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SUPPLEMENTARY FILE 1

A backgrounder on adaptation tracking and global adaptation mapping

The study of adaptation tracking has grown rapidly over the past decade to address the question: are we adapting? Adaptation tracking examines what kinds of adaptation are emerging in response to anthropogenic climate change, who is adapting, and where adaptation is being planned and implemented.¹ Adaptation tracking addresses a particular gap in the climate change literature, which is the need for longitudinal and comparative research approaches that assess changes in the status of adaptation across temporal and spatial scales, and evaluative research that helps us understand whether adaptation efforts are sufficiently ambitious and appropriately targeted to effectively address key risks and vulnerabilities over the long-term.^{2,3} For example, adaptation tracking approaches are used to establish baseline knowledge on the evolving status of adaptation responses,⁴ in the comparative study of adaptation policy adoption,⁵⁻⁸ and in reviews of climate financing mechanisms like the Adaptation Fund.⁹⁻¹¹ Adaptation tracking is also important beyond scientific research, as it informs approaches to adaptation assessment under programs like the Global Stocktake under the Paris Agreement,¹² the UN Environment-DTU annual adaptation gap report,¹³⁻¹⁵ and third-party assessments of adaptation progress (e.g. Climate Watch's NDC Tracker).

Conceptual, methodological, and data availability challenges have stymied efforts to track adaptation.^{3,16-20} Key challenges include: the difficulty of deciding on what counts as 'adaptation'; the lack of clear metrics by which to measure adaptation effectiveness, the components of which are widely debated and ultimately concern averted future impacts; political considerations, with reluctance by countries to compare across nations and allocate resources to the monitoring, reporting, and verification of adaptation actions; and an absence of systematically collected and comprehensive datasets on adaptation, limiting the ability to compare and provide information on adaptation policies, programs, and activities across all countries and over time.

In response to these challenges, various methodologies and methods are proposed in the scientific literature for adaptation tracking, which aim to balance the need for substantive information on adaptation responses with parsimony, comparability, and efficiency. One common approach relies on content analysis of primary documentation of adaptation policies, programs, and projects to systematically collect information about who is adapting, where, and how. These studies typically rely on data sources like adaptation plans or strategies, project reports, websites, or legislative records like meeting minutes or Hansards. While this type of analysis can provide a complete picture of adaptation activities occurring in different places, and yield rich information about the design and targeting of adaptation interventions, it also tends to require more resource-intensive data collection and so faces challenges in scaling up analyses to a global level. Other approaches therefore rely on secondary information like national communications to the UNFCCC, which summarize adaptation activity happening across countries or regions.^{4,21} These types of information sources provide higher-level snapshots of adaptation, and thus lack the detail of primary documents but can be more easily scaled up to the global level.

There is growing interest in the use of machine learning techniques to efficiently conduct much larger-scale analyses of primary documents.²² Techniques like topic modelling and sentiment analysis can be used to analyse the content of documents and identify trends across large volumes of text.¹⁹ Neural network models can also be used to sift through primary documents to identify adaptation-relevant documents for further study. In one recent example of this, Biesbroek et al. train a neural network

model to classify blocks of text as related to “adaptation,” “mitigation,” or “non-climate,” and use this model to analyze over 12,000 policy papers published by the UK government and identify documents that are highly likely to be relevant to adaptation policy.²³ Overall, their study shows an accuracy level of 78%.²³ This study shows promise for addressing one of the core challenges of the “dependent variable problem” in adaptation research: identifying adaptation-relevant policies or initiatives that are not explicitly labelled adaptation.²⁴ There is considerable interest in the potential of supervised machine learning to support or even replace human coders in the content analysis of primary documents, but to our knowledge this approach has not yet been successfully demonstrated in the adaptation literature.

The GAMI project falls into a third approach to adaptation tracking, which is the systematic review of scientific studies in order to synthesize the overall state of scientific knowledge. Systematic reviews differ from traditional literature reviews because the aim to achieve a high level of transparency and replicability in their methods, include a critical analysis of study quality, and achieve universal inclusion of studies relevant to the research question at hand. Systematic review approaches have been used across the social sciences, but specific standards and methodologies for developing review protocols come primarily from the health sciences. Systematic reviews are focused literature reviews that aim to answer a specific and relatively narrow question using a set of pre-defined criteria for study inclusion and document analysis. Systematic reviews are becoming increasingly common in adaptation research, as the volume of research is growing at a rapid rate and researchers are turning to systematic reviews as a way to track emerging findings and identify knowledge gaps.²⁵ The IPCC does not require systematic reviews as a component of the assessment process—although some have called for this (e.g. Peticrew and McCartney, 2011²⁶)—but GAMI reflects the growing recognition by adaptation researchers that this type of approach provides a valuable framework for synthesizing the research that’s reviewed in the assessment reports. GAMI demonstrates the opportunities, challenges, and, perhaps most importantly, feasibility of scaling up systematic reviews using a collaborative approach to a global assessment of adaptation research across regions and sectors. The model may be useful for informing future IPCC assessment processes.

