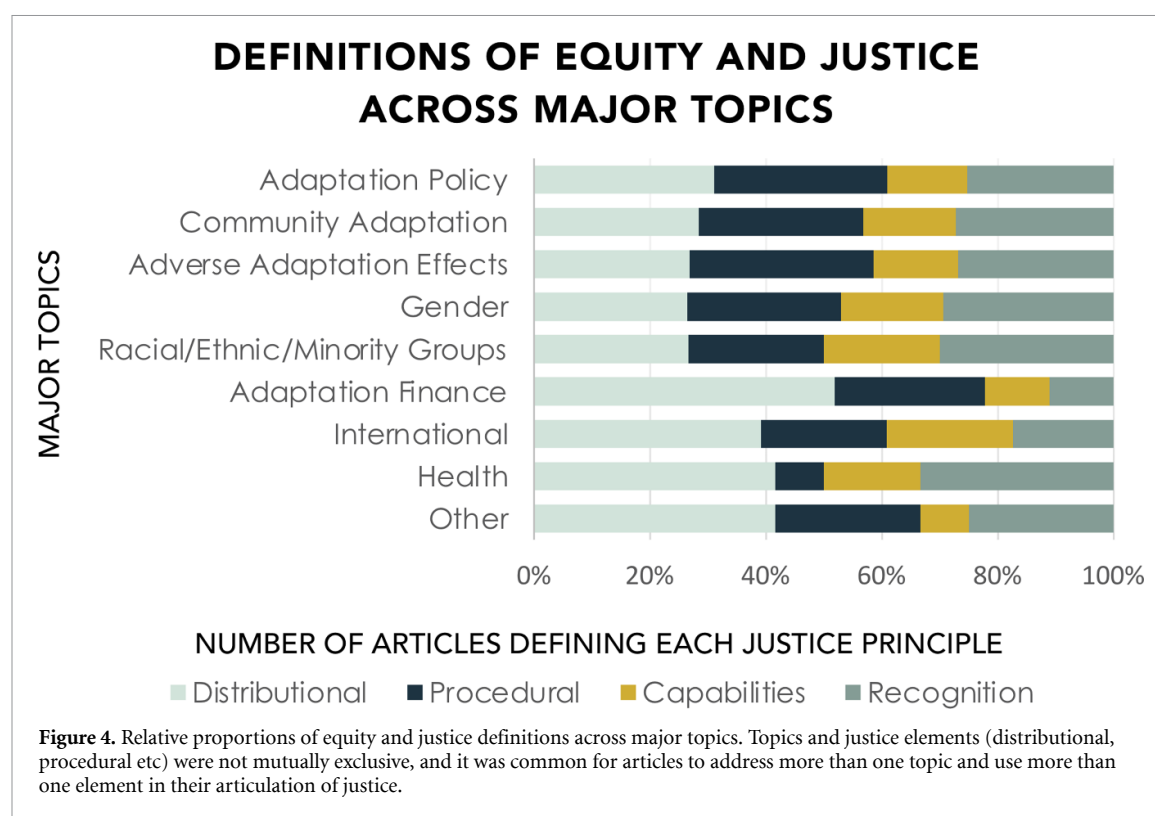
Thirty articles focused on climate change adaptation policy or planning. These included an assessment of policy impacts on social equity and health [65], a critical analysis focused on the likelihood of the Paris Agreement to protect capabilities [59] and an analysis of 'how adaptation plans from C40 member cities address inequality in risk' [76].

Twenty-eight articles examined adaptation in communities and cities. They included articles that examined the extent to which environmental justice principles are being incorporated in water management projects [75], identified adaptation strategies to reduce the vulnerability of communities to climate change impacts [58], and focused on how climate adaptation efforts can result in negative consequences (e.g. increased conflict and insecurity or the exacerbation of inequality) [13, 66]. For example, Anguelovski *et al* discuss how low-income and minority groups can be adversely impacted by urban land-use planning within the context of climate adaptation [66]. Here, injustice is defined in terms of 'acts of commission and acts of omission'. Commission refers to when 'infrastructure investments, land use regulations, or new protected areas disproportionately affect or displace disadvantaged groups' [66]. Acts of omission are defined as 'plans that protect economically valuable areas over low-income or minority neighborhoods, frame adaptation as a private responsibility rather than a public good, or fail to involve affected communities in the process' [66]. Adverse effects of

adaptation strategies or efforts were addressed in a total of 13 articles. One of these articles addressed how adaptation strategies can exacerbate insecurity and conflict by reinforcing class and ethnic hierarchies [13]. Another article discussed how 'adaptation interventions make those who lack resources and power increasingly and disproportionately vulnerable to climate-related risks' [68].

