

Defining and conceptualizing equity and justice in climate adaptation

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ABSTRACT

Diverse disciplines are contributing to the growing body of evidence exploring the interaction between climate adaptation and justice and/or equity. As a result, the literature lacks consistency in how the terms equity and justice are applied and defined, challenging efforts to synthesize evidence and translate it into policy and practice. This scoping review aims to investigate the diversity of ways in which climate adaptation researchers conceptualize equity and justice and synthesize common frameworks to lend insight into emerging practices and future research needs. Our results synthesize 316 articles and highlight several gaps in the literature with respect to specific climate hazards and social identity groups. The results also indicate that very few scholars define and differentiate between equity and justice, but when they do, issues of scale, affected actors, pathways and normative principles are key components in such definitions. We expand on these themes, arguing that there is little utility in adaptation scholars and practitioners coming to complete consensus on best approaches for studying and evaluating equity and justice. Rather, research needs to address the plurality of approaches by being explicit in their definitions and conceptual grounding. We provide guidance for achieving such clarity in both the study and practice of climate adaptation. Finally, we compare common equity and justice frameworks according to their specific utility and most relevant contexts. We conclude by underscoring the importance of pluralism in how equity and justice are measured and defined as it parallels the diverse contexts in which climate adaptation occurs. The results of our review call for more nuanced investigation and communication of the ways in which equity and justice intersect with climate adaptation.

1. Introduction

The impacts of climate change, once viewed as consequences for the future, are now a present-day reality (Pörtner et al., 2022). Scientific experts and policy makers alike underscore the importance of adaptation (defined as the ‘processes of adjustment to actual or expected climate and its effects’ (IPCC, 2014, pp.5), as a critical tool for addressing the climate crisis (Chu et al., 2019; Shi and Moser, 2021). However, adaptation strategies, whether they be diversified livelihood programs or nature-based solutions, are shaped by the institutional systems from which they emerge and are affected by the same injustices and inequities that shape the rest of society (Paavola and Adger, 2006; Walker et al., 2022). In recognition of these interactions, researchers are paying increasing attention to the equity and justice implications of climate adaptation (Araos et al., 2021; Coggins et al., 2021).

Researchers across disciplines contribute to literature in climate adaptation and social justice and as a result, have relied on a variety of conceptual approaches for investigating issues of justice and equity (J/E). Interdisciplinary scholarship is an important approach for understanding complex issues from multiple angles but can also create a body of work that uses different terminology to discuss similar constructs (Palmer et al., 2016) or has unclear gaps in the knowledge and is difficult to summarize (Turner et al., 2015). Simultaneously, policy makers and practitioners require clear guidance and concrete strategies for translating science into policy and practice (Antonopoulou et al., 2021). Scholarship can play an important role in propelling this work, but disjointed and ambiguous literature creates a barrier for such translation of science into practice. This study seeks to help address this issue by reviewing and synthesizing how scholars are conceptualizing J/E. We identify and discuss the diversity of theoretical framings that scholars

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have applied by systematically reviewing the literature focused on the J/E in the context of climate adaptation. We further discuss the implications for adaptation scholars and practitioners.

1.1. Climate justice

Issues of J/E are central to understanding how the climate crisis impacts communities around the world (Sultana, 2022). The reality that ‘those least responsible for the crisis are most vulnerable’ and subsequent discussions about ‘who has the right to continue to emit versus who as the responsibility to mitigate emissions’ has dominated the discourse on climate justice (Burnham et al., 2013; Okereke and Coventry, 2016). More recently, research focused on evaluating the J/E impacts of climate adaptation strategies has gained traction as an important aspect of climate justice (Coggins et al., 2021; Owen, 2021).

Regardless of focus on adaptation to impacts versus mitigation of emissions, climate change scholars rely on a variety of definitions and frameworks of J/E, resulting in a need for literature syntheses providing clarity on how and when such conceptual tools overlap. Thomas and Twyman’s broad definition of climate justice is one of the most frequently cited: “equity and justice, or ‘fairness’, in climate change can be considered in terms of processes, which largely relate to emissions issues, and outcomes, which relate to impacts, vulnerability and adaptation” (2005, pp 116). In this review, we rely on this broad definition to capture the plurality of ways in which J/E equity are conceptualized and investigated in the climate adaptation literature. We argue the results of this review provide additional definitional considerations and discuss this at length in the proceeding paragraphs.

Much of the work investigating the climate crisis from a justice lens applies the seminal work of David Schlosberg, who presents a multidimensional framework of environmental justice (2004). This commonly referenced framework categorizes environmental justice into three dimensions: the distribution of costs, risks, and benefits (distributional justice); the meaningful inclusion of affected groups in decision-making (procedural justice); and the acknowledgement of the well-being, knowledge, and perspectives of affected groups as valued members of society (recognitional justice). Schlosberg’s trivalent approach to justice has been widely used in climate and environmental spaces and has been adapted and expanded by other scholars to include structural justice, the recognition of institutions and systems that shape people’s ability to participate in decision-making processes (Law et al., 2018; McDermott et al., 2013). While this framework is popular among scholars, minimal scholarship has attempted to clarify its relationship with other justice frameworks and its overlap with the concept of equity. For example, in work by Bulkeley et al. studying climate change impacts in urban contexts, the authors discuss the distributional and procedural aspects of justice, but also use rights-based and corrective approaches to conceptualize justice (2013). Work by McDermott et al. uses an adapted version of Schlosberg’s trivalent approach in the context of ecosystem services and uses the term equity rather than justice as the key construct (2013). The application of multiple conceptual approaches can increase the nuance with which adaptation scholars collectively investigate justice and equity issues. However, further investigation into the linkages and distinctions between approaches is needed before more nuanced understandings of these various approaches can be effectively applied.

1.2. Interaction between climate adaptation and issues of justice and equity

As scientists and policy makers increasingly recognize adaptation as a critical strategy for addressing climate change impacts (Chu et al., 2019; Shi and Moser, 2021), significant literature has started to document the ways in which J/E issues interact with climate adaptation. This body of work demonstrates how historically marginalized communities are subject to pre-existing inequities that increase vulnerabilities and limit adaptive capacity (Antwi-Agyei et al., 2021; Maru et al., 2014).

Scholarship in the fields of public health (i.e. Boeckmann and Zeeb, 2016), urban planning, (Anguelovski et al., 2016) and rural agriculture (i.e. Alston et al., 2018) have played an important role in documenting this interaction. Research has also shown that adaptation strategies not grounded in J/E considerations can unintentionally exacerbate or create new inequities (Coggins et al., 2021; Araos et al., 2021; Peck et al., 2022), resulting in maladaptation (Bertana et al., 2022).

