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To cite this article: Katharine Vincent & Georgina Cundill (2021): The evolution of empirical adaptation research in the global South from 2010 to 2020, *Climate and Development*, DOI: [10.1080/17565529.2021.1877104](https://doi.org/10.1080/17565529.2021.1877104)

To link to this article: <https://doi.org/10.1080/17565529.2021.1877104>



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Published online: 04 Feb 2021.



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# The evolution of empirical adaptation research in the global South from 2010 to 2020

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## ABSTRACT

This paper applies a scoping review approach to inductively assess the evolution of empirical adaptation research in the global South over the period 2010 to 2020 using, as indicators of the literature, three leading adaptation journals covering different scales of analysis: Global Environmental Change, Regional Environmental Change and Climate and Development. The review confirms that previous calls for an increase in empirical adaptation research have been heeded. Research covers both policy and practice, and also different scales, with a particular focus on agricultural and rural settings. There is significant and growing interest in the determinants of adaptation and adaptive capacity (including the role of barriers and enablers), and a small but growing interest in the role of gender. The overall increase in total publications does not show even geographical or sectoral coverage. Large swathes of sub-Saharan Africa and the Middle East/North Africa remain severely under-researched; and the overwhelming majority of papers focus on rural and agricultural issues rather than cities. This analysis offers tangible evidence to highlight where geographical and thematic gaps exist in our research on adaptation in the global South.

## ARTICLE HISTORY

Received 7 October 2020  
Accepted 8 January 2021

## KEYWORDS

Climate change; climate adaptation; scoping review; developing countries; IPCC

## 1. Introduction

Climate adaptation research has grown and evolved significantly over the past 20 years (Arnell, 2010). A recent review of adaptation research in the five Inter-Governmental Panel on Climate Change (IPCC) assessment reports to date found that the literature has moved away from an early focus on whether adaptation was necessary, to a subsequent focus on how to adapt, and more recently to questions of how to scale up adaptation efforts in an effective and equitable manner (UNFCCC, 2019). However, while these broad trends are evident and useful to understand, they mask stark differences in the geographical and associated thematic distribution of research worldwide (Berrang-Ford et al., 2011; Ford, et al., 2015).

Given that the developing world is expected to experience significant impacts of climate change, understanding the extent of applied adaptation research taking place in the global South specifically is critically important (Xu et al., 2020). Although some effort has been made to develop baseline assessments of observed adaptations in climate change hot-spots, such as glacier-fed systems, semi-arid regions and mega-deltas (Cochrane et al., 2017), these are scarce. The 'streetlight effect', meaning we look where it is easiest to look, can lead researchers to focus on questions and cases based on data availability and convenience, which can privilege parts of the world with pre-existing data availability (Hendrix,

2017). In addition to data availability constraints in the global South quite generally, it has long been recognized that research funding gaps tend to coincide geographically with high levels of social vulnerability, and thus significant adaptation needs (Adger et al., 2003).

The differences in the geographical distribution of research effort have implications for countries that need research to inform local policy, and also for global coordination efforts intended to support vulnerable nations in their efforts to adapt. For example, the UNFCCC contains provision for financial and technical support for adaptation in developing countries, and progress towards the global goal on adaptation will be monitored through a regular global stocktake (Khan et al., 2020; Lesnikowski et al., 2017). Although the methodology for the global stocktake remains under development, research plays an important role (Tompkins et al., 2018). Similarly, the Paris Agreement promises financial support for vulnerable countries, but access to such support requires research to inform the design of appropriate adaptation plans (Persson & Remling, 2014; Remling & Persson, 2014). Therefore, understanding the geographical distribution, and thematic focus, of research efforts can highlight knowledge gaps that will become increasingly evident and important as the global stocktake takes shape, and as decisions are made regarding climate finance to ensure that such finance is equitable and effective (Chen et al., 2018).

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In 2011, Berrang-Ford et al. showed that out of the adaptation research that had taken place until that point, the major focus was on vulnerability assessments and intentions to act, rather than adaptation actions; middle income and low-income regions were under-represented; and there was limited reporting on adaptation focusing on women (Berrang-Ford et al., 2011). At the start of the last decade calls were made for adaptation research to become more multi-scalar and action-oriented, and for the theory to be applied to policy and practice (Lahsen et al., 2010; Mustelin et al., 2013). With 10 years having passed, it is timely to review the extent to which these calls have been heeded and emerging findings have influenced the subsequent nature of adaptation research.

This paper therefore presents an assessment of the evolution of empirical adaptation research in the global South over the 10-year period 2010–2020, focusing on the geographical distribution and thematic foci of empirical studies. Section two presents an introduction to adaptation research, reflecting on what adaptation is, and what previous reviews have told us about adaptation research in general, and the global South specifically. Section three presents the methods used for the scoping review in terms of journals selected and inclusion criteria for the sample, as well as the process of inductive coding and data analysis. Section four presents the results, section five discusses the findings, and section six concludes by highlighting implications of the findings for future research directions and the politics of adaptation.

## 2. The status of adaptation research

### 2.1. What is adaptation?

Although there is widespread consensus on the need for adaptation, agreeing a universal definition has been problematic in research and this has, in turn, had implications for its representation in policy and practice (Khan & Roberts, 2013; Preston et al., 2015). The IPCC defines adaptation as ‘the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities’ (Field et al., 2014, p. 1758). In this sense, a key aspect of adaptation is multi-scale action, and includes ‘building the capacity of nations, regions, cities, the private sector, communities, individuals, and natural systems to cope with climate impacts’ (Noble et al., 2014, p. 839).

Since climate is one of many drivers to which society is constantly responding, disentangling adaptation from a broader process of change is complex (Rothman et al., 2014). Added to that, what adaptation looks like is very much context- and scale-dependent, in terms of who is adapting to what and how, leading to the (over)use of a handful of heuristics across diverse contexts, which can limit alternative entry points (Preston et al., 2015). Furthermore, the fact that climate change is an unfolding phenomenon also complicates a definition for adaptation, because it may only be seen in the future (Tompkins et al., 2018).