Fourteen articles focused on climate adaptation finance in different ways. One article qualitatively evaluated the meetings that took place during the negotiations for the Kyoto Protocol Adaptation Fund [52]. Here, justice was defined as 'the fair process, which involves all relevant parties, of raising adaptation funds according to responsibility for climate impacts, and of allocating the funds raised in a manner that puts the most vulnerable first' [52]. Other articles on adaptation finance considered how equity has been factored into adaptation investment decisions [73], the distribution of funding at the sub-national level in Malawi [50], and the effectiveness of adaptation funding within vulnerable communities [71]. Eleven articles addressed equity and/or justice in climate adaptation at the international level. Most of these articles addressed global adaptation finance ( $n = 8$ ).

Ten articles addressed gender equity and equality. Nine articles addressed challenges and injustices facing racial, ethnic and minority groups. For example, how 'low-income minority communities have historically borne a disproportionate share of environmental hazards' is highlighted in one article [77]. Another article addresses 'colorblind adaptation planning' by examining 'barriers to participation and



inclusion of African Americans in adaptation planning' in relation to sea-level rise impacting a coastal community in the United States [78]. Five articles focused on human health impacts of climate change and addressed the exacerbation of health inequalities and inequities under climate change. They discussed equity in terms of climate change 'putting pressure on existing inequities' and 'unequally distributed social determinants of health' [46]. Another paper states that 'populations more vulnerable to climate change tend to have higher rates of pre-existing chronic conditions or disability and include groups such as the elderly, children, and those experiencing relative socio-economic deprivation or social isolation' [67]. Here, equity issues relating to health are described as 'what is right, fair, or just based on whether the cause is unavoidable or unnecessary' [67].

Other topics that were addressed include how economic inequality affects how institutions adapt to hazards [79] and the extent to which indigenous knowledge and traditional institutions have been recognized and incorporated in adaptation plans [80]. Although many perspectives on justice manifested in the included articles, one article discussed that 'universal principles of justice state that subjects have a moral right not to suffer from the adverse effects of climate change' [52].

Definitions of distributive and/or procedural aspects of justice were most often used across the majority of common topics, with the exception of articles on gender and/or ethnic, racial, and minority groups (figure 4). These topics were addressed

through the lens of recognition more often than distribution or procedural justice principles (figure 4). With the exception of international and health papers, the capabilities approach was the least commonly used definition across all topics (figure 4).

## 4. Discussion

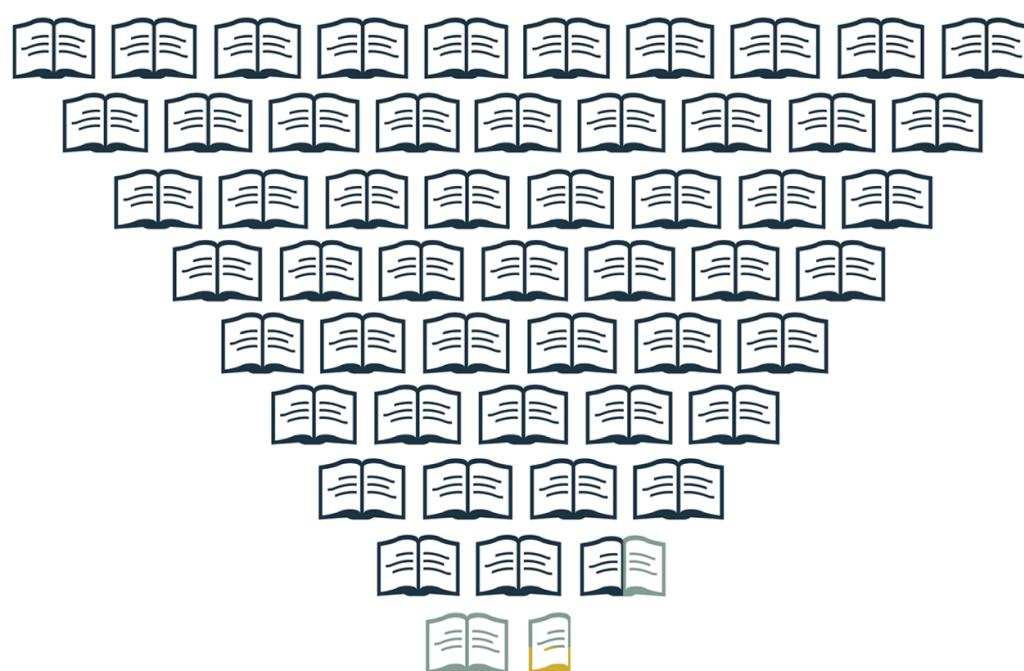
### 4.1. Our findings highlight the limited number of articles undertaking a methodological assessment, particularly with a multiscale approach