The J/E implications of adaptation strategies have been studied at different scales, geography contexts, and thematic areas. Adaptation finance is one field in which this is evident, with numerous recommendations on just and equitable adaptation funding distribution in the literature (Barr et al., 2010; Grasso, 2010; Persson and Remling, 2014). Specifically, Grasso centers distributive and procedural justice in funding allocation, with prioritization of those most vulnerable to the impacts of climate change. Adaptive capacity has similarly been studied with a J/E lens, with a focus on gender (Bhattarai, 2020; Rao et al., 2019), urban planning (Kokx and Spit, 2012) and agriculture (Abah and Petja, 2017). Rao et al. and Bhattarai focus on gender in the contexts of women’s agency in Asia and Africa and community forestry in Nepal, respectively. Themes of equity and justice emerge in adaptation policy and governance as well, exemplified by Brockhaus et al.’s work on climate change policies in the Global South (2021) and Mach et al.’s literature on managed retreat in the United States (2019). While these studies are just a small representation of the significant amount of work conducted on this topic, they underscore the diversity of contexts in which climate adaptation and J/E have been discussed.

Only a small number of studies have attempted to review and synthesize different aspects of research on the nexus of adaptation and J/E. In their review, Coggins et al. investigate the literature empirically assessing the J/E implications of climate adaptation strategies (2021). They assess 1) how J/E are defined within empirical research, and 2) how extensively and rigorously J/E are assessed within this literature. This study includes 68 empirical studies, highlighting a significant gap between the number studies that discuss the J/E implications of adaptation ($n = 1391$), and the number that empirically assess it ($n = 68$). Coggins et al. deductively apply a combination of Schlosberg’s justice typology (2004) and the capabilities approach associated with the work of Nussbaum (2000, 2003) and Sen (1993) to guide their analysis. Another review by Araos et al. (2021) focuses on empirical studies discussing adaptation responses, separating articles into adaptation planning versus implementation. The authors find that 52 % of the adaptation planning literature considers issues of J/E while 59 % of the adaptation implementation literature considers J/E. Further, in both the planning and implementation studies, income and gender are the most common social identities studied or discussed. Like Coggins et al. (2021), Araos et al. (2021) apply Schlosberg’s justice framework, but only consider distributional and procedural justice in their analysis. Other reviews with more specific scopes, such as adaptation planning in urban contexts (see Swanson, 2021) or inclusive approaches to adaptation (see Pham and Saner, 2021), have also been conducted in recent years.

Previous scholarship reviewing this literature provides a critical foundation for reaching clarity on how J/E frameworks can be used to achieve more ethical and effective climate adaptation. However, several key questions remain. First, how does the literature beyond the scope of empirical assessments contribute to our collective understanding of the J/E approaches most relevant for studying and facilitating adaptation? Second, what other frameworks or conceptual tools are being applied in this literature, and what are the linkages and distinctions between them and the most common frameworks (i.e., Schlosberg, Sen, Nussbaum)? To address these remaining gaps, our review broadly includes peer-reviewed literature focused on climate adaptation and J/E and we take an inductive approach to analyzing how scholars define J/E. The specific research questions that guide this review are: 1) What are the publication trends in climate adaptation and J/E scholarship – specifically, what social identities, climate hazards, and geographic contexts

have been studied, and using what types of data and methodological approaches? 2) How do climate adaptation scholars conceptualize and define J/E? 3) Do scholars make a distinction between the terms justice and equity? 4) What theoretical frameworks do climate adaptation scholars use to guide their work?

2. Methods

2.1. Article search and inclusion

We conducted a scoping review in concordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines (Tricco et al., 2018). We searched the following databases: Dimensions (via CU Boulder subscription), Environment Complete (via EBSCO), Social Sciences Full Text (via EBSCO), Web of Science (via Clarivate). The search was conducted by a professional systematic review informationist and included a mix of keywords and subject headings representing ‘climate adaptation’, ‘climate mitigation’, ‘equity/inequity’, ‘justice/injustice’, and others. The search had no time limitations and was completed in May 2022. Articles were limited to those written in English language. Studies that were not published in academic journals were excluded. Reproducible search strategies can be found in the [Supplemental Materials](#).

The searches yielded a total of 6031 citations across all the utilized databases. All citations were imported into the online screening platform Covidence (Cochrane) via EndNote (Clarivate). Duplicate citations ($n = 712$) were automatically identified and removed by Covidence. Each article was independently screened by two reviewers during each stage of the screening process. A team of four reviewers screened references by title and abstract removing irrelevant articles ($n = 4509$). [Table 1](#) outlines this screening criteria. All disagreements were adjudicated by a third reviewer. Full-text articles ($n = 801$) were screened by a team of five reviewers ([Table 1](#)) and again, all disagreements were adjudicated by a third reviewer. The full-text screening excluded 485 studies, leaving 316 studies included in our review. Before screening, all reviewers pilot screened approximately 38 articles to reach a Fleiss’ kappa value of 0.79 (Fleiss, 1971). Study selection is presented in a PRISMA flowchart ([Fig. 1](#)).

Table 1
Inclusion/exclusion criteria.

Criteria for Inclusion	Criteria for Exclusion
1. Peer-reviewed journal article.	1. Articles that focus only on the impacts of climate change (and not adaptation).
2. Explicitly uses the words J/E and they must be a main focus of the paper, (i.e., terms need to be in more than just the introduction or conclusion AND need to be a variable of interest OR a key theme of the paper)	2. Articles that focus only on reducing carbon emissions (climate change mitigation)
3. Focus on climate adaptation – defined as the adjustment to actual or expected climate change impacts. Authors must use adaptation/adaptive terminology.	3. Articles that focus on a vulnerable or marginalized groups where J/E may be relevant, but the authors don’t articulate how J/E are related to climate change adaptation
4. Discusses the concepts of adaptation and equity in relation to each other – i. e., how equity/inequity influences adaptation or how adaptation influences equity/inequity or other interaction.	4. Articles that talk about vulnerability assessments, or resilience but don’t study adaptation.
5. Available in English	5. Articles that talk about natural disasters but do not describe them as linked to climate change.
	6. Book chapters, thesis, dissertations, conference abstracts, white papers, and professional reports.

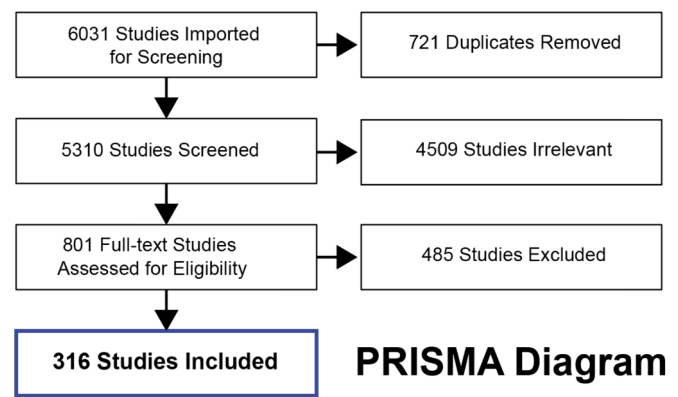


Fig. 1. PRISMA flowchart.

2.2. Data extraction of included articles

Data extraction of the included articles ($n = 316$) was completed by 6 reviewers. Data from each article was extracted by one reviewer and checked for errors by a second reviewer. [Table 2](#) outlines the variables extracted. The team of reviewers achieved intercoder reliability by collaboratively practicing extraction, comparing decisions, and discussing any discrepancies. The team practiced coding articles in sets of ten until all reviewers were consistently extracting the same text. The team practiced extraction on 30 total articles.