Despite the ongoing debates on adaptation definitions, there is broad agreement, including in the 5th IPCC Assessment Report, that climate risk is a function of hazard,

vulnerability and adaptive capacity (Field et al., 2014). In the policy sphere, adaptation plans typically focus on addressing the causes of vulnerability (LDC Expert Group, 2012). As a result, a significant amount of adaptation research effort looks at vulnerability assessments (e.g. Berrang-Ford et al., 2011; Ford, 2015). Vulnerability assessments themselves can vary depending on the framing of vulnerability (O’Brien et al., 2007). For example, a distinction can be drawn between coping (as responding to current conditions) and adaptation (as anticipating and responding to future conditions), whilst recognizing there may be a relationship between the two (Berman et al., 2012; Vincent et al., 2013). However, concerns have been raised that responding to current vulnerability is insufficient to enable long term adaptation (Dilling et al., 2015). Here lies one of the deep challenges facing the adaptation research community: it is difficult to observe adaptation when the effectiveness of an action may only be understood in the future; however merely adapting to the current adaptation deficit may not be sufficient to adapt to future change.

Given the challenges with defining adaptation, focus is often rather placed on developing adaptive capacity. Adaptive capacity is understood as the potential stock of assets which can be drawn upon to enable adaptation at a future point, as and when required (Vincent, 2007). However, concerns have been raised that latent capacity does not always translate into adaptation outcomes (Mortreux et al., 2020; Mortreux & Barnett, 2017). It is also important to distinguish between general or generic adaptive capacity and specific adaptive capacity that directly supports adaptation to a particular climate hazard (Eakin et al., 2014).

### 2.2. What do we know about trends in the field of adaptation research?

The broader field of climate change research is significant and evolving. Typically, technical approaches (which tend to be linked with physical science and mitigation rather than adaptation) have predominated (Pasgaard & Strange, 2013). Between 1990 and 2018, the natural and technical sciences received 770% more funding than the social sciences for research on issues related to climate change (Overland & Sovacool, 2020). This is relevant because adaptation is an intrinsically human endeavour and therefore, without human insights, data and the hard sciences will not meet the challenges of the next decade (Shah, 2020). In addition, a recent study of over 400,000 publications on climate change from Web of Science using topic modelling shows that applied, solutions-relevant knowledge – especially in agriculture and engineering – is under-represented (Callaghan et al., 2020). This suggests that there is a need for more social science research, and that applied social science research that focusses on climate solutions, including mitigation efforts, is important. From 1990 to 2018, only 0.12% of research funding was spent on the social science of mitigation, for example (Overland & Sovacool, 2020).

As well as broad distinctions between mitigation and adaptation, and technical solutions and social science, there are geographical variations in the distribution of research. This reflects both where the research takes place, and who is

**Table 1.** Characteristics of the three adaptation journals reviewed, together with the number of returns of initial search criteria, and the ultimate sample size after selection criteria were applied.

Journal	Impact factor (2018)	Scope	Retrieved from initial search using 'adapt*'	Sample size after selection criteria applied (n)
Global Environmental Change	10.427	'... publishing high quality, theoretically and empirically rigorous articles, which advance knowledge about the human and policy dimensions of global environmental change ... interprets global environmental change to mean the outcome of processes that are manifest in localities, but with consequences at multiple spatial, temporal and socio-political scales ... interested in articles which have a significant social science component ... (including those) that address the social drivers or consequences of environmental change, or social and policy processes that seek to address problems of environmental change. Topics include ... the drivers, consequences and management of changes in ... climate'	Over 800	50
Regional Environmental Change	3.149	'... to publish scientific research and opinion papers that improve our understanding of the extent of [environmental changes], their causes, their impacts on people, and the options for society to respond. "Regional" refers to the full range of scales between local and global ... Topics addressed include ... the adaptation of social-ecological systems to environmental change in the context of sustainable development'	Over 1000	70
Climate and Development	2.402 (2017)	'... dedicated to the range of issues that arise when climate variability, climate change and climate policy are considered along with development needs, impacts and priorities. It presents ... empirical studies of the interactions between climate impacts ... adaptation and development on scales from the local to global. Contributions from and about developing countries are particularly encouraged'	Over 450	135

doing the research. Based on a quantitative analysis of more than 15,000 scientific publications from 197 countries, richer and more institutionally developed countries play a bigger role in supplying climate change knowledge (Pasgaard & Strange, 2013). Although it is smaller in quantity than the developed world, research in and on the global South does tend to focus on adaptation, and the human and social impacts of climate change (Berrang-Ford et al., 2011; Pasgaard & Strange, 2013). Analysis of author affiliation from the same dataset shows that publications concerning climate change in developing regions are dominated by first authors based in developed countries and in Brazil, India, China, and South Africa (Pasgaard et al., 2015). Author affiliations lead to clusters or 'modules' of countries which are typically linked by geographical proximity or similarity of political and economic characteristics, but there is often little knowledge exchange between those established country clusters (Pasgaard et al., 2015). The need for greater inclusion of researchers from middle and lower income countries in global change research is widely recognized (Lahsen et al., 2010).

### 2.3. What do we know about trends in adaptation research in the global South?

Adaptation research in the global South also exhibits geographical variation. In 2011 it was reported that middle income countries were underrepresented with regards to adaptation, and low-income regions dominated by reports from a small number of countries (Berrang-Ford et al., 2011). In 2015 it was reported that adaptations were primarily being reported from African and low-income countries, with gaps particularly notable in north Africa and central Asia (Ford, et al., 2015). However, there had been a significant increase in reported adaptations in 47 vulnerable hotspot nations in Africa and Asia since 2006 (Ford, et al., 2015). The nature of adaptation

research involved vulnerability and impact assessments and tangible adaptations, as well as adaptation policy, particularly at the national level (Ford, et al., 2015; Lwasa, 2015).