Assessing the state of adaptation for the Global Stocktake will require multiple lines of evidence that synthesize information contained in a variety of sources, including primary data (e.g. policy documents, project reports), secondary data (e.g. national assessments or reports to bodies like the UNFCCC), and scientific research. Indeed, Ford et al. reveal different kinds of adaptation are profiled in the peer-reviewed literature, grey literature, and National Communications, in their work focusing on adaptation in ‘hotspot’ regions of Africa and Asia.²⁷ The three general approaches to adaptation tracking described above can provide significant amounts of information to support this process. They each provide different types of information and levels of detail, so should be seen as complementary to one another. The IPCC plays an important role in establishing the scientific basis for international climate change agreements, so to the extent that systematic reviews can play a role in synthesizing adaptation data for its assessment reports, this approach also has a role to play in informing the Global Stocktake of adaptation action.

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SUPPLEMENTARY FILE 2

What evidence do we have that adaptation responses are reducing risk?

Approach

One of the central questions of assessments of adaptation progress is to what extent adaptation responses have reduced climate risks. Our codebook (SM6) therefore covers this topic via two questions:

- 4.1 (Implementation): What is the general stage of the response activities described in the document?
- 5.1 (Risk reduction): Is there any evidence (implicitly or explicitly) provided that activities successfully reduced risk or vulnerability?

With regards to Question 5.1, we noted that many of the reports of risk reduction were assumed rather than evidenced, and coder responses were widely variable in terms of their interpretation of what represented sufficient evidence of risk reduction. There was consensus among the team that Question 5.1 was not a reliable and robust measure of evidence of risk reduction in the dataset.

We thus focused on Question 4.1 in the codebook, reflecting the stage of adaptation. We extracted articles where coders had selected 'evidence of risk reduction' as the stage of adaptation. The codebook defines this stage as: *"There is moderate to substantial evidence that key indicators of vulnerability and/or risk have declined, as well as (qualitative or quantitative) evidence that adaptation efforts have contributed to these reductions. Evidence may be attribution-based or based on robust narratives and theories of change."* In total, 58 out of the 1,682 articles in our database were coded as meeting this condition.

We conducted a re-analysis to further re-code these 58 articles to assess what kinds of evidence on risk reduction outcomes are present within these articles. The re-analysis sought to ensure that the evidence of risk reduction was indeed demonstrated and not just assumed by the authors. It also distinguished between primary data of risk reduction and secondary data (evidence from other studies) with the former taken as a more robust form of evidence. Articles could also provide different types of evidence: either based on quantitative or qualitative data, or on both. Where surveys were used, we categorised those that asked open-ended questions (e.g. about perceptions and experiences) into the qualitative category and surveys that asked closed questions into the quantitative category.

Articles newly coded as "yes" on the question for evidence of risk reduction could provide two different types of evidence: evidence about aspects of the adaptation process and its inputs, but not the results of that process, and evidence on the outcomes of the adaptation response (i.e. the results of the process). Articles could also provide different types of data for these outcomes: they can include both quantitative and qualitative data, or just one type of data. Where surveys were used, we sorted surveys that asked open-ended questions about perceptions and experiences into the qualitative category and surveys that asked closed questions into the quantitative category.

Coding

Coding of the 58 articles focused on the presence of empirical evidence and on the type of data (quantitative or qualitative). Articles that did not provide primary data on risk reduction were excluded.

Table 1: Questions used for re-coding the 58 articles

Category	Code	Definition	Examples
Outcome-based (direct) evidence			
Improved capacity-building demonstrated	1: Yes 0: No	Data capturing improvements in different capacity of communities, individuals, households, countries, or regions that help them adapt to climate changes, including: availability of resources and information, stocks of human and social capital, attitudes/values/perceptions. Capacity can be improved without evidence of reductions in experienced risks/vulnerabilities, or it can be improved along with evidence of reductions in experienced risks/vulnerabilities (this latter case is generally what we would expect to find in fully mature, successful adaptations – they improve capacity and reduce experienced risks). (MUST be empirically demonstrated – if it is assumed by the author or justified based on referencing secondary sources then it doesn't count)	Awareness of climate change risks, vulnerability, opportunities; access to financial or decision-making resources; access to information; improvements in infrastructure; access to insurance
Risk/vulnerability reduction demonstrated	1: Yes 0: No	Article empirically demonstrates the effectiveness of an action in reducing experienced risks or vulnerabilities (MUST be empirically demonstrated – if it is assumed by the author or justified based on referencing secondary sources then it doesn't count)	Systems, infrastructure, communities, and sectors are less vulnerable to climate change impacts (e.g. through effectiveness of adaptation interventions/response measures); Non-climate pressures and threats to human and natural systems are reduced (particularly where these compound climate change impacts); people have reliable access to food, employment, etc.
Types of evidence			
Quantitative	1: Yes 0: No	Measurement based	Funding levels, participation numbers, crop yields, lives lost, probabilities of risk
Qualitative	1: Yes 0: No	Narrative based	Perceptions, stories about experiences

Summary of findings:

Of the 58 articles that we re-analyzed, only 30 presented primary evidence of risk reduction as an outcome of adaptation responses, for example in improved food security and health outcomes using indicators such as from increased agricultural yields and caloric in-take. A further 9 articles presented evidence of improvements in adaptive capacity, but with no clear evidence of changes in risk outcomes. Outcome-focused studies applied a mix of quantitative and qualitative methods; 15 articles used quantitative methods to assess risk reduction outcomes, 11 used qualitative methods, and 4 integrated both qualitative and quantitative methods. 14 articles that documented risk reduction outcomes also described process-based indicators of adaptation progress, such as increases in access to subsidy programs, adoption of strategic plans, and expanded organizational capacity. 19 papers were identified as having insufficient evidence of risk reduction based on the standard of evidence applied in the re-analysis.