2.3. Data analyses

Descriptive statistics were conducted in R statistical software (R core team, 2022) to answer research questions about publication trends, adaptation foci, climate change hazards, social identities, geographic context, scale, and study design. For study aim, text extracted from each article was deductively coded using qualitative thematic analysis (Braun and Clarke, 2006). A list of study aim themes was created, and articles were subsequently categorized into these themes. For social identity

Table 2
List of variables extracted from articles.

Extraction variable	Description
Journal Discipline	Description of disciplinary focus on journal’s website
Publication date	N/A
Aim of study	Sentences extracted from the article that uses “this study aims to,” “the goal of this study,” “the purpose of this article,” etc.
Type of data collected	Primary, secondary, systematic, or scoping review, conceptual <i>Articles could be coded as multiple</i>
Study design	Quantitative, qualitative, mixed methods, no data <i>Articles could be coded as multiple</i>
Geographic focus	Continent where data was collected <i>Articles coded as ‘global’ if multiple continents were included</i>
Geographic scale	Local (smaller than national), national, or international <i>Articles could be coded as multiple</i>
Climate change hazard	Air quality, disease vector, drought, extreme heat, flooding, general climate hazards, sea-level rise, storms and hurricanes, wildfire <i>Articles could be coded as multiple</i>
Social identity group implicated	Age/generation, gender, disability, LGBTQ+, nationality or migration status, previously colonized country, race and ethnicity, religion, socio-economic status, vulnerable or historically marginalized groups more broadly, other <i>Articles could be coded as multiple</i>
Equity defined	Term not used, term used but not defined, term defined
Definition of equity used	If defined, text extracted that defines term
Justice defined	Term not used, term used but not defined, term defined
Definition of justice used	If defined, text extracted that defines term

groups, the exact phrasing used in the article to describe the social group was extracted and used to confirm the initial categorization made by reviewers. When appropriate, articles were coded in more than one category to address the complexity and intersectionality of social identities.

To investigate definitions of J/E, and distinctions between definitions, we conducted a multi-step mixed methods analysis. During the extraction phase, coders looked for the use of the term ‘equity’ or ‘justice’ in each article, and an explicit definition following the use of the term. For both J/E, articles were then subsequently coded as ‘*did not use the term*,’ ‘*used the term but did not define*,’ or ‘*used and defined term*’. For the articles coded as ‘*used and defined*’, all definitions for both J/E were extracted. Next, two lists of definitions (one for equity and one for justice) were thematically coded separately for definition components using the six-step processes outlined by Braun and Clarke (2006) using the qualitative analysis software NVivo (QSR International, 2020). Finally, the dataset was filtered for articles that defined both J/E, and definitions from these articles were used in a comparative analysis (Bazeley, 2013) looking for any distinctions authors made between the definitions of the two terms.

In addition to analyzing the J/E definitions used in climate adaptation literature, we also explored the most common frameworks authors referenced when defining J/E. Each time an article defined the words ‘justice’ or ‘equity’, we extracted the references used in the definition. We then looked at frameworks that were referenced by multiple articles and conducted a comparative analysis of these frameworks using the themes that emerged from our thematic analysis of the J/E definitions.

3. Results

3.1. Article publication trends in study design and focus

In total, 316 studies met our inclusion criteria. A tabular dataset including the search terms, excluded, and included articles can be found at an online repository at <https://doi.org/10.25810/n7ny-my85>. Of the 316 included articles, over 36 % (n = 114) were published in journals self-described as interdisciplinary. The earliest article included was published in 2001, and publication frequency substantially increased over the course of the next 20 years, nearly doubling between 2020 and 2021 (see Fig. 2).

We also extracted information about study design and type of data used in each article. 42 % of papers were conceptual (n = 135), 32 % relied on primary data, 20 % (n = 63) utilized secondary data and a remaining 17 % (n = 54) conducted a systematic or scoping review of pre-existing literature. A significant number of papers did not rely on any data (40 %, n = 129), while 31 % (n = 98) employed qualitative methods, 21 % applied mixed methods (n = 66), and another 7 %

(n = 23) used quantitative methods.

The articles focused on a variety of adaptation themes. The most frequent theme, representing 35 % of articles, presented conceptual or theoretical framings for understanding adaptation without a specific adaptation context, followed by 20 % focused on policy and governance issues and 19 % discussed the evaluation of adaptation outcomes. Fig. 3 illustrates the distribution across of study aim themes.

Most articles discussed climate change hazards generally (71 %), while 20 % focused on flooding, 14 % on sea-level rise, 10 % on extreme heat and another 10 % on drought. Strikingly, only 1 % of papers focused on either wildfire or air quality hazards related to climate change (See Fig. 4). A similar pattern emerged around social groups implicated in the J/E issues. Most articles (59 %, n = 188) used broad language such as ‘vulnerable’ or ‘historically marginalized’ groups. With respect to specific social identities, socio-economic status and race/ethnicity were most commonly addressed, comprising 26 % (n = 82) and 15 % (n = 47) of articles, respectively. Social identities such as age, gender, nationality/migration status (including some literature on informal settlements), Indigeneity, and colonial history were also observed in several articles, whereas religious and LGBTQ+ identities were discussed in very few articles (see Fig. 5). Articles were also analyzed for geographic scale and location. 49 % (n = 150) investigated climate change adaptation locally, 15 % (n = 47) nationally and 36 % (n = 112) internationally. North American and African contexts were the most frequently discussed (see Fig. 6).

3.2. Defining equity and justice

Regarding the use of the term ‘equity,’ 18 % (n = 56) of articles used and defined the term, 66 % (n = 208) of articles used the term but did not explicitly define it and 16 % (n = 50) did not use the term at all. Contrastingly, 38 % (n = 119) of articles defined the word ‘justice,’ 45 % (n = 142) used the term but did not define it and 17 % (n = 55) of articles did not use the term justice at all (see Fig. 7).

The included articles used a variety of definitions and conceptual framings to define J/E. However, authors consistently relied on several component themes in their definitions. These components included the *actors affected* by the J/E issue, the *scale* of the issue, the *pathway(s)* of the equity/justice issue and the normative *principle(s)* used as criteria for J/E (see Fig. 8).

Affected Actors. In nearly all definitions of J/E, authors explicitly mentioned the various social groups involved in or affected by the climate adaptation issue. Many articles discussed *affected actors* broadly, and others focused specifically on a single, or a few, social identity groups. Some articles defined equity or justice using a comparison of two groups, such as current vs. future generations (McGinlay et al., 2021) or Global North vs. Global South (Chen et al., 2018). Conversely, other

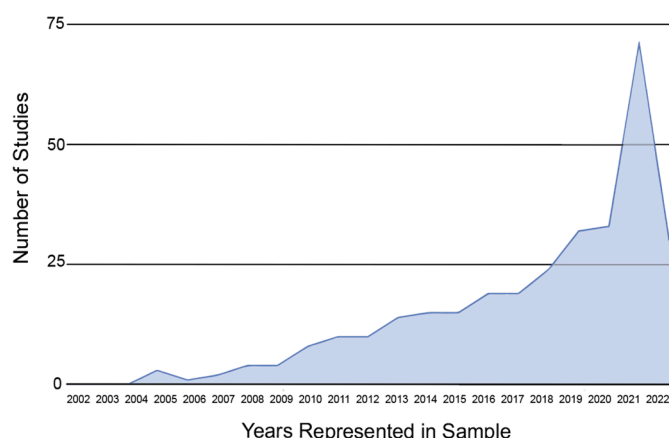


Fig. 2. Article publication frequency by year.