The limited empirical work highlighted in our findings contrasts with the substantial volume of climate adaptation literature engaging more broadly with concepts of equity and justice (table 4). For instance, more than 12 900 documents included equity/justice and climate adaptation discourse at the topic level through Web of Science™; of which only 58 articles met our inclusion criteria from this database ( $n = 58/12\ 900$ ; 0.45%) (table 4 and figure 5). Additionally, while many of the >2 M documents from Google Scholar™ that include adaptation and equity/justice terminology will invariably not be focused on this topic (table 4), this highlights a substantial gap between the breadth of interest and discourse on equity and justice in adaptation and the volume of literature directly engaging with operationalization and empirical assessment of adaptation justice.

The relatively small number of articles included in this review that do incorporate an empirical assessment of equity and justice are ad hoc and fragmented



## Articles that Meet Our Inclusion Criteria Compared to the Scope of Climate Adaptation Literature that Addresses Equity/Justice in Web of Science™



 = 250 articles



**Figure 5.** Number of articles that met the inclusion criteria for this systematic map (table 1) compared to the scope of climate change adaptation literature that considered justice and/or equity more broadly from Web of Science™ (table 4).

with respect to their scale (countries, subnational levels, cities, communities, households and individuals), topic, and location. The articles that focused on international adaptation finance were an exception as they addressed the same international scale and broad topic. Even so, they focused on different aspects within the topic of adaptation finance. On average, the included articles defined and empirically measured or assessed equity and/or justice to a relatively high extent according to our criteria. However, it is noteworthy that most of these articles only addressed equity/justice at a single scale and that the multiscale approach has received limited attention. Given the limited proportion of articles undertaking a methodological assessment, particularly with a multiscale approach, it appears that climate adaptation literature is lacking the significant bulk of empirical literature needed to gain deeper insights into equity and justice in climate adaptation.

The fragmented and varied interpretations and use of the ideas of justice and equity as well as

the insufficient implementation of methodological assessment can also help explain the experienced limitations of achieving actual justice outcomes/impacts in adaptation planning and practice. For example, as the majority of articles on justice in adaptation are limited to a community, city or household level and are often not nested within higher spatial scales (e.g. subnational and national drivers of injustice), the danger is that root causes of injustice remain poorly understood or unaddressed (see also, Satyal *et al*) [81]. Equally, if we consider only the international scale of analysis in which the debate centers around who pays for the costs of adaptation, issues of loss and damage or similar aspects of global climate policies [35, 59], ideas of equity and justice may remain only philosophical in nature, lacking specific details and mechanisms to contextualize them effectively in national policies and operationalize in the local implementation (e.g. through National Adaptation Planning processes or Local Adaptation Plan of Actions).

#### 4.2. Different conceptions of justice are present throughout the literature

As outlined in our results, the articles include various conceptions of justice. Some emphasize distributive justice, while others focus on procedural or recognition justice or the capabilities approach. Our results highlight that there is a greater explicit focus on distributional and procedural elements of justice within the literature. In addition, our findings suggest that empirical assessments of justice are featured in certain debates or sectors of adaptation (e.g. climate policy, community level vulnerability, and adaptation finance) more than others, and that certain ideas of justice were applied more often in some sectors than others. For example, distributional and procedural approaches are emphasized within articles that address adaptation finance and/or adaptation policy (figure 4). Recognition features more under the topics of gender and issues facing racial, ethnic and minority groups. This may be because impact assessments take a technical or compartmentalized approach to justice (e.g. the nature of distribution and participation) as compared to delving into more socially-complex issues such as capabilities, recognition, historical injustice and pre-existing discrimination (figures 3 and 4) [81]. The capabilities approach is not the primary justice approach under any topic, however, it features more in the cases of international adaptation efforts and adaptation challenges facing racial, ethnic or minority groups compared to other topics.