Examples of primary evidence framed as capacity-building outcomes:

- Increased incomes from crop production and cost savings in agricultural inputs
- Access to rangelands for grazing
- Household awareness of flood risks and willingness to make household-level changes, and engagement with local governments on flood protection
- Increase in crop and livestock insurance coverage
- Community supports for collective action and coping
- Increased employment
- Increased asset ownership
 - One paper references concerns about equity: benefits are only experienced by a minority of households
- Social learning from disaster experiences
- Information dissemination through social networks
- Increases in financial support for farming equipment and infrastructure

Examples of primary evidence framed as risks reduction outcomes:

Noting that five papers also reported maladaptation or mixed results in the outcomes:

- Increases in agricultural yields
- Improved food security and asset ownership
 - One paper references concerns about equity: benefits are only experienced by a minority of households
- Water conservation
- Dietary intake and food diversity
- Crop production and farming incomes
- Water security
- Reduced flood damage
- Reduced soil erosion
- Crop yields during droughts
- Improved food security and reduced health vulnerabilities from improvements in irrigation
 - One paper that solutions are short-term and not sustainable in the long-term
- Quality of grazing areas for livestock
- Reduced crop sensitivity to drought
- Reduced disease burden
- Livelihood diversification

- One paper that outcomes can be conflicting and maladaptive.
- Increased food security
- Reduced rural poverty
- Water security
 - One paper references concerns about equity: Benefits of rural environmental programmes tend to cluster around those with higher social and political status and more assets.
- Financial security
- Losses from disaster events
- Strengthened livelihoods
- Reduced daily hours of work for women
- Improved energy security
- Improved access to local markets
- Peri-urbanization and access to employment and resources
 - One paper notes that opportunities for some come at the expense of others (maladaptation)

SUPPLEMENTARY FILE 3

METHODOLOGY FOR ASSESSMENT OF EVIDENCE OF TRANSFORMATIONAL ADAPTATION

Introduction

This document provides detail of the methodological process used to assess evidence of transformational adaptation in global sectors and regions, using a database of 1682 academic articles identified by the Global Adaptation Mapping Initiative (GAMI) database.

Transformational adaptation is defined as adaptation that changes the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts. The operational definition of transformational adaptation remains contested as it reflects a range of conceptual factors; a city might implement radical new policies which do not extend beyond its area, while an entire nation may undertake 'incremental' but persistent and widespread change. The term 'transformational' is not a one-dimensional scale, but rather a multi-dimensional scale integrating different aspects of change. In this work, we built on Termeer et al.'s¹ conceptualization of transformational change, comprised of 3 components from Termeer (scope, depth, speed), plus the addition of a fourth component: challenge to adaptation limits. We used these 4 components to conceptualize the multi-dimensional space within which adaptation responses can be more or less transformative.

Depth relates to the degree to which change reflects something new, novel, and different from existing norms or practices. Scope refers to the scale of change – geographic or institutional. Speed of change refers to the dimension of time within which changes are happening. Challenge to adaptation limits reflects evidence that adaptation limits are being challenged or overcome. For each article in our database, we assessed evidence of the overall scope, depth, speed, and challenge to limits reflected in the adaptation response(s) documented in that article. We then collated these assessments by global sector and region to assess overall evidence for each region and sector that adaptation responses were transformational in nature. We further assessed confidence in the evidence underpinning our assessments.

Operationalizing assessment of transformational adaptation

Drawing on Termeer et al. and others¹⁻¹⁴, we developed operational descriptions of high, medium, and low evidence of transformational adaptation for each of our 4 components (depth, scope, speed, limits). Evidence on depth, scope, speed, and limits was already documented in narrative format for each article in our database based on the data collection codebook. We consulted with the GAMI Advisory Team and external reviewers to receive feedback and ensure that our definitions and categorizations were reasonable and valid. A summary of descriptions for high, medium, and low evidence of transformational adaptation is provide in Table 1.

Table 1. Defining high, medium, low categories for evidence of transformational adaptation, based on depth, scope, speed, limits of adaptation.