As well as geographical variation, adaptation research has historically been weak on documenting the socially differentiated interventions and outcomes of adaptation efforts. There has typically been less focus on the implementation and reporting of adaptation initiatives targeting vulnerable groups, including women, children and the elderly (Berrang-Ford et al., 2011; Ford, et al., 2015). However, awareness is increasing. An analysis of 123 peer-reviewed adaptation, resilience and vulnerability articles from 2006 to 2015 shows that there was an increase in gender engagement, with studies from sub-Saharan Africa consistently exhibiting high levels of gender engagement (Bunce & Ford, 2015). The sophistication of engagement with gender also appears to have improved over time, with critical feminist studies, the emergence of studies focusing on men, and intersectionality (Iniesta-Arandia et al., 2016; Kaijser & Kronsell, 2014; Rao et al., 2019, 2020).

### 3. Method

Calls have been made for increased transparency in methods used to sample and synthesize climate change research (Berrang-Ford et al., 2015). In order to assess the geographical distribution, thematic focus, scale of concern and sectoral focus of approaches of empirical adaptation research in the global South over the 10-year period 2010–2020, different types of review processes would have been feasible. We chose to undertake a scoping review as the main aim was to describe patterns and trends within an assessment of the quantity and extent of available research literature (Grant & Booth, 2009; Pham et al., 2014; Thomas et al., 2020). Whilst the approach we employed was systematic, it differs from a typical systematic review in that we did not preselect adaptation themes and then assess

their occurrence in a wide range of journals. Instead, we took an inductive approach so that the nature of adaptation research emerged from a sample of adaptation journals that act as indicators of the nature of the field. The period 2010–2020 was chosen to reflect the last decade, and because it marks 10 years since the first similar review was conducted by Berrang-Ford et al. (2011).

### 3.1. Sampling

In line with the inductive approach, we selected a sample of journals with high impact factors that publish empirical adaptation research at different scales without particular thematic or geographical focus, and are targeted by adaptation researchers (Table 1). Global Environmental Change (GEC) is a high impact journal that ‘publishes high quality, theoretically and empirically rigorous articles, which advance knowledge about the human and policy dimensions of global environmental change’. Regional Environmental Change (REC) has a slightly lower impact factor than Global Environmental Change, and its remit is to

publish scientific research and opinion papers that improve our understanding of the extent of [environmental changes], their causes, their impacts on people, and the options for society to respond. ‘Regional’ refers to the full range of scales between local and global ...

An assessment of REC publications in 2015 showed that approximately half of papers up until that time had a climate change focus (Ford, 2015). Climate and Development (C&D) was important to include alongside GEC and REC because the journal explicitly encourages empirical contributions from the developing world. In a recent editorial, the editors note that ‘adaptation’ was the topic most frequently addressed in Climate and Development from 2011 to 2018, in around 800 manuscripts (Schipper & Ensor, 2019). Whilst there are many more journals that publish adaptation research in the global South, they tend to have specific thematic, sectoral or geographical specialisms that make them less suitable for a broad inductive scoping of the evolution of the nature of empirical adaptation research.

### 3.2. Selection criteria

Sample selection involved systematic and sequential assessment of an ever-decreasing sample size of papers reflecting different steps and the application of exclusion criteria. Initial search criteria were for papers that included the term ‘adapt\*’ in the time period 2010–2020 (ending at the end of 2019), considering the title, abstract and keywords. This initial search yielded a sample of over 800 papers in GEC, over 1000 papers in REC and over 450 papers in C&D. From this initial sample, the first round of cuts involved papers that did present empirical research in the global South. Since climate change adaptation is often a political issue, the definition used for ‘global South’ was non-Annex I countries as defined by the United Nations Framework Convention on Climate Change (UNFCCC). This includes developing countries that did not have mitigation commitments under the Kyoto Protocol, namely Latin America and the

Caribbean, Africa, the Middle East, and Asia. To further reflect geographical diversity, when later analysing distribution we divided Asia into central, south and southeast; Africa into sub-Saharan Africa and the Middle East and North Africa (MENA); and small islands in the Caribbean, South Pacific and Africa into Small Island Developing States (SIDS). The individual countries represented were counted up to a total of 9 countries per paper.

Having identified all the papers with ‘adapt\*’ in the title, keywords and/or abstract where research took place in the global South, several rounds of exclusions took place. This was conducted by the first author to reduce errors of interpretation, particularly in the latter rounds of exclusion where there was scope for some subjectivity. The second round of exclusions took out papers that did not include ‘adapt\*’ in the title, keywords or abstract. Since some such papers appeared in search returns the term must have appeared in the main text, but a rapid assessment confirmed that these papers were not reporting empirical adaptation research. This stage also took out papers that spoke of adaptation to a stress not related to climate change (for example ‘Adapting to changes in volcanic behaviour’ or ‘Rapid ecosystem change challenges the adaptive capacity of Local Environmental Knowledge’). The third round of exclusions took out editorials, reviews and perspectives/opinion pieces as they also did not report empirical research.

The most subjective decision on exclusion criteria came in round four, where the authors evaluated whether or not the resulting papers reported empirical adaptation research. We defined empirical research as based on observation or measurement and deriving results from experience rather than theory. Methodological papers were also excluded (unless they contained substantial adaptation empirical evidence in their application), as were global synthesis and modelling studies unless they expressly covered empirical adaptation examples. In reality, many global studies tended to be one step removed from the original adaptation, synthesizing and/or reporting on intervention portfolios (e.g. Kim et al., 2017) or analysing policy documents with particular questions in mind (e.g. Holvoet & Inberg, 2014). In addition, three further categories were excluded: papers with limited contributions to empirical adaptation research; topics related to adaptation that do not cover empirical adaptation research; and papers that apply language and framings different from adaptation as described in the introduction (e.g. vulnerability and impact assessments, and papers framed in other theoretical approaches, e.g. resilience or social-ecological systems). This resulted in a final sample of 255 papers for full review.