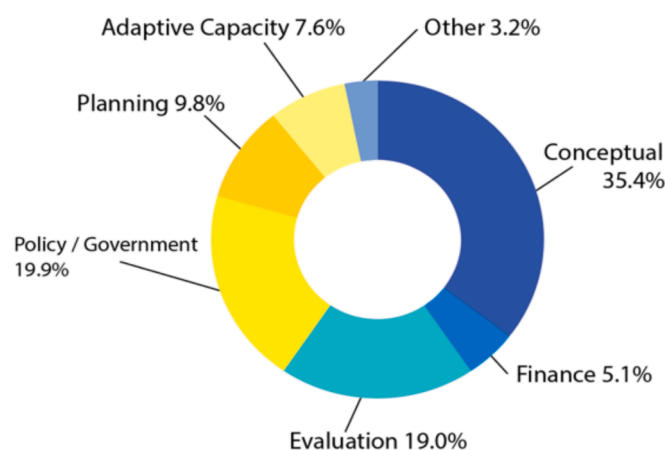


Fig. 3. Distribution of study aim themes of included articles.

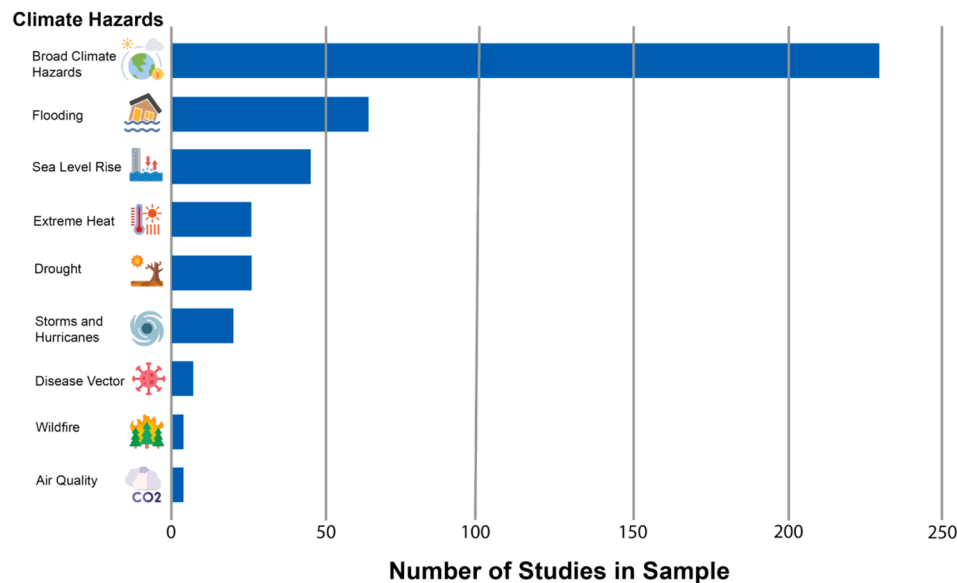


Fig. 4. Distribution of types of climate hazards studied in included articles.

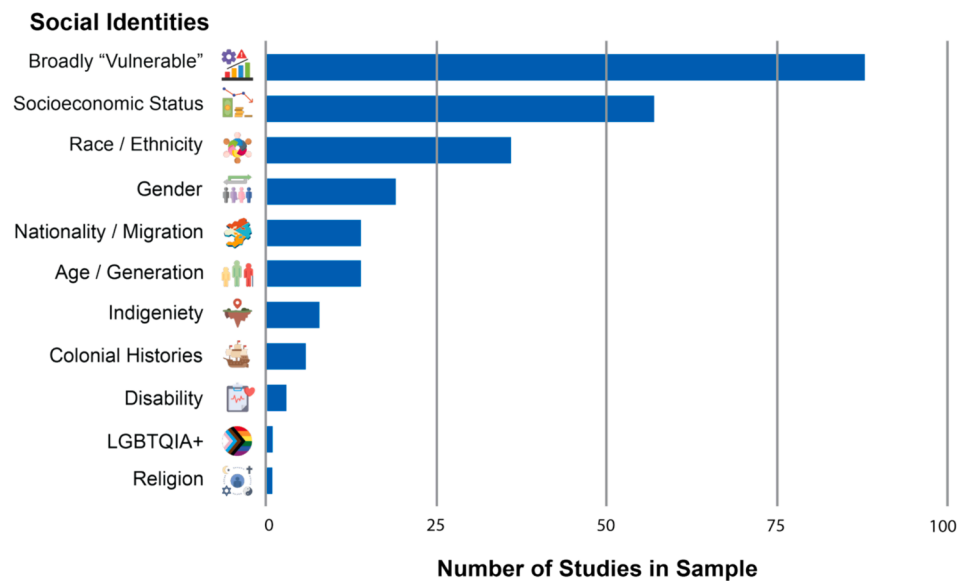


Fig. 5. Distribution of social identities studied in included articles.

articles focused on the experience of a single social group without explicitly referring to another actor(s), such as the labor burden of livelihood adaptation on women (Bhattarai et al., 2015).

Scale of issue. In addition to the actors involved, the *scale of the issue* was commonly included in J/E definitions in reference to both spatial scale and governance scale. Spatial scale was frequently referenced in articles focused on distributive J/E, often in the context of exposure of a particular social group to a climate hazard. Contrastingly, governance scale, (e.g., local, regional, or national governments), was commonly discussed in relation to procedural J/E. Both equity and justice definitions constructs relied on scale; however, justice definitions tended to discuss the role of scale uniquely, sometimes including a debate over whether the individual or state was the most appropriate unit of analysis for evaluating the justice implications of climate adaptation.

Pathway or type. We use the term ‘*pathway*’ to reference the different conceptual ways in which J/E may materialize in adaptation work. *Pathways* provide a ‘*lens*’ for identifying issues of J/E. Distributive, procedural, recognitional and structural J/E (Grasso, 2010; McDermott

et al., 2013; Schlosberg, 2004) are examples of J/E *pathways*. These four *pathways* were the most commonly applied conceptual tool for considering J/E in the climate adaptation literature (described in more detail below). While some authors refer to these pathways as types of equity and others as types of justice, there seems to be significant consensus on the substantive differentiation between them.