Attention to only one form of justice (e.g. distributive justice) at the expense of others, including issues of structural inequities (such as lack of recognition and gaps in capabilities which can curtail potential for adaptation), means only a partial and incomplete effort of operationalizing equity and justice is being implemented. To develop a more comprehensive and nuanced approach to the use of justice concepts, adaptation research should acknowledge that multiple different forms of injustice may be in play in any given situation, and that a full articulation of the problem—as well as a pathway towards resolution—requires identifying and describing these differences. This, in turn, necessitates that empirical research on justice is informed by a well-developed inclusive conceptual framework for recognizing different forms of injustice, drawing on philosophical articulations in order to do so.

It is beyond the scope of the present enquiry to develop a complete framework of this nature, which would go beyond a literature search and engage in an ambitious interdisciplinary approach to equity and justice in climate adaptation, drawing both on philosophical and social science expertise on justice [9]. Nevertheless, we note that some articles that we examined as part of our review contain much richer nuancing in their notions of equity and

justice than is captured by the widely used categories that we commenced with. This suggests that further distinctions within each category have the potential to enrich discussion of justice and equity. For instance, the ‘multi-dimensional framework’ for adaptation justice developed by Satyal *et al* [81] is one example of such an approach.

In addition to achieving greater clarity on the different notions of equity and justice that ought to feature in an overall framework, it is also important for such a framework to understand how different concepts and approaches to equity and justice interact with one another in different contexts and scales. For instance, do they promote each other when implemented alongside one another? Can they be at odds with one another in ways that require them to be traded off with one another in real-life policy and practice decisions? Are they independent and therefore requiring their own efforts to achieve? How these questions are answered will make a significant difference to the kinds of policy intervention that aim to promote justice in adaptation within particular contexts.

Finally, our results indicate that there is a need for research to be strengthened at the subnational and country level, as well as for increased application of a multiscale approach. As previously discussed, while research and discussion on equity and/or justice issues in adaptation mostly focus on a single scale (e.g. individual or local level), these issues need to be situated, translated and integrated into a multiscale framing and analysis to achieve a comprehensive and holistic understanding [81]. In particular, as there is a disconnect between national and local scales due to limited governance institutions and processes at the subnational level, there is a need to make strategic linkages between these scales, such as through multiscale analysis and ‘vertical integration’ in the governance of climate change adaptation (see Ziervogel *et al*) [82].

#### 4.3. Equity and justice approaches in climate change mitigation do not provide a suitable model for climate adaptation

Adger utilizes the example of the 1997 Kyoto Protocol to argue that climate change mitigation is directly connected to climate change impacts and adaptation as adaptation provides ‘incentives for participation and non-participation in the Kyoto process and determine(s) the success of the Kyoto Protocol and the (United Nations Framework Convention on Climate Change) in general’ [83]. He advocates for the integration of adaptation in equity and policy debates ‘because of the integrated nature of the climate feedbacks, adaptation and mitigation at all scales’ [83]. There is substantial literature on equity and justice on mitigation, particularly at the international level, because it lends itself well to grand reflections on

**Table 6.** High level overview of articles that analyzed multiple scales of justice (i.e. distributional, recognition, capabilities approach and procedural justice) and/or scored highly relative to our criteria (see table 5).