### 3.3. Data analysis

A database of bibliographic references, abstracts and keywords was created in Microsoft Excel. The geographical distribution of research was assessed based on the location of the empirical studies reported in each paper. Where a paper reported empirical evidence from multiple countries, countries were captured up to a total of 9, together with categorization of whether the paper was a comparative study and, if so, whether it included cases in the same or different

regions. Thematic foci were identified using inductive coding. An initial set of thematic codes was identified based on a preliminary reading of the abstracts of the sample papers. These codes were discussed between the authors, and then refined. Categorical codes were applied to whether or not a paper addressed determinants of adaptation or adaptive capacity (yes/no) and whether it applied a gender lens (yes/no). Inductively-identified codes were applied to the main sector addressed by the empirical adaptation (infrastructure, health, tourism, urban and peri-urban, water, forestry, fisheries, coasts, agriculture and rural) and the scale of focus of the intervention (individual/household, community, institutional – at regional, national, sub-national, organizational, or informal level, or multiple). Once the final codes were agreed, data were captured quantitatively with each paper representing a data point.

### 3.4. Limitations

There are limitations with the methods employed in this study. In particular scoping reviews are criticized for lacking methodological standardization (Pham et al., 2014). To counter this, we have been fully transparent in the steps in the methodology. The risk of inadvertent exclusion errors is always subjective but is potentially high in this study given the conceptual ambiguity around adaptation and the relationship between it and related terms (Berbés-Blázquez et al., 2017; Birkmann & von Teichman, 2010). For example papers where authors speak of coping, resilience, disaster risk reduction, climate risk mitigation and vulnerability reduction are all excluded, even though it is possible that those terms have been used in the same way others might use adaptation. One paper, for example, talks of mitigation measures that, applying the IPCC definition of adaptation, could also be considered adaptation ('The influence of gendered roles and responsibilities on the adoption of technologies that mitigate

drought risk: The case of drought-tolerant maize seed in eastern Uganda'). A paper entitled 'How resilient are farming households and communities to a changing climate in Africa?' was excluded because it was resilience framing yet, if the terminology were replaced, refers to similar underlying situations to what might appear in an adaptation framing.

Many papers were excluded that mentioned the relevance of the findings to adaptation, but were not empirical adaptation research in their own right. Although this was a subjective decision, the risks of inconsistency were minimized by one person making all the decisions.

## 4. Results

On aggregate, the total number of empirical adaptation papers in the global South published in all three journals has shown a general increasing trend from 2010 to 2020 (Figure 1). This takes place against the backdrop of more regular publication in all three journals: with GEC increasing from four to six editions annually in 2013; Regional Environmental Change increasing from four to six editions annually in 2013, and then from six to eight editions annually in 2015; and Climate and Development increasing from four editions annually in 2014 to five in 2015, seven in 2017, eight in 2018 and 10 in 2019. An increase in empirical adaptation papers in the context of increasing editions reflects the fact that adaptation continues to make up a notable proportion of the content published in these journals. In addition, there is a discernable increase between 2018 and 2019, when the number of empirical papers nearly doubled from 31 to 59. A significant proportion of this increase is represented by papers published in C&D, which may reflect an editorial change during the same time period. When comparing between journals, the general increasing trend is shown particularly in C&D. In REC the number has generally increased over the period, but remained fairly constant over the last 4 years. The number of empirical

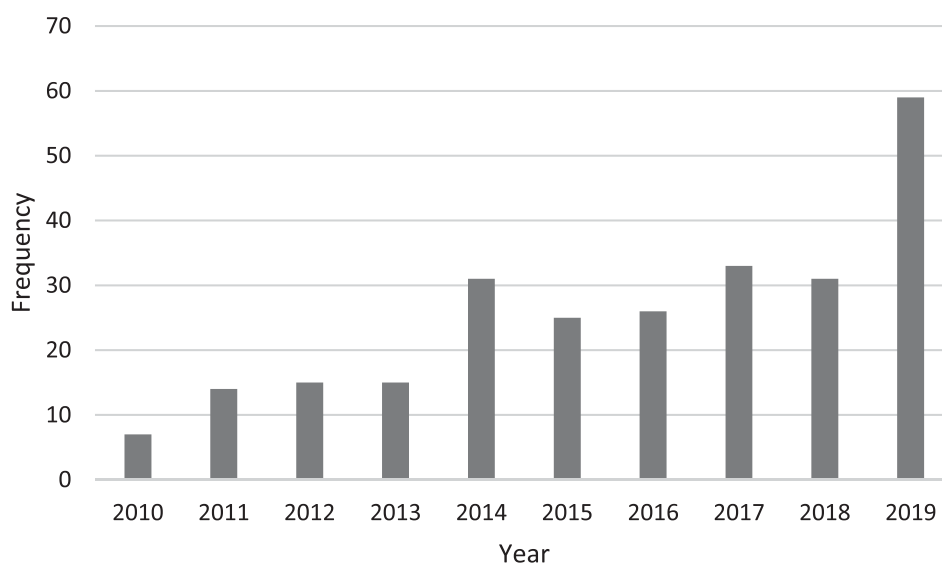
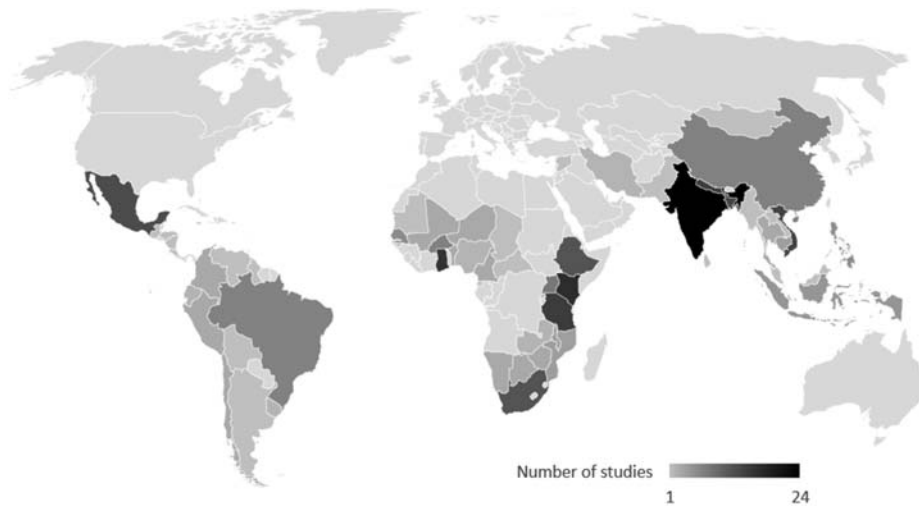


Figure 1. Distribution of empirical adaptation papers in the global South by year.