Depth	<i>Question 4.4 in GAMI Protocol</i>
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<p>Depth relates to the degree to which change reflects something new, novel, and different from existing norms or practices. Extent to which actions offer potential to lead to positive systemic change. Incremental actions are taken to tackle the source of risk and reduce risk, while transformation goes beyond the source of risk, e.g. farmers seeking alternative livelihoods when farming is not feasible anymore in the face of drought.</p>	
High	<p>High depth (in-depth) change is more transformational: it might involve radically changing practices by altering frames, values, logics, and assumptions underlying the system. This might involve deep structural reform, complete change in mindset, radical shifts in perceptions or values, and changing institutional or behavioral norms. Adaptation actions are increasingly radical (depth of change), including altering of values, re-framing of problems, and dramatic changes in practices.</p>
Medium	<p>Medium (moderate) depth describes incremental changes: a shift away from existing practices, norms, or structures, but only to a limited degree. Perspectives, values, and practices are changing to involve novel or more radical approaches (depth of change). Changes in risk perception may be medium depth.</p>
Low	<p>Low (limited) depth follows business-as-usual practices, with no real difference in underlying values, assumptions, or norms. This includes practices that are largely expansions of existing practices. Adaptations largely are incremental by expanding existing practices, with limited evidence of novel change beyond business-as-usual practices (depth of change).</p>
Scope	<i>Question 4.5 in GAMI Protocol</i>
<p>Scope refers to the scale of change – geographic or institutional.</p>	
High	<p>High (broad, large) scope refers to large-scale and system-wide changes that involve an entire organization, a country or large region, and large populations. Broad scope efforts may be multi-dimensional, multi-component, and/or multi-level. Development of networks, inter-organizational coordination are more likely to lead to changes of broad scope. Adaptation is implemented at or very near its full potential across multiple dimensions. Adaptations are widespread and substantial, including most of the possible sectors, levels of governance, actors (e.g. nationally implemented legislation or policy), or reflect widespread changes in behavior (scope of change). For example, this may include numerous cities or national-level changes, or institution-wide change. It may also address shifts in underlying norms and behaviors across entire populations.</p>
Medium	<p>Medium scope could describe multiple communities or households acting without coordination, a single sector taking action, or a small regional action. Adaptation is expanding and increasingly coordinated. There are growing efforts that exceed business-as-usual practices and challenge the fundamental attributes of the social-ecological system. There is some expansion and/or mainstreaming of change (scope of change) to include a wider region, or involvement of coordinated, multi-dimensional, multi-level adaptation.</p>
Low	<p>Low (small) scope might refer to local initiatives, activities taken by individuals or households. Adaptation is largely localized. There are primarily disjointed adaptation initiatives, with limited evidence of coordination or mainstreaming across sectors,</p>

	jurisdictions, or levels of governance (scope of change). This could be a single city or government department.
Speed	<i>Question 4.6 in GAMI Protocol</i>
Speed of change refers to the dimension of time within which changes are happening.	
High	High (fast) speed adaptation actions are either (a) those described as being fast for their type of action (e.g., building a bridge in a year might still be considered fast) or (b) those that can take place and see results within 1-3 years.
Medium	Medium (moderate) speed adaptations are those that occur or see results over 3-5 years. Adaptations are increasingly exceeding business-as-usual behavioral or institutional change to reflect accelerated adaptive responses (speed of change).
Low	Low (slow) speed adaptations are those that take 5 years or more to be executed or to see results. Adaptations are largely slow, consistent with existing behavioral or institutional change, and limited evidence of accelerated adaptive response (speed of change). Change is evident, but not rapid.
Limits	<i>Question 6.4.2 in GAMI Protocol</i>
Evidence that limits are being challenged or overcome	
High	Soft limits are present (as identified in questions 6.1.1 and 6.2.1) and there is evidence that these soft limits are being overcome. (The occurrence of adaptation is not itself evidence that limits are being overcome) Hard limits are being approached, if not overcome. Adaptations exceed soft limits and begin to approach hard limits. If no hard limits, exceed soft limits by a substantial margin.
Medium	Soft limits are present and are being addressed or challenged but limited evidence that they are being overcome. Adaptations may overcome soft limits but do not challenge or approach hard limits.
Low	Limits are present and are a current or potential future limit on the level of adaptation possible. Adaptations may approach but do not exceed or substantively challenge soft limits.

Article-level assessment of transformational adaptation

Four researchers from the GAMI Synthesis Team used narrative data on depth, scope, speed, and limits to re-code each article based on the categories outlined in Table 1. Each article was assigned as high, medium, or low for each of the four dimensions of transformational adaptation. Each of the 4 team members coded the same 25 articles on depth, scope, speed, and limits. We reviewed our answers and discussed discrepancies until consensus was reached on operationalizing the definitions and categorizations in Table 1. This step ensured consistency across coding. Next, the team members coded all 1682 articles in the GAMI database for depth, scope, speed, and limits.

Sectoral- and regional-level assessment of transformational adaptation

We then divided the GAMI database into fourteen region*sector combinations, following the divisions used by the GAMI protocol (Table 2). Many articles fall into more than one region or sector if they, for example, involve comparative work or adaptations that address multiple issues. Each article was assigned to one or more sectors and regions. Our dataset had already been coded for relevant regions and sectors relevant to each article. Papers could also be assessed as “not applicable” or “unable to assess” if the article provided insufficient information on the element in question (e.g., speed) to provide a score.