| Article title  | Author(s)                        | Topic(s)   | Summary  | Aspects of justice assessed (implicit or explicit)                  | Scale(s) of equity/justice examined in the article   | Score |
|--|----------------------------------|--|--|---|--|-------|
| Uneven socio-ecologies of Hispaniola: asymmetric capabilities for climate adaptation in Haiti and the Dominican Republic [88]            | Mimi Sheller and Yolanda M. León | Community adaptation and international adaptation  | This paper utilizes the capabilities approach to analyze how communities and governments respond to environmental changes (growth of lake surface area) in Haiti and in the Dominican Republic [88]. Data collected via semi-structured interviews is analyzed [88]. | Capabilities and recognition approaches                             | Examines climate justice at the community level (climate impacts, local perceptions of environmental changes, and adaptation strategies), subnational level (response of government/ organizations), and between countries (between Haiti and the Dominican Republic, and international responses) [88]. | 9     |
| Bamboo beating bandits: conflict, inequality, and vulnerability in the political ecology of climate change adaptation in Bangladesh [13] | Benjamin K. Sovacool             | Adverse impacts of adaptation initiatives, community adaptation, adaptation policy, and issues facing racial, ethnic and minority groups | This article empirically investigates (through interviews and a literature review) the adverse effects of climate change adaptation measures in Bangladesh through the processes of 'enclosure, exclusion, encroachment, and entrenchment' [13].                     | Distributional, Procedural, Recognition and Capabilities approaches | This study highlights the 'multi-scalar nature of the political ecology of adaptation in Bangladesh' at the Individual/household, community/city and regional/subnational level [13].  | 9     |

(Continued.)

Table 6. (Continued.)

| Article title  | Author(s)   | Topic(s)   | Summary  | Aspects of justice assessed (implicit or explicit)                  | Scale(s) of equity/justice examined in the article  | Score |
|--|---|--|--|---|---|-------|
| The role of justice in the north-south conflict in climate change: the case of negotiations on the Adaptation Fund [52]                              | Marco Grasso  | International adaptation and adaptation finance  | This article qualitatively assesses international negotiation meetings (Kyoto Protocol Adaptation Fund) based on the extent of their alignment with theories of procedural and distributive justice [52].  | Distributional, procedural, recognition and capabilities approaches | This article focuses on the country level (i.e. between developing and developed countries) [52].                       | 9     |
| A social justice framing of climate change discourse and policy: adaptation, resilience and vulnerability in a Jamaican agricultural landscape [72]. | Jeff Popke, Scott Curtis, and Douglas W. Gamble                     | Community adaptation and adverse effects of climate change adaptation initiatives  | The authors analyze the 'justice implications' of different climate change frameworks through their assessment of an agricultural case study in Jamaica [72].  | Distributional, procedural, recognition and capabilities approaches | This article focuses on the local context and addresses individual/household and community/city levels [72].            | 9     |
| Uncovering climate (in)justice with an adaptive capacity assessment: a multiple case study in rural coastal North Carolina [89]                      | Matthew Jurionas, Erin Seekamp, Louie Rivers III, and Bethany Cutts | Adverse effects of climate change adaptation efforts, community adaptation, and issues facing racial, ethnic and minority groups | This article examines the 'perceptions of adaptive capacity within predominantly African American communities in a rural, low-lying coastal region in eastern North Carolina' and utilizes a climate justice lens to assess an engagement strategy framework [89]. | Distributional, procedural, recognition and capabilities approaches | This article addresses the community/city level (i.e. 'predominantly African American rural coastal communities') [89]. | 10    |

(Continued.)

Table 6. (Continued.)

| Article title  | Author(s)  | Topic(s)   | Summary  | Aspects of justice assessed (implicit or explicit)                  | Scale(s) of equity/justice examined in the article  | Score |
|--|--|--|--|---|---|-------|
| Addressing multi-dimensional injustice in indigenous adaptation: the case of Uganda's Batwa community [81] | Poshendra Satyal, Morten Fibieger Byskov and Keith Hyams | Community adaptation, issues facing racial, ethnic and minority groups, and adaptation policy. | This article utilizes a 'multi-dimensional framework of adaptation-related injustice' for their conceptual approach and conducts semi-structured interviews and focus group discussions to assess injustices facing the Indigenous Batwa community in Uganda [81]. | Distributional, procedural, recognition and capabilities approaches | This study addresses the community/city scale (empirical research with the Indigenous Batwa community) and the regional/subnational level (incorporates analysis of national adaptation plans and policies) [81]. | 10    |

rather clear issues of distributive justice for example between the North and the South and the current and future generations (e.g. Adger *et al*) [6]. When procedural or recognition justice issues are addressed, these also tend to focus on 'grand' issues such as the de facto ability of the states to participate in negotiations on equal footing or whether groups such as indigenous peoples have a recognized status in the negotiations. In contrast, there is no one currency comparable to a ton of carbon emissions or their removal in adaptation: adaptation consists of a myriad of public and private interventions in the form of public policies, services and investment, burden sharing arrangements, private investments and behavior change, for example. These interventions can be taken in a number of sectors and at different or multiple levels. This complexity of adaptation renders it a 'wicked problem', where examination of justice and equity must remain context-specific: Fenton *et al* for example, demonstrate how autonomous adaptation in Bangladesh results in starkly contrasting outcomes even in the same setting among differently situated groups [84].