Distributional J/E was the most frequently discussed pathway and refers to the difference in risks, costs and benefits of climate adaptation experienced by affected actors; it acknowledges that the distribution of these ‘*goods*’ and ‘*bads*’ occurs simultaneously and is interconnected. Most articles that used J/E terminology were focused on adaptation outcomes (e.g., exposure to risk, access to adaptation finance), while a smaller number of the justice articles included the distribution of adaptation responsibilities. Procedural J/E refers to meaningful involvement of the various actors in decision-making processes and recognitional J/E refers to the valuing of affected actors (their experiences, perspectives, knowledge, and well-being) as important and full members of society. Table 3 provides examples of text coded to the

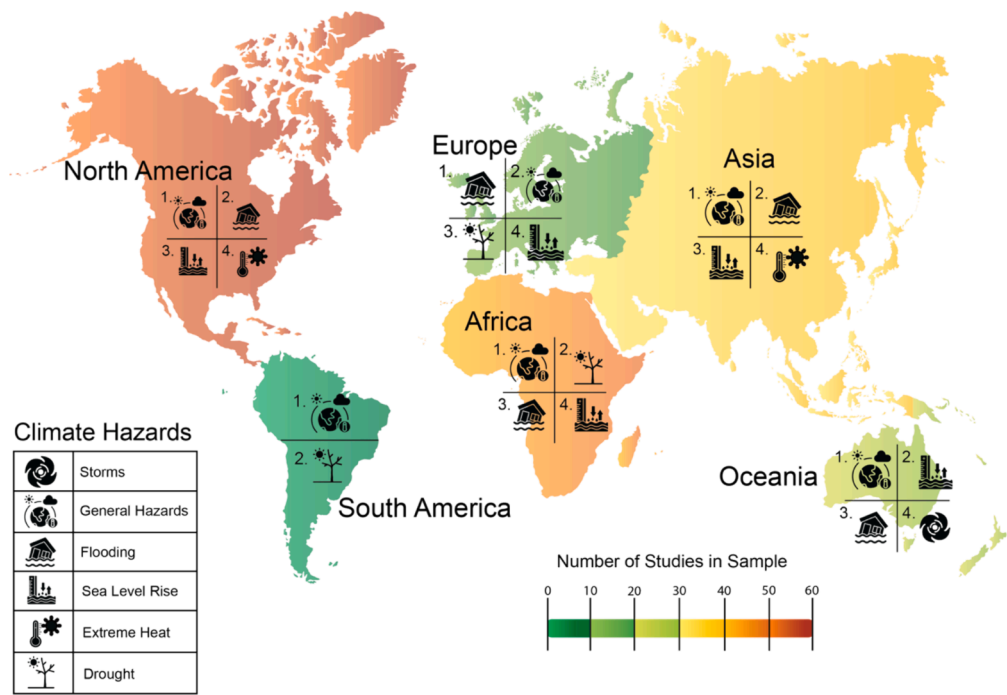


Fig. 6. Map showing distribution of studies by continent and top hazards studied in each continent.

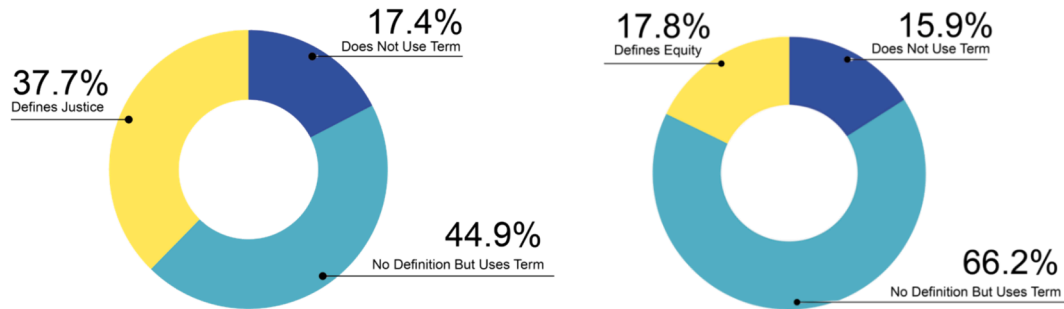


Fig. 7. Proportion of studies that defined justice (left) and equity (right).

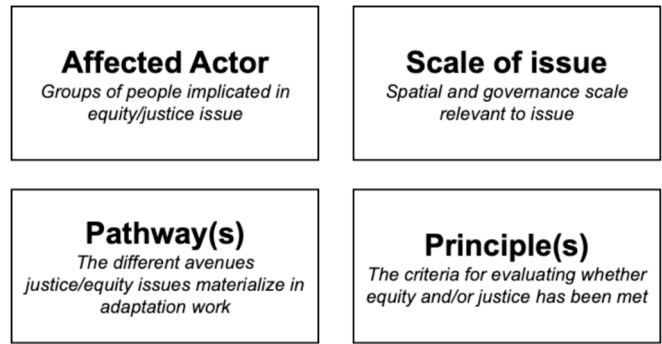


Fig. 8. Components of equity and justice definitions that emerged from thematic analysis.

various pathway subthemes. A significant number of studies (albeit fewer) used structural J/E (also sometimes called contextual) to reference the ways in which historical, systemic, and pre-existing inequities shape or exacerbate other equity or justice issues. Articles also noted the importance of pluralism and directionality, since these pathways do not occur in isolation but simultaneously and often influencing another. Recently published articles referenced this pluralism frequently, and

explicitly discuss how structural and recognitional equity lay the ‘bedrock’ for how distributional and procedural pathways occur. Our use of the term ‘pathways’ is in recognition of these interactions between the types of J/E and that these ‘pathways’ help us move from an abstract understanding of J/E to a place where we can identify what J/E ‘looks’ like in real world examples of climate adaptation.

Principle. In addition to *pathways*, another common component of J/E definitions was the normative criteria used to evaluate if J/E was achieved. We use the term ‘*principle*’ to refer to these normative criteria. For example, a *pathway* lens can guide a J/E analysis to focus on the disproportionate amount of adaptation burdens a social group might experience (distributional J/E) but a *principle* determines how to evaluate what is considered a ‘disproportionate amount.’ The included articles referenced a variety of normative principles that we broadly categorized into *needs-based*, *egalitarian*, *rights-based*, *capabilities*, and *corrective* approaches. Articles that used a *needs-based* principle argued that J/E should be concerned with prioritizing the needs of the most vulnerable, while articles that describe *egalitarian* approaches discussed equal division of resources and processes (see [Holtug, 2009](#)). Articles also applied and discussed *rights-based* approaches (see [Tschakert and Machado, 2012](#) advocating for a common ‘threshold’ of rights that all groups and individuals should have, while others relied on the *capabilities approach*, a more abstract but widely referenced argument for

Table 3
J/E definitions coded to pathways theme and subthemes.