For each region-sector combination, the team assigned an overall score of low, medium, or high to each of the 4 dimensions of transformational adaptation (depth, scope, speed, limits). This aggregate score reflects a conceptual average of the overall state of adaptation within a region-sector. For example, there may be a small number of highly transformational adaptation examples in a particular region or sector, but if the overall profile of adaptations across all articles in our dataset is low, then the aggregate score will be low. These scores thus reflect the overall profile for a sector-region of the extent to which evidence suggests that adaptation responses are transformational.

Table 2. Articles in each region*sector combination

	Cities	Food	Health	Ocean	Poverty	Terrestrial	Water
Africa	249	397	132	23	338	49	50
Asia	77	404	185	53	269	66	84
Australasia	6	17	27	8	11	5	9
Central & South America	12	57	21	3	38	12	14
Europe	67	45	45	22	11	22	9
North America	66	88	81	28	52	52	72
Island States	15	38	42	35	41	12	19

Assessing confidence in evidence

The volume of evidence to assess transformation adaptations varied between sectors and regions, and between dimensions of transformational adaptation. There was much more evidence to confidently code depth and scope, for example, than speed of adaptations. Evidence also varied in its quality and consistency. To assess confidence in the evidence underpinning our assessment, we used an approach combining aspects of the IPCC’s uncertainty framework¹⁵ and the GRADE-CERQual¹⁶ approach to assessing confidence in qualitative evidence. For each sector-region-dimension of adaptation, we conducted a formal confidence assessment, considering both level of agreement and robustness of evidence.

We developed a protocol to assess robustness of each dimension. For every article, we assigned four robustness scores: one each for depth, scope, speed, and limits based on the quality of the paper and the relevance of the paper to the issue (e.g., how clearly and explicitly it addressed speed of adaptation). We discussed this protocol as a group and went over an example to ensure we all had a similar understanding of the criteria.

For each region*sector combination (n= 49), team members then filled out a summary table that provides the following information:

- Region and Sector
- Variable (Depth, scope, speed, limits)
- Ranking on evidence of transformational adaptation (High, Medium, Low)
- Number of papers that support the ranking (e.g., number of papers in Africa*Ocean combination that demonstrated high depth adaptation)
- Number of papers that assessed the variable in question (i.e., number of papers that actually addressed depth; often less than the total number of papers in that region*sector because some papers were unable to be assessed)
- % of papers assessed that support the ranking (divide number of papers support by number assessed)
- Citations (a list of author name, title, journal for all articles that, e.g., documented high depth adaptation)
- Level of agreement (see Table 3 for specifics, generally high agreement if a supermajority of papers assessed agreed on the ranking, medium if a majority agreed, and low if a general spread of responses); a justification for the agreement assessment
- Robustness ranking (high, medium, low) (see Table 3 for specifics, draws on the robustness rankings for the given variable by article and also considers overall region*sector evidence); a justification for the agreement
- Overall confidence ranking (see Table 3)

If fewer than 5 studies addressed the element in question (e.g., speed), either because there were too few papers in the region*sector (e.g., Central & South America, Oceans), or because many of the papers did not provide enough information to assess a given element, then the ranking in the final table was given as “Insufficient information to assess”.

Level of agreement, robustness at the region*sector level, and overall confidence were assigned based on the criteria found in Table 3. Our confidence assessment was informed by the GRADE-CERQual guidelines¹⁶ for assessment of confidence in qualitative evidence, adapted and simplified to integrate the IPCC’s uncertainty guidance language.¹⁵

Table 3. Confidence assessments standards

Level of Agreement	
	<p>Level of agreement across the papers assessed (how many of the papers assessed agreed, e.g., what was the spread)</p> <p>Example: All studies provide evidence of autonomous adaptation. There is variation in the details of these processes, but no general disagreement over the generalized statement of evidence on this. Studies 67-70 additionally address the sufficiency of evolutionary adaptation. All studies indicate consensus that the pace of adaptations does not appear to be sufficient to keep pace with the rate of climate change.</p>
High	No or very minor concerns about the extent to which the underlying literature is consistent with your key statement; This could be assessed by number cutoffs but also requires judgement. For example, if a supermajority of studies agree to the