**Figure 2.** Geographical distribution of published empirical adaptation research from 2010 to 2020 in the global South.

adaptation papers in the global South in GEC increased to a peak in 2015 and has tended to decline since then, with only two published in 2019.

#### 4.1. Geographical distribution

The geographical distribution of published empirical adaptation research varies across the global South (Figure 2). In Latin America and the Caribbean, papers on Mexico and Brazil account for over half of the countries represented. Several of the continental Latin American countries are not represented in any empirical adaptation research, namely French Guiana, Paraguay, Suriname, Belize, El Salvador, Guatemala, Panama. In sub-Saharan Africa approximately one third of countries do not appear in any empirical adaptation research. Five countries that are bigger economies and have significant numbers of research institutions each appear in at least 12 papers – these are South Africa, Tanzania, Kenya, Ethiopia and Ghana. MENA remains relatively poorly represented with only 3 papers overall: two from Iran and one from Syria, with none from the north African countries. In Asia parts of the continent are better represented than others. Within east Asia China dominates. However, this research effort is dwarfed by that emerging from South Asia, and especially from India, Bangladesh and Nepal. Although research from India, Bangladesh and Nepal dominate research output not only in the region, but globally, there are no papers on Afghanistan or Bhutan in this sample. The majority of countries in southeast Asia are represented, with Vietnam frequently covered (in approximately one third of papers covering the sub region). The number of papers on Small Island Developing States (SIDS) is also relatively significant. As well as Cape Verde and Comores as African SIDS, the South Pacific and Caribbean are both represented.

The vast majority of papers (82%) report empirical adaptation research in one country, whilst 11% of papers cover more than one country in the same region. Five per cent cover more than one country in more than one region (for example sub-Saharan Africa and India), whilst only 2% are

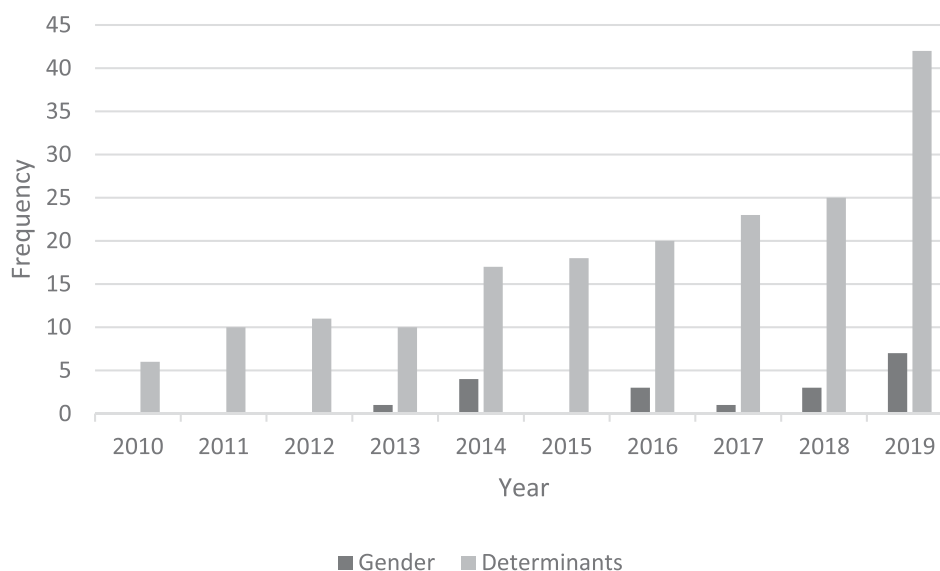
papers that include countries from both the global South and global North.

#### 4.2. Emerging thematic foci

##### 4.2.1. Determinants of adaptation and adaptive capacity

A common thread linking 71% of papers was consideration of the determinants of adaptation or adaptive capacity (Figure 3). Mirroring the increase in papers overall, the number of papers considering these determinants has also increased over the 10-year period. At the household/individual level this includes tangible assessments of demographic (including gender) and socio-economic determinants of adaptive capacity and/or access to adaptation options, as well as the role of social networks. There has been increasing emphasis more recently on consideration of cognitive barriers and enablers, for example the role of perceptions and risk framing (e.g. Ayeb-Karlsson et al., 2019; Tucker et al., 2010; Villamizar et al., 2017), the role of information, for example as playing a role in whether or not adaptive capacity leads to adaptation, particularly in natural resource-dependent sectors (e.g. García de Jalón et al., 2015; Saroar & Routray, 2012) and rights-based approaches to adaptive capacity (e.g. Coleman, 2011; Ensor et al., 2015).

Drivers, and barriers and enablers, of adaptation are also commonly identified at both individual/household level but, more commonly, at the various institutional levels. Drivers, barriers and enablers may include access to resources, such as technology (e.g. both at institutional level, e.g. Eakin et al., 2015, community level e.g. Regmi & Star, 2014, as well as at individual/household level, e.g. Wuepper et al., 2020), but also the role of policy (in)coherence (e.g. England et al., 2018) and the cross-scalar interactions between policies, institutions, and individual/household actions (e.g. Ensor et al., 2015; Horlings & Marschke, 2020; Rasmussen et al., 2019). Notably, a number of papers also highlight the social implications of adaptation options – for example when something allows a certain population group/location to adapt to climate change but, in so doing, has implications for other population groups or places (particularly offsite effects) (e.g. Beckman,



**Figure 3.** Number of papers considering gender differences and determinants of adaptation/adaptive capacity.

2011; Buggy & McNamara, 2016; Few et al., 2017). A very small number of papers took a dynamic approach to adaptation and adaptive capacity, looking at adaptation pathways over time, whether retrospectively (e.g. Dorward et al., 2020; Sen & Bond, 2017), prospectively (e.g. Ayeb-Karlsson et al., 2019) or both (e.g. Fazey et al., 2016).