J/E Pathway	Examples of coded text from articles
Distributional	<i>"Distributive justice relates to outcomes in society, namely, who is beneficially or adversely affected by a decision or allocation of resources, and relates to the responsibilities and duties of the winners toward the losers"</i> (Adger et al., 2016, pp 1081) <i>"We relied on a social justice framework that is based on the understanding that unequally distributed social determinants of health create a situation of inequity among European population"</i> (Boeckmann and Zeeb, 2016, pp 12391)
Procedural	<i>"In the context of adaptation, procedural justice refers to the level and form of inclusion, participation, and influence of marginalized groups in all stages of the process, including decision-making, planning, implementation, and evaluation of initiatives"</i> (Araos et al., 2021, pp 1456) <i>"...justice requires explicit organizational and decision-making processes that ensure participation of affected actors in the planning process"</i> (Fiack et al., 2021, pp 2)
Recognitional	<i>"(scholars) refer to recognition as the range of social and cultural values and practices that impede the full recognition of a group as an accepted member of the moral and political community"</i> (Alba et al., 2020, pp 365) <i>"How a problem is framed determines what actors are considered salient for inclusion..."</i> (Eakin et al., 2022, pp 5)
Structural	<i>"(justice includes) ... the recognition that minority groups are structurally vulnerable and intergenerationally disadvantaged in terms of their cultural political and socioeconomic rights"</i> (Chu and Cannon, 2021, pp 87) <i>"Justice theory states that vulnerability is exacerbated when these underlying social and political conditions are not properly recognised in the distributions of goods and risks"</i> (Lyons et al., 2019, pp 1599)

ensuring everyone can live the life they value (see Nussbaum, 2003). Finally, *corrective approaches* (including compensatory and reparative approaches) focused on historical responsibility and current capacity as criteria for who should pay the costs of equitable or just climate adaptation (see Adler, 2007). Strikingly, definitions of justice frequently discussed these *principles* while equity definitions relied more heavily on the vague and normative term ‘fair’ as the normative *principle*. Table 4 provides examples of text coded to each principle subtheme.

3.3. Distinguishing between equity and justice

Of the 316 included articles, 30 % (n = 95) used both the terms equity and justice but did not differentiate between them, while 8 % of included articles (n = 26) used both terms and made a clear distinction between them. When authors attempted to make distinctions between the definitions, they were often unclear. In the few cases where the distinction was clear, there were a variety of ways this distinction was made and little commonality across articles. In a few papers, authors argued for equity as a *principle* of justice, describing equity similarly to how other authors described the *principle* of *needs-based* justice. In one such paper, Grasso described equity as a normative criterion for the “implementation of justice” (2007, pp. 225). Contrastingly, a handful of articles described equity as an evaluation or state (e.g., a situation is equitable or inequitable) and justice as the corrective action to address the equity concern. In yet another small number of articles, authors used the term equity vaguely, often relying on the word ‘fair’ in their definitions, and then more deeply discussing the literature and various pathways and principles when articulating justice definitions.

3.4. Common references and citations for equity and justice

Over two hundred different references were used by authors to

Table 4
J/E definitions coded to principles theme and subthemes.

J/E Principle	Examples of coded text from articles
Needs-based	<i>"Justice as fairness – and in particular the difference principle: if a decision-maker has no information regarding their position within a society, they would distribute resources to the most disadvantaged groups."</i> (Barrett, 2013, pp 2) <i>"Adaptation finance justice requires that developed country parties take pre-cautionary measures to assist developing countries to adapt to climate impacts by providing adequate, scaled up, predictable, balanced and new and additional adaptation finance, with priority to those Parties that are particularly vulnerable."</i> (Ciplet et al., 2013, pp 6)
Egalitarian	<i>"Environmental justice is often defined as the principle that, all people and communities are entitled to equal protection of environmental and public health laws and regulations."</i> (Fiack et al., 2021, pp 2) <i>"Justice as fairness... is based on two principles of justice which guides equal, free, and mutually disinterested rational individuals in their judgments concerning their social contract and their economic and social arrangements."</i> (Grasso, 2007, pp 11)
Rights-based	<i>"Climate justice links human rights and development to achieve a human-centred approach, safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and its impacts equitably and fairly"</i> (Nurhidayah and McIlgorm, 2019, pp 12) <i>"Climate justice, highlights the substantive and procedural rights of individuals, communities, and governments to enjoy – safe, clean, healthy, and sustainable environment and take measures within their national legislative and judicial systems and at regional and international levels to mitigate and adapt to climate change, in a manner that respects human rights"</i> (Beauregard et al., 2021, pp 653)
Capabilities approach	<i>"Climate justice can be defined as the guarantee of restoring the individual freedoms (or capability) after climate changes or any extreme climatic event through mitigation or adaptation actions"</i> (Alves and Mariano, 2018, pp 361) <i>"Climate change should be designed to... empower individuals while promoting community agency, self-reliance and generating improvements for health and well-being."</i> (Buse and Patrick, 2020, pp 869)
Corrective	<i>"The case for pre-funding rests primarily on the principle of responsibility, namely that those who have caused a harm should be required to contribute to alleviating the damage they have caused".</i> (Boston and Lawrence, 2018, pp 45)

define J/E. Below, we outline some of the most frequently referenced frameworks that also represent a diversity of ways to conceptualize J/E. Table 5 categorizes each of the frameworks using the themes that emerged from our thematic analysis (*affected actors, scale, pathways, principles*).

4. Discussion

The results of this study indicate that J/E focused climate adaptation scholarship often broadly considers social identities, geographies and specific climate hazards. Studies were frequently published in interdisciplinary publications (such as Cities, World Development, Sustainability, and Climatic Change), but a significant number of articles did not clearly define or describe J/E, despite being important constructs of the study. The articles that did provide definitions used similar components within their definitions: *affected actors, scale, pathway(s), and principle(s)*. A variety of frameworks were referenced when explaining conceptual approaches, representing the diverse ways in which J/E can be studied.

Our findings support several patterns found in other scholarship synthesizing the climate adaptation literature. Like other reviews, our analysis highlights how few studies clearly define and describe J/E

Table 5

Categorization of common justice and equity frameworks using results from thematic analysis in order of publication year.

Authors Citation	Article Summary	Related citations	Justice vs Equity	Affected Actors	Scale	Pathway	Principle
Schlosberg, 2004	Presents a 3-fold framework for environmental justice	Schlosberg, 2007; Schlosberg, 2012; Schlosberg and Collins, 2014	Justice	Global organizations, NGO's	Global	Distributional, procedural, recognitional	Not discussed but adds a capabilities approach in 2012 reference
Thomas and Twyman, 2005	Case study approach to understanding equity and justice in climate change livelihood adaptations	N/A	Justice & equity	Natural resource dependent societies in southern Africa	Sub-national	Distributional, procedural	Needs-based
Paavola and Adger, 2006	Conceptual review of social justice dilemmas specific to climate adaptation	N/A	Justice	Vulnerable people, developed vs developing countries	Global	Distributional, procedural	Needs-based, corrective, egalitarian
Grasso, 2010	Justice framework for adaptation funding	Grasso, 2007	Justice	Nation states	Global	Distributional, procedural	Corrective, Needs-based
Bulkeley et al., 2013	Examines how issues of justice are addressed in climate change projects in multiple cities around the world	Bulkeley et al., 2014	Justice	Global North and Global South cities	Local	Distributional, procedural	Rights-based, corrective
Hughes, 2013	Presents criteria for evaluating justice in climate adaptation in urban communities	N/A	Justice	Cities	Local	Distributional, procedural, recognitional	Needs-based, capabilities
McDermott et al., 2013	Presents a multi-dimensional framework for equity in payments for ecosystem services	N/A	Equity	Multiple actors	Local	Distributional, procedural, structural	Review multiple principles

constructs, despite the increase in publication frequency over the last few decades (Araos et al., 2021; Coggins et al., 2021; Pham and Saner, 2021). Much like the Coggins et al. (2021) review, our findings underscore the high variability in actors, scales, and types of J/E examined. In terms of novelty, our study uniquely broadens the scope beyond that of empirical work and includes conceptual papers (35.4 % of included studies). Additionally, our research questions went beyond understanding definitions from a single theoretical lens and sought to identify the common conceptual approaches to study J/E in climate adaptation. These strategies enabled us to compare the diverse conceptual approaches various scholars employ when studying J/E in climate adaptation.