	answer (e.g. >70% of studies agree that adaptation is High Depth, 20% medium, and 10% low)
Medium	Minor to moderate concerns about the extent to which the underlying literature is consistent with your key statement; This could be assessed by number cutoffs but also requires judgement. For example, if a majority of studies agree to the answer (e.g., 50% of studies agree that adaptation is High Depth, 40% medium, 10% low); This could also include the case where the answers are split between two close answers (e.g., 45% High, 45% Medium, 10% low)
Low	Moderate to serious concerns about the extent to which the underlying literature is consistent with your key statement; This could be assessed by number cutoffs but also requires judgement. For example, if studies are evenly split between the categories with no clear pattern (e.g., 33% High, 33% medium, 33% low); Or categories are split bimodally (e.g., 45% High, 10% medium, 45% low);
Robustness	
<p>Robust evidence considers the # of articles assessed, the type of articles; relevance of articles (e.g., do they address the question directly or is it inferred by coders). and adequacy of methods. <i>Types</i> of articles (all GAMI articles are scientific peer-reviewed publications, so high). <i>Adequacy</i> of evidence relates to quantitative or qualitative volume of evidence base, and this is based on the richness of the information (e.g., is speed barely mentioned or discussed in depth). <i>Relevance</i> of the literature relates to the extent that the literature provides a range of contexts and reflects what I am really asking (e.g., can the papers in the Africa*Cities category really reflect the entire range of adaptation in African cities? Or do they only address East Africa, or mostly address Europe and mention Africa?).</p> <p>GAMI questions that can help with this assessment: Quotes for each question; Summary; Description of Response and Implementation Tools (3.1.1-3.2.2); Methods (7.1); Adequacy (7.2); Coherence (7.3); Relevance (7.4)</p>	
High	No or very minor concerns about the extent to which the underlying literature is consistent with your key statement; You feel certain that there is good quality evidence upon which to base the conclusions drawn; Numerous articles provide an answer to the question; They address the issue directly (not inferred by coders), and have no methodological concerns (e.g., they have large sample sizes or detailed case studies)
Medium	Minor to moderate concerns about the extent to which the underlying literature is consistent with your key statement; You feel reasonably sure there is good evidence upon which to base the conclusions drawn; Multiple articles provide an answer to the question; At least some of them address the issue directly; there are only a few studies with methodological concerns or the concerns are minor
Low	Moderate to serious concerns about the extent to which the underlying literature is consistent with your key statement; You are not entirely certain that the evidence upon which conclusions are based is solid; Only a few articles address this topic (must be more than 5 or we do not assess and label this as "Insufficient

	information”); They may not address the topic directly, or they may have methodological concerns (either concerns are frequent or severe or both)	
Confidence		
How confident are we in our ultimate conclusion (e.g., that adaptation in African Cities is occurring with limited depth)? This will be a combination of the level of agreement and robustness of the evidence provided.		
High agreement Limited robustness of evidence <i>(E.g. medium confidence)</i>	High agreement Medium robustness of evidence <i>(E.g. high confidence)</i>	High agreement Robust evidence (high) <i>(E.g. very high confidence)</i>
Medium agreement Limited robustness of evidence <i>(E.g. low confidence)</i>	Medium agreement Medium robustness of evidence <i>(E.g. medium confidence)</i>	Medium agreement Robust evidence (high) <i>(E.g. high confidence)</i>
Low agreement Limited robustness of evidence <i>(E.g. Very low confidence)</i>	Low agreement Medium robustness of evidence <i>(E.g. low confidence)</i>	Low agreement Robust evidence (high) <i>(E.g. medium confidence)</i>

The ranking for each variable was collected in a table, along with the overall confidence ranking. An “overall” extent of adaptation score for each region*sector combination was assessed based on the rankings for each element (depth, scope, speed, limits) and given a confidence assessment based on the confidence for each element. The four scores for ranking and four scores for confidence were compiled using the following logic:

Overall High ranking / confidence if there are:	Overall medium ranking / confidence if there are:	Overall low ranking / confidence if there are:
4 high rankings/confidence	4 med	4 low
3 high; 1 med	1 high; 3 med	1 high; 3 low
3 high; 1 low	3 med; 1 low	1 med; 3 low
2 high; 2 med	2 med; 2 low	
	2 high; 2 low	
	2 high; 1 med; 1 low	
	1 high; 1 medium; 2 low	

Thus, a region*sector that had medium depth, medium scope, low speed, and low limits assessment with medium, high, low, and medium robustness scores, respectively, would be assessed an overall

medium extent of adaptation with medium confidence. Very low confidence or insufficient information assessments were treated as low confidence for purposes of assessing overall extent.

A narrative description was added to each by selecting illustrative examples for each element within each region*sector. These examples are not necessarily representative of the category (especially for sectors with a large number of studies).

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SUPPLEMENTARY FILE 4

Expert elicitation methods and results

The data collected within this initiative represent only a small fraction of adaptation actions globally. A wide range of adaptation-related activities take place on a daily basis. These might be highly adaptive but not be recognized as such (e.g. livelihood strategies, poverty reduction programmes, shifting behaviours and attitudes, incremental change in policy priorities). Or activities may be adaptive but not documented with the scientific literature. Many adaptation actions are documented in national and other governmental and non-governmental policy documents and elsewhere in the grey literature. And there is a large volume of knowledge held within local knowledge and Indigenous knowledge bases that is not included in this review.

It is difficult to impossible to fully assess the extent to which our results (evidence in the literature) reflect the reality of global adaptation. We do expect, however, that GAMI results are a reasonable representation of the adaptation actions that are documented formally within scientific publications.

In order to assess the extent to which our results might be reflective of on-the-ground adaptation trends – or the extent to which results are biased – we undertook an internal expert elicitation process within our collaborative network team of co-authors, with two objectives:

- 1) To assess confidence in evidence for key results statements
- 2) To assess potential trends and bias in these results

We focused on whether our results reflect expert judgements of real-world responses, focusing on our classifications of evidence for transformational adaptation. In total, 70 adaptation experts across the 49 sector-region combinations indicated their judgments about the actual, real-world extent of adaptation, as compared to our relative frequencies documented from the scientific literature. ‘Experts’ in this case were invited from our co-author team of 126 adaptation researchers, and selected based on regional and sectoral adaptation expertise.