#### 4.2.2. Gender

Mirroring the overall general trend for empirical adaptation research in the global South, the number of papers that consider gender also increased over the 10 year period, with particular peaks in 2014 and 2019 (Figure 3). Seven percent of papers make explicit reference to gender as a lens of analysis. Of the papers applying a gender lens, nearly half (47%) focus on Africa, with 32% focusing on Asia, 11% focusing on SIDS, and 11% reporting multiple countries (of which half were multiple countries in Africa, and the other half were multiple countries in both Africa and Asia). A handful of individual countries have more than one empirical adaptation paper with a focus on gender, namely Ethiopia, Kenya, Bangladesh and Vietnam.

In all cases, focus is on making visible the particular circumstances of women who are typically invisible in gender-blind approaches. The majority of these papers highlight how gender is a differentiating factor in determining adaptive capacity or access to adaptation options (e.g. Mersha & van Laerhoven, 2019). Of these, the majority look at explicit differences between men and women (e.g. Afriyie et al., 2018), whilst a minority focus expressly on women (e.g. Caretta, 2014). Other papers look at gendered perceptions of performance of adaptation projects (e.g. Clissold & McNamara, 2020), highlighting opportunities and barriers to making projects gender-responsive based on multiple experiences across sub-Saharan Africa (Bryan et al., 2018), and assessing the degree of gender-sensitivity in policies in Bangladesh and Ethiopia (e.g. Mersha & van Laerhoven, 2019; Shabib & Khan, 2014). Reflecting earlier findings by Bunce and Ford (2015), the focus was generally on gender with limited consideration of

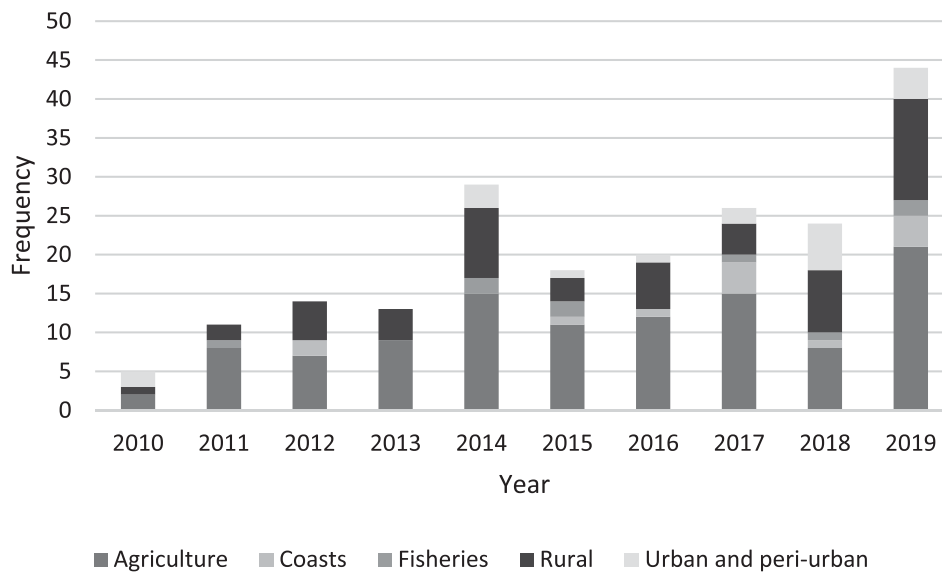
intersectionality, although there are exceptions (e.g. Huynh & Resurreccion, 2014).

#### 4.3. Sectoral focus

The majority of papers – 88% – had a single sectoral focus, and the general trend was for the number of papers with a single sectoral focus to increase over time, reaching a peak in 2019 (Figure 4). The remaining 12% focused on policy, institutions or programmes without specifying a particular sector. Agriculture and the rural sector in general account for the vast majority of sectorally focused papers across all years. This covers papers that report on general rural issues and agriculture, including livelihoods (e.g. Tambo & Abdoulaye, 2013 and Trærup & Mertz, 2011 in Africa; Keshavarz et al., 2014 in MENA; Patnaik et al., 2019 in South Asia) and adapting to rainfall variability (e.g. Huynh & Resurreccion, 2014 in south-east Asia; Mapfumo et al., 2016 in Africa; Patnaik et al., 2019 in South Asia). Studies focus on water management, including water harvesting (e.g. Boelee et al., 2013; Bunclark et al., 2018), water policy (Wilk et al., 2013) and local water management institutions (Villamayor-Tomas & García-López, 2017); agricultural and weather insurance (e.g. Bogale, 2015 in Africa; Panda et al., 2013 in South Asia); and decision making in the face of risk (e.g. Habtemariam et al., 2019). Agricultural crops that are represented include cereals (maize, rice), fruits (apples, pineapples) and beverage crops (coffee), whilst livestock that are represented include goats, cattle and camels (including through pastoralism).

The second most common focal sector is urban and peri-urban areas, which includes a focus on policy development and governance (e.g. Adekola et al., 2020; Boyd et al., 2014), spatial planning (e.g. Mitchell & Laycock, 2019; Waters & Adger, 2017) and infrastructure and policy to manage flood and other risks (e.g. Mansur et al., 2018; Schaer et al., 2018). Coasts, fisheries, water and forestry together comprise just 3–6% of the total sample. In coastal areas studies focus on low lying regions, flooding infrastructure and livelihoods





**Figure 4.** Number of papers per year published in the top 5 sectors (for clarity of reading the graph, sectors where fewer than 7 papers were published over the 10-year period are excluded. This includes water, forestry, health, tourism and infrastructure, including sanitation).