4.1. Gaps and directions for future research

Our results highlight disparities in scholarship focused on specific climate hazards and social identities. First, studies tend to discuss issues of J/E very broadly, with most articles using terms such as ‘historically marginalized’ or ‘vulnerable groups.’ Of the studies that focused on specific identities, shockingly few investigated climate adaptations in the context of Indigenous communities. Considering the history of injustice and documented climate vulnerability and resilience (Ford et al., 2020; Shaffril et al., 2020), these finding points towards a critical gap in the scholarship. Additionally, few articles focus on the experiences of LGBTQ+ communities or people with disabilities. Hazards research highlights the unique risk posed by climate change to LGBTQ+ communities due to the exacerbation of pre-existing inequalities (housing insecurity, reduced access to social services etc.) that occurs during and after disasters (Goldsmith et al., 2022). Similarly, people with disabilities face unique challenges when it comes to the risks of climate change. In their review, Lindsay et al. highlight the lack of resources designed to support people with disabilities as they prepare for and recover from climate change related disasters (2022). Despite this research, the recognition of vulnerabilities to climate related hazards associated with queerness and disability has received limited attention. While frameworks and broad discussions around climate adaptation and historically marginalized groups are important additions to the literature, environmental justice scholars have underscored the essential need to understand the nuance and complexity of specific identities (Amorim-Maia et al., 2022; Mikulewicz et al., 2023). Climate adaptation

scholarship needs to work to avoid further marginalizing these groups by relegating them to the margins of the literature (Borderon et al., 2021).

Like the generalized approach to studying social identities, the included articles tended to conceptualize climate hazards broadly and very few articles specifically discussed wildfire, air quality, and disease vectors. While there are J/E analyses of these natural hazards outside of the climate adaptation space (Abara et al., 2012; Masri et al., 2021; Miranda et al., 2011), focusing on the nuance of how vulnerable communities experience adaptations to these hazards within the framing of climate change is an important area for future research.

4.2. Let's be clear about what we mean

One of the most important takeaways from our results is an unsurprising yet important paradox – the included articles are highly interdisciplinary, but most articles also lack specificity and clarity in defining key terms. When articles did define J/E as key constructs in their study, they lacked consistency across definitions. To be clear, we are not arguing for a universal definition of J/E to be used in climate adaptation research. We recognize that such issues are nuanced and complex, and therefore need to be defined and operationalized in ways that are specific to contexts, scales, and the needs of impacted communities. However, the power of scholarship lies in our ability to synthesize findings, to create depth in our understanding of specific contexts and compare across contexts (Silver, 2008). To do so effectively, key study constructs need to be clearly defined (Milkoreit et al., 2018). Further, clear definitions become increasingly important when multiple disciplines are contributing to an area of research and the research has significant application. We are calling for more clarity through explicit definitions and rich description of what climate adaptation researchers mean when they use the terms of justice and equity especially when they are key variables of interest.

Interdisciplinary scholarship is a powerful tool for understanding issues and problems from multiple angles, but only when that scholarship can be coherently tied together to build collective understanding of a problem. Our findings highlight that climate adaptation scholarship focused on J/E is being conducted using a variety of disciplinary approaches and is rapidly increasing in publication frequency. Our data highlight a sharp publication increase in 2021, perhaps as a result of the

racial justice movements of the previous year spurred by the murder of George Floyd.¹ These findings point towards an increase in resources dedicated to understanding inequities and injustice by adaptation scholars and funders. This is an encouraging trend as such research has the potential to make adaptation practice and policy more just. However, if we want to be able to translate science into meaningful practice, we must conduct this science with as much clarity as possible and build a body of literature that can coherently highlight both areas of congruence and uncertainty.

Our data provide a useful tool for reaching such clarity, particularly the combination of themes that emerged as components of J/E definitions. Rather than agreeing on a single definition, we suggest articulating the *affected actors* that are involved, the *scale* of analysis, the *pathway* used to conceptually characterize the equity and justice issues, and the normative *principle* applied as an evaluative criterion. These themes provide the necessary information to understand which findings, frameworks and implications are most relevant to one another. In other words, rather than stopping at broad definitions of J/E (such as Thomas and Twyman's reliance on 'fairness'), we encourage scholars to scaffold from this broad base and articulate 1) which social groups are at the center of the analysis, 2) what spatial and political scales bound the analysis, 3) how does J/E conceptually materialize or occur in the context, and 4) what normative values are being by the authors to evaluate whether J/E are being met. For example, our authorship team is currently applying this scaffolding to case-study research on the J/E implications of a flood adaptation efforts in upstate New York (see Walker et al., 2022). Our analytical approach is strengthened by acknowledging that our J/E analysis is focused on low income, rural communities, bounded by the scope of the Catskills watershed, looks at all four J/E pathways, and uses needs-based and corrective principles for evaluating J/E. This scaffolding ensures that our chosen definition of J/E is relevant to the case study, conceptual clarity guides our identification and description of the J/E issue and the appropriate indicators are chosen to for measuring and evaluating the J/E outcomes of the adaptation effort.

We also acknowledge that there is a significant difference between observing J/E issues and addressing them. The scaffolding we propose is a tool to conceptually wrestle with the complexity of J/E in the context of adaptation, which is an important first steps in creating actionable strategies for addressing J/E. In our work in upstate NY, we have used the framework to identify explicit, community-guided suggestions for a flood buyout program in the region. These data-driven guidelines include comprehensive community planning led by trusted community members as a leverage point for addressing the structural and procedural J/E concerns with the buyout program (*pathways*). The *affected actor* and *scale* components of the framework help us identify who should play the role of leading such planning, and the need for both township and watershed wide planning. Finally, the *principle* component of the framework force us to explicitly acknowledge the normative way in which we are thinking about J/E being met – in our case, by prioritizing low-income and vulnerable community members (needs-based principle) and beginning to address the historical use of eminent domain in the community (corrective principle). We strongly believe that such a strategy strengthens researchers' analytical coherence and communication of implications. If such clarity is not achieved, we lose an ability to make nuanced recommendations for how equitable adaptation can be met and to generalize findings across contexts and case studies. Alternatively, if we can coherently explain how we are investigating J/E and acknowledge that any single definition could never address the complexity and plurality of these issues, we allow room for an elevated

and complex discussion on what it means to achieve equitable climate adaptation.