The expert elicitation survey is provided in Box 1.

We found that the majority of experts judged the extent levels to be appropriately reflective of real-world and on-the-ground adaptation extent. Experts indicated that it was more likely that adaptation depth and scope were overestimated in our results, and that speed and limits may be underestimated.

Box 1: Expert elicitation protocol focusing on evidence of transformational adaptation each sector and region

This short set of questions is designed to assess your judgments about the evidence of transformational adaptation as reported in available literature. Your judgments should build on the evidence systematically reviewed, and they should take into account both the strengths and the limitations of that evidence.

Please answer this set of questions for each sector/region combination you have been assigned. Before beginning, review the synthesis package for the sector/region. Have the synthesis package open as you respond to these questions.

1) Please specify the sector and region:

[pick one sector from drop-down menu]

[pick one region from drop-down menu]

2) The general stage of adaptation-related response activities:

In the synthesis package for this sector/region, please open section 4A, which synthesizes evidence on the general stage of adaptation-related response activities. You will see in the synthesis package a description of the number of adaptation efforts falling into each stage in the literature systematically reviewed. There is also a synthesis statement about the stage of adaptation for the sector/region.

Consider the **relative frequency** of each stage in the literature reviewed. For each stage, select the option that best describes your judgment:

- 1) Response activities are **much more often** in this stage than the literature would suggest. That is, compared to other stages, this stage is described in the literature **much less frequently** than it is actually occurring in real-world responses.
- 2) Response activities are **more often** in this stage than the literature would suggest. That is, compared to other stages, this stage is described in the literature **less frequently** than it is actually occurring in real-world responses.
- 3) This stage is described in the literature **about as frequently** as it is actually occurring in real-world responses.
- 4) Response activities are **less often** in this stage than the literature would suggest. That is, compared to other stages, this stage is described in the literature **more frequently** than it is actually occurring in real-world responses.
- 5) Response activities are **much less often** in this stage than the literature would suggest. That is, compared to other stages, this stage is described in the literature **much more frequently** than it is actually occurring in real-world responses.

Each stage *[response mode will be organized as a table]*:

Vulnerability assessment and/or early planning

Adaptation planning and early implementation

Implementation expanding

Implementation widespread

Evidence of risk reduction associated with response has been assessed

For each stage:

[pick one judgment option]

Briefly describe your reasoning:

[space for open response]

For your responses to this question overall, please indicate your confidence:

[option to pick one: very low, low, medium, high, very high]

3) The depth of adaptation-related response activities:

In the synthesis package for this sector/region, now turn to section 4B, which synthesizes evidence on the depth of adaptation-related response activities. You will see in the synthesis package a description of the number of adaptation efforts falling into each depth category for the literature systematically reviewed. There is also a synthesis statement about the depth of adaptation for the sector/region.

Definition of depth: The degree to which a change reflects something new, novel, and different from existing norms and practices. A change that has limited depth would follow business-as-usual practices, with no real difference in the underlying values, assumptions, and norms. This would include responses largely based on expansion of existing practices rather than consideration of entirely new practices. In-depth change, by contrast, might involve radically changing practices by altering frames, values, logics, and assumptions underlying the system. This might involve deep structural reform, complete change in mindset by governments or populations, radical shifts in public perceptions or values, and changing institutional or behavioral norms.

Select the statement that best describes your judgment:

- 1) Adaptation in this sector/region is **actually occurring at greater depth** as compared to adaptation efforts described in the literature. That is, response activities in practice are more new, novel, and different than the literature would suggest.
- 2) Adaptation in this sector/region is actually occurring at the depth documented for adaptation efforts described in the literature.
- 3) Adaptation in this sector/region is **actually occurring at lower depth** as compared to adaptation efforts described in the literature. That is, response activities in practice are less new, novel, and different than the literature would suggest.

Briefly describe your reasoning:

[space for open response]

Please indicate your confidence:

[option to pick one: very low, low, medium, high, very high]

4) The scope of adaptation-related response activities:

In the synthesis package for this sector/region, now turn to section 4C, which synthesizes evidence on the scope of adaptation-related response activities. You will see in the synthesis package a description of the number of adaptation efforts falling into each scope category for the literature systematically reviewed. There is also a synthesis statement about the scope of adaptation for the sector/region.

Definition of scope: The scale of change. A small scope might refer to local initiatives, or activities restricted to particular neighborhoods, communities, groups, or projects. Broad scope would refer to large-scale and system-wide changes that might involve an entire organization, a country or large region, and large population. While changes of small scope might involve isolated efforts, broad scope might be multi-dimensional, multi-component, and/or multi-level. Development of networks, inter-organizational coordination, and social relations within a response are more likely to lead to changes of broader scope.