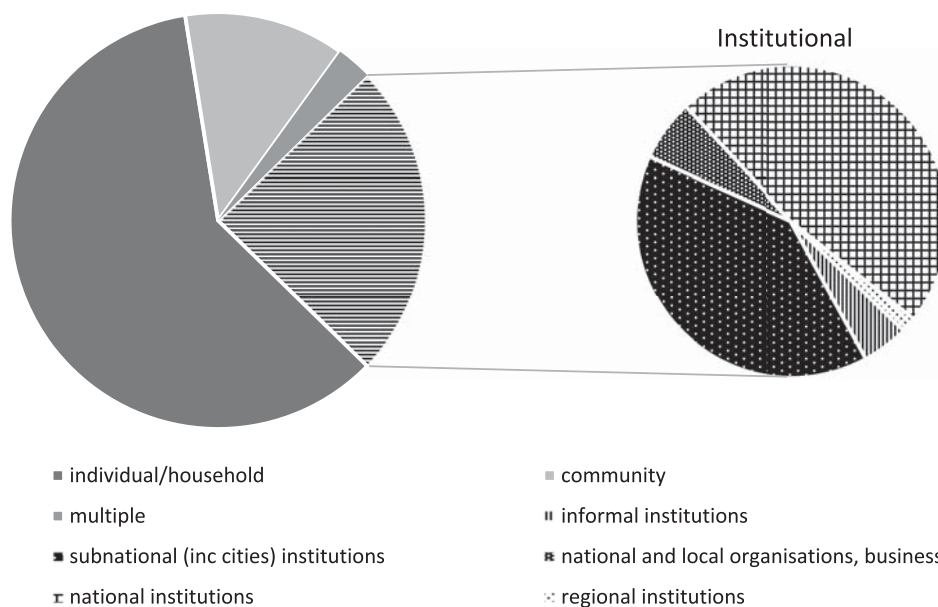
(e.g. Betzold & Mohamed, 2017; Jamero et al., 2018; Nunn et al., 2017). Fisheries research tends to focus on the adaptive capacity of small-scale fisheries and localized aquaculture systems (e.g. Hoque et al., 2018; Shaffril et al., 2017). Studies focused on the health sector are comparatively under-represented, comprising just 1% of the sample, and studies focusing on tourism, sanitation and other infrastructure are represented by just one paper each.

#### 4.4. Scale of concern

Over half of the papers (60%) focus on adaptation at the level of individuals or households, with 13% having a community or collective focus (Figure 5). Within this latter category, we find

studies focusing on long term livelihood strategies among populations (e.g. Kelso & Vogel, 2015), perception studies (e.g. Halder et al., 2012) and reflections on community-based and collective adaptation interventions (e.g. Asugeni et al., 2019; Clissold & McNamara, 2020).

A quarter of the papers focus on institutions at a variety of levels. Within that category, the majority focus on questions of national policy (12%) or sub-national (10%) public institutions and questions of governance. At a national level, studies interrogate a range of issues, including gender-sensitive policy (e.g. Shabib & Khan, 2014) and policy coherence between climate change and disaster risk reduction policy (e.g. de Leon & Pittock, 2017) and with climate change across sectors (e.g. England et al., 2018). At a sub-national scale, research has



**Figure 5.** Scale of consideration of empirical adaptation papers: pie on the left shows individual/household, community and multiple levels; whilst the pie on the right provides the breakdown of institutional scales (which included formal governance structures at sub-national, national and regional level, as well as informal institutions and national/local organizations, including business).

focussed on questions of local government or city governance (e.g. Cuevas et al., 2016; Hetz, 2016), and on non-political spatial units, such as river basins (e.g. Engle & Lemos, 2010; Huntjens et al., 2012). Regional governance structures, national and local organizations and informal institutions are the focus of less than 2% of papers each. Also under-represented (at 3%) in the sample is research that focuses on multiple scales of concern simultaneously (e.g. Daniell et al., 2011).

Although multiple scales of governance were the explicit focus of only a few papers, the scale specificity of adaptation, and the opportunities for synergies and trade-offs at different levels, were recognized in 23% of papers (e.g. Rasmussen et al., 2019; Sapkota et al., 2019; Sissoko et al., 2011). These variously explore the interaction between formal and informal governance (for example government compared to traditional leadership) and formal governance and informal institutions (e.g. Ensor et al., 2015; Sova et al., 2017); as well as between institutions and individuals (e.g. Kuruppu & Liverman, 2011), policy and practice (e.g. Herwehe & Scott, 2018), projects and individuals, and the public and private sector (e.g. Klein et al., 2018). Thus there is good coverage of empirical adaptation research at different levels of governance.

## 5. Discussion

Previous calls to increase focus on tangible adaptation research have clearly been heeded as the results show that there has been a growth in focus on empirical adaptation research – both in terms of actual and potential adaptation options – as opposed to just vulnerability reduction as was reported by Berrang-Ford et al. (2011). The empirical adaptation research covers both policy and practice and different scales of analysis, from regional, to national, to individual/household, and across these scales. Research is also starting to look at how those different levels of operation interact to create both barriers to and enablers of adaptation action (e.g. Dujardin et al., 2018; Horlings & Marschke, 2020; Mycoo, 2018).

Thematically, a large proportion of papers consider the determinants of adaptive capacity, and the barriers and enablers to adaptation. There is a slow but steady growth in the number of papers that are applying a gender lens. There is a positive trend to engage with differences between women and men in the context of adaptation options, actions and policy. However less emphasis has thus far been placed on more intersectional approaches (Kaijser & Kronsell, 2014), although we do see exceptions (e.g. Huynh & Resurreccion, 2014). Our sample suggests that gender studies are predominantly being pursued in Africa and Asia, with comparatively fewer studies currently reported for Latin America. Although this may well be a product of the journal selection in this study, encouraging research with a gender lens in Latin America is important, as would be an emphasis on intersectional approaches in all regions.

There has been an expansion of geographical spread in empirical adaptation research. There are many more papers than indicated in previous related reviews (Berrang-Ford et al., 2011; Ford, et al., 2015), despite the much more limited literature search in this study. That said, the geographical distribution is still uneven, both across and within regions. The

Middle East and North Africa is still poorly represented. East Asia is dominated by one country, whilst southeast Asia and Latin America also have one and two countries that are represented in many more papers than other countries. South Asia and some Small Island Developing States are relatively well researched. Coverage of sub-Saharan Africa has increased significantly, although nearly a third of countries still have no empirical adaptation research reported in these three journals. A small number of African countries dominate – from the west, east and southern parts of the continent. Therefore, although discussion often focuses on how to increase research outputs from under-represented regions in Africa, what we are seeing is a need to include a broader range of countries in all regions.