In Table 5, we compare some of the most common frameworks used when defining and operationalizing J/E. Our table highlights just a handful of the potential J/E frameworks that have been applied in the literature. The delineation between *affected actors*, *scale*, *pathway*, and *principle* is a helpful conceptual tool for determining which frameworks are most applicable to a specific context or adaptation theme. By first determining how one would know if an adaptation strategy was just and/or equitable (*principle*), and then how J/E issues may conceptually materialize or occur (*pathway*) scholars can then determine which frameworks are most appropriate for their study context. This distinction between principle and pathway, in addition to the *scale* and *affected actors*, have the potential to transform vague descriptions of J/E into scholarship that is specific and comparable across disciplines and contexts. While categorizing all potential frameworks and creating tools to guide researchers and practitioners is beyond the scope of this review, we think this is an important next step for narrowing the gap between research, policy, and practice. Such a tool would encourage researchers and practitioners to think critically about the complexities of their J/E analysis (i.e., which principle am I using?) as well as help determine which conceptual frameworks would be a helpful guide.

4.3. Recently published frameworks that provide clarity to justice and equity investigations

In addition to the frequently referenced articles included in Table 5, we want to highlight some lesser-known or recent frameworks we believe are helpful tools for investigating J/E in climate adaptation. In their work focused on urban adaptation, Amorim-Maia et al. develop a conceptual framework tying together a cross-disciplinary body of literature discussing intersectionality, climate change adaptation, and urban justice (2022). They outline the drivers of injustice associated with urban adaptation strategies and associated intersectional climate justice pathways. Alternatively, Chu and Cannon review adaptation plans and subsequently develop indicators to evaluate the extent to which adaptation plans take into consideration the J/E implications of suggested adaptation strategies (2021). Malloy and Ashcroft synthesize literature on urban climate change governance, climate adaptation, urban planning, social justice theory, and policy implementation, presenting three requirements for the implementation of just adaptation. They argue that just adaptation must incorporate 1) the inclusion of socially vulnerable populations as full participants, 2) adaptation framings that explicitly recognize systemic injustices (frames of resilience, equity, transformation), and 3) a focus on incremental evaluations of implementation. Finally, Leonard proposes a sea-level rise adaptation framework that is explicitly designed and developed by Indigenous scholars and communities, prioritizing Indigenous water security and knowledge systems (2021). These frameworks rely on unique assumptions regarding pathways and principles and can be applied in multiple contexts and scales.

4.4. Limitations

While we believe this review has implications for future climate adaptation research, there are limitations to the study. First, we recognize our limited ability to extract data that reflects the intersectionality of social identities and groups. Several environmental justice scholars have argued for the use of an intersectional lens to understand J/E in environmental contexts with more nuance (Alvarez and Evans, 2021; Malin and Ryder, 2018). Our data extraction process captured whether an article discussed multiple distinct social identities, but due to limited resources and need for continuity in the extraction process, we did not differentiate between studies that discussed people with multiple identities versus studies that separately evaluated multiple social identity groups.

¹ The authors recognize that the discussion of the George Floyd murder and potential impact on publication trends deserves a much more significant and nuanced discussion, but is outside the scope of this paper and should be prioritized for future research.

The second key limitation of this review is due to the interdisciplinary nature of climate adaptation research. Scholarship related to adaptation, but not using adaptation terminology, may have been missed in our search. The authors of this review largely distinguish between adaptation and mitigation by defining adaptation as adjustments or changes to deal with the impact of climate change and mitigation as efforts to reduce emissions. However, we recognize that in some fields, and particularly in literature on fire hazards, the terms mitigation and risk mitigation are often used similarly to how conceptualize adaptation (Brenkert-Smith et al., 2006; Meldrum et al., 2019). This review includes articles that use adaptation language, and as a result, might have missed studies that we would conceptually consider as adaptation focused but only use the word mitigation. Additionally, scholarship focused on topics such green infrastructure and urban sustainability are related bodies of literature, but do not often use adaptation language (e.g. Anguelovski et al., 2020; Cobbinah and Finn, 2022; Ranganathan and Bratman, 2021). Another example of related work with different terminology is scholarship by Whyte (2020) and Ulloa (2017) discussing an Indigenous and relational notion of justice and adding an important alternative to the J/E principles included in our framework. While such a principle did not emerge from our analysis of our data, because the studies did not use adaptation terminology, the value of a relational criterion as one of the potential *principles* for achieving J/E should not be overlooked.

A third limitation is that we were only able to include studies with an English translation available. Though we sought translation for any studies not written in English, eleven studies were excluded for this reason. Additionally, all our data comes from peer-reviewed publications which is inherently an inequitable space. The peer review process largely prioritizes work by authors who write in English. Further, high publishing fees mean that grassroots organizations and researchers with lower financial resources are often excluded from the publishing process (Demeter, 2020; Skopec et al., 2020). As a result, our review also excludes such work. We hope future scholarship can build upon the results of this study to overcome these important limitations.

4.5 Conclusions and key takeaways

The findings from this review contribute to a growing body of literature highlighting a recent and rapid increase in scholarship focused on the J/E implications of climate adaptation. It also underscores the unequal distribution in where, who and in what contexts such scholarship is focused. Specifically, our review synthesizes the large number of studies that are conceptual rather than empirical in nature and discuss climate hazards and social identities broadly across multiple scales and a variety of geographic contexts. Most significantly, our findings underscore the interdisciplinary nature of J/E and adaptation literature, which we believe explains an additional finding from our review: rarely does the literature clearly define J/E. When authors do define these constructs, there are a multitude of conceptual approaches that guide such definitions. Our subsequent analysis of the definitions and references authors rely on to explain J/E highlights critical definition components. We suggest that the themes from our analysis (*affected actors, the scale, pathway, and principle*) provide helpful guidance for clearly explaining the nuances of J/E and adaptation work. They can also be utilized to support the selection of frameworks that are best suited for designing and J/E implications of climate adaptation strategies. Interdisciplinary work is a critical tool to understand the multifaceted intersection of social justice and climate adaptation. However, if climate adaptation scholars want to do work that engages multiple types of science and has applied value, they need to think through the complex assumptions often hidden in our vague descriptions of J/E and clearly explain their conceptualizations.

CRedit authorship contribution statement

S.E. Walker: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **E.A. Smith:** Conceptualization, Funding acquisition, Supervision, Writing – review & editing. **N. Bennett:** Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **E. Bannister:** Formal analysis, Investigation, Writing – original draft. **A. Narayana:** Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **T. Nuckols:** Formal analysis, Investigation, Methodology, Visualization. **K. Pineda Velez:** Formal analysis, Investigation, Writing – original draft. **J. Wrigley:** Data curation, Methodology, Resources, Writing – review & editing. **K.M. Bailey:** Conceptualization, Funding acquisition, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data is available in online repository, link in manuscript

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Appendix A. Supplementary data

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