Within climate change mitigation, justice encompasses 'issues surround(ing) both the historical responsibility for enhancing atmospheric concentrations of the main greenhouse gases and in allocating present and future responsibility for action' [83]. These kinds of clear-cut strategies are not sufficient in the context of the complexity of adaptation. The incidence of climate change impacts varies across space and time and so does exposure, sensitivity and adaptive capacity as the key aspects of vulnerability [85]. Justice in adaptation is not only about impacts and vulnerability: several ways of adapting usually co-exist and they have their own specific implications for distributive, procedural, capabilities, and recognition justice (see e.g. Paavola) [86]. Therefore, although the same principles of justice underlie justice in mitigation and justice in adaptation, it is likely that adaptation will render particular aspects of justice salient, and the types of injustice that prove particularly consequential will vary between the two cases. The multi-faceted equity and justice issues that arise within climate change adaptation require separate attention that accounts for the complexity of adaptation in order for equity and justice issues to be adequately addressed in research, policy and practice.

## 5. Conclusion

Two decades ago, Adger stated that although climate change adaptation is 'of considerable policy relevance and concern [it] has not been effectively assessed to date' [83]. Our findings suggest that the situation has not dramatically changed: limited empirical assessment of equity and justice still persists, despite the rather voluminous broader discourse around justice and equity in adaptation [2, 3, 87]

and emphasis on equity and justice within the IPCC reports [3, 87]. The results of this systematic map indicate that there is a clear research gap in equity and justice assessment within the climate adaptation literature, which particularly calls for research employing a multiscale approach that situates justice at the local level within equity and justice contexts at subnational and national levels. Here, we provide an overview of articles that contain comprehensive justice approaches and/or assessments above in table 6. These illustrative examples can serve as recommendations for future research to help address the identified research gap as they employed multiscale approaches, assessed multiple components of justice and/or scored highly relative to our criteria (reflecting detailed definitions of equity/justice and robust assessments of equity/justice).

The relatively small proportion of reviewed articles that conduct an empirical assessment of equity and justice about adaptation to climate change are rather ad hoc and fragmented in terms of their scale, location, and topic. In addition, our results highlight that greater attention is given to certain aspects of justice (e.g. distributive and procedural justice concerns) on particular topics (e.g. adaptation finance); evidencing an incomplete effort in operationalizing equity and justice within the context of climate adaptation. The interdisciplinary research agenda proposed by Byskov *et al* incorporates ethics and justice theories within adaptation and resilience planning, to ensure that adaptation initiatives consider those most vulnerable to climate change [9]. Given that climate change and adaptation interact across different scales, the relationship between planning and implementation across different levels also should be considered [9, 35]. In order to develop a more comprehensive and nuanced approach to equity and justice in climate change adaptation, the agenda for research, policy and practice on equity and justice issues needs to incorporate not only an interdisciplinary perspective, but also a multiscale and holistic approach to justice that is separate from, but complementary to, climate change mitigation approaches. Indeed, a justice framework comprised of and further defining all four interconnected and inseparable aspects of distribution, procedural justice, recognition and capabilities needs to be applied.

## Data availability statement

The data that support the findings of this study are available upon reasonable request from the authors.

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## Conflict of interest

The authors of this review have no competing interests to declare.

## Authors' contributions

SC contributed to the conceptual approach, methodology, analysis, visualization of results, writing, and editing of the manuscript, LBF contributed to the conceptual approach, visualization of results, methodology, writing and editing of the manuscript, KH contributed to the conceptual approach, methodology, writing, and editing of the manuscript, PS contributed to the analysis, writing, and editing of the manuscript, JF contributed to the writing and editing of the manuscript, JP contributed to the writing and editing of the manuscript, IAR contributed to the methodology and analysis, SH contributed to the conceptual approach, methodology, and editing of the manuscript.

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