In the same way that there is uneven geographical distribution, the distribution of sectors covered in empirical adaptation research is even more skewed. Agriculture and rural issues predominate – which likely reflects the economic dependence of many countries in the global South on these sectors. Urban and peri-urban issues are the second most researched sector. This is important given the rapid rates of urbanization in the global South – but the number of papers here is still small – only 19 papers in 10 years. This result may be an outcome of researchers submitting their adaptation research to journals which deal specifically with urban issues, but nevertheless this finding suggests that journals focusing on adaptation represent far more rural adaptation than urban.

Other sectors that are critical for climate-resilient development – namely water (outside of its use for agriculture), infrastructure and health – are also under-represented, at least in the three journals reviewed here. The role of the private sector is expressly addressed in just one paper (Canevari-Luzardo, 2019). Clearly public sector adaptation has been the main focus, together with private individual/household level actions in the rural/agricultural sector. Given the emphasis on private sector growth in enabling development in the global South, this does represent a challenge – although research priorities and case studies are beginning to appear on these issues in other outlets (e.g. Atela et al., 2018; Crick et al., 2018). Of course, the methodology used in this study may have masked focus on some sectors. For example, a paper that referenced the tourism sector is also an example of the private sector but was classified as tourism as the sector of focus in this analysis (e.g. Parsons et al., 2018). Nevertheless, we find scope to significantly ramp up research effort in the global South on cities, the role of the private sector, water, infrastructure and health in the context of climate change adaptation, alongside the continued necessary emphasis on agricultural and rural issues.

Given the ongoing and increasing political (and financial) support for adaptation, particularly at international levels through the UNFCCC, this assessment of the current gaps in empirical adaptation research in the global South has several implications. The fact that some countries and sectors are under-represented runs the risk that research is not effectively able to illuminate the needs for policy intervention to reduce the adverse impacts of climate change. Of course our sample purposefully selected non-geographically-specific journals that have a strong focus on empirical adaptation research, as opposed to journals with a thematic, sectoral or geographical

focus that also publish adaptation research among a wider scope. The geographical and sectoral gaps noted here may be addressed in empirical adaptation research published in geographically- or sector-specific journals. However, these journals were selected as high ranking target publications for empirical adaptation research, and thus if not represented here it is likely that the gaps we identify persist across the adaptation literature. Therefore, this assessment could provide an input to the global stocktake which will assess the extent to which adaptation is taking place. It can also inform more equitable and effective distribution of adaptation finance.

It is important to bear in mind that empirical adaptation research is one component of a broader adaptation field. Indeed, our exclusion criteria give a good indication of the other topics in the broad adaptation field that are common. These include impact assessments and vulnerability assessments, as well as related theoretical framings, such as resilience and social-ecological systems. In particular, some research topics within adaptation that have gained momentum globally and are represented in the sample journals in the global North, such as adaptation pathways, have not yet been a major thrust of research in the global South. At the same time, there remains significant overlaps and occasionally conflicting use of terminology to refer to related concepts, for example coping, resilience, disaster risk reduction, climate risk mitigation and vulnerability reduction. The search criteria used here relied on authors using ‘adapt\*’ – but an interesting extension study could interrogate the epistemological and theoretical underpinnings of included and excluded research to outline the range of ways in which adaptation is (or is not) used as an entry point.

## 6. Conclusion

In this paper we have undertaken a scoping review to inductively assess the nature and progress in empirical adaptation research in the global South over the 10-year period 2010–2020, based on an indicative sample of three major journals that publish empirical adaptation research – GEC, REC and C&D. Our analysis has identified scope for increased research emphasis on a range of currently under-researched thematic questions, a shift from region-level research investment toward widening the countries involved in research from specific regions, and key sectors requiring increased research investment.

As such, the review can inform future research directions. Understanding gaps in empirical adaptation research highlights priority gaps that need to be addressed to inform policy and practice, given the substantial support for putting adaptation into practice through the UNFCCC and the forthcoming global stocktake under the Paris Agreement. It raises the question of whether or not we are researching what we need to know about climate change in order to ensure effective and equitable adaptation. Other papers have highlighted future key areas for applied adaptation research (e.g. Jones et al., 2017), but this review highlights not just normative gaps, but also tangible gaps based on the extent and nature of current evidence.

These findings also contribute to the emerging literature on the critical politics of adaptation. Given that adaptation is not just a research issue but also one for policy and practice, both the availability of evidence and the definition of research directions is embedded within a context of differential vulnerability and unequal power relations in the decision-making around adaptation in the international sphere (Scoville-Simonds et al., 2020). In the process of short listing for this review we also observed a number of papers on cognitive aspects of decision-making and framing as it affects adaptation decisions (that were excluded here for not reporting empirical adaptation examples). This links to broader debates around the framing of climate change as an issue of concern and the recognition of ontological pluralism beyond the typical science-policy-behavioural change pathway (Nightingale et al., 2020). New framings will create new future research directions.

In the immediate term, as we move into the next decade greater emphasis needs to be placed on who is producing research as well as new themes resulting from the reframing of adaptation and recognition of its political dimensions. These two areas are closely interlinked. The majority of adaptation research is produced by wealthy countries and there is little exchange between ‘modules’ of authors who are typically linked by geographical proximity or similarity of political and economic characteristics (Pasgaard et al., 2015; Pasgaard & Strange, 2013). Calls have long been made to ensure greater inclusion of knowledge production by researchers from the global South because of the relationship between who is producing knowledge and how it feeds into political debates around climate change (Lahsen et al., 2010). Interrogating who produced empirical adaptation research in the global South over the period 2010–2020 would thus also be an illuminating contribution.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

This work was carried out with financial support from the UK Government’s Foreign, Commonwealth & Development Office and the International Development Research Centre, Ottawa, Canada.

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