Select the statement that best describes your judgment:

- 1) Adaptation in this sector/region is **actually occurring at higher scope** as compared to adaptation efforts described in the literature. That is, response activities in practice are at broader, larger scale than the literature would suggest.
- 2) Adaptation in this sector/region is actually occurring at the scope documented for adaptation efforts described in the literature.
- 3) Adaptation in this sector/region is **actually occurring at lower scope** as compared to adaptation efforts described in the literature. That is, response activities in practice are at smaller scale than the literature would suggest.

Briefly describe your reasoning:

[space for open response]

Please indicate your confidence:

[option to pick one: very low, low, medium, high, very high]

5) The speed of adaptation-related response activities:

In the synthesis package for this sector/region, now turn to section 4D, which synthesizes evidence on the speed of adaptation-related response activities. You will see in the synthesis package a description of the number of adaptation efforts falling into each speed category for the literature systematically reviewed. There is also a synthesis statement about the speed of adaptation for the sector/region.

Definition of speed: The dimension of time within which changes are happening. A slow or incremental change might include small changes in incremental steps, or a series of small shifts. Faster change might involve rapid jumps or what might be called “transformative” changes in terms of relatively sudden shifts in views, perceptions, attitudes, and norms.

Select the statement that best describes your judgment:

- 1) Adaptation in this sector/region is **actually occurring at higher speed** as compared to adaptation efforts described in the literature. That is, response activities in practice are more rapid and transformational than the literature would suggest.
- 2) Adaptation in this sector/region is actually occurring at the speed documented for adaptation efforts described in the literature.

- 3) Adaptation in this sector/region is **actually occurring at lower speed** as compared to adaptation efforts described in the literature. That is, response activities in practice are more gradual and incremental than the literature would suggest.

Briefly describe your reasoning:

[space for open response]

Please indicate your confidence:

[option to pick one: very low, low, medium, high, very high]

6) The limits of adaptation-related response activities:

In the synthesis package for this sector/region, now turn to section 4E, which synthesizes evidence on the extent to which adaptation-related response activities are challenging or exceeding adaptation limits. You will see in the synthesis package a description of the number of adaptation efforts for which adaptation limits were discussed. Where they were discussed, the type of adaptation limit is specified (hard, soft). The number of adaptation efforts approaching limits is also indicated, based on the literature systematically reviewed.

Definition of limits: Constraints and limits to adaptation-related responses can be categorized as:

- (1) Economic: existing livelihoods, economic structures, and economic mobility;
- (2) Social/cultural: social norms, identity, place attachment, beliefs, worldviews, values, awareness, education, social justice, and social support;
- (3) Human capacity: individual, organizational, and societal capabilities to set and achieve adaptation objectives over time including training, education, and skill development;
- (4) Governance, institutions, and policy: existing laws, regulations, procedural requirements, governance scope, effectiveness, institutional arrangements, adaptive capacity, and absorption capacity;
- (5) Financial: lack of financial resources;
- (6) Information/awareness/technology: lack of awareness or access to information or technology;
- (7) Physical: presence of physical barriers; and
- (8) Biological: temperature, precipitation, salinity, acidity, and intensity and frequency of extreme events including storms, drought, and wind.

Hard limits are intractable, while soft limits are moveable. For example, governance and financial constraints, such as lack of institutional arrangements and funding, may result in insufficient or ineffective adaptation measures. This may lead to a soft limit that could be changed over time with improved governance and funding.

Select the statement that best describes your judgment:

- 1) Adaptation in this sector/region is **more often approaching limits (soft and/or hard)** as compared to adaptation efforts described in the literature. That is, response activities in practice are more often challenging or exceeding limits than the literature would suggest.
- 2) Adaptation in this sector/region is actually approaching limits about as often as documented for adaptation efforts described in the literature.
- 3) Adaptation in this sector/region is **less often approaching limits (soft and/or hard)** as compared to adaptation efforts described in the literature. That is, response activities in practice are less often challenging or exceeding limits than the literature would suggest.

Briefly describe your reasoning, including the types of limits you judge to be most relevant in this sector/region:

[space for open response]

Please indicate your confidence:

[option to pick one: very low, low, medium, high, very high]

7) Information to support project management:

In analysis and presentation of data, your name will not be associated with your responses. We request your name and contact information only for purposes of managing the project.

Your name: [area to specify]

Your email address: [area to specify]

Results

Results are shown in Figure 1, indicating team expert judgments about the actual, real-world stages of adaptation (A) and evidence of transformational adaptation (B), as compared to relative frequencies documented from the scientific literature. For general stages of adaptation-related response activities (A), respondents indicated their judgments about whether real-world response activities are more often (or less often) in the specified stages. For the depth, scope, speed, and limits of adaptation (B), respondents considered whether real-world evidence of transformational adaptation in the sector-region combination is occurring at greater, similar, or lesser extent. That is, they indicated their judgments about whether real-world adaptation is actually at greater (versus lower) depth, at higher (versus lower) scope, at higher (versus lower) speed, or more (versus less) often approaching limits, compared to the evidence of transformational adaptation documented from the scientific literature. Each respondent provided judgments for 1–4 sector-region combinations. Example narrative responses to support judgements are provided in Tables 1 and 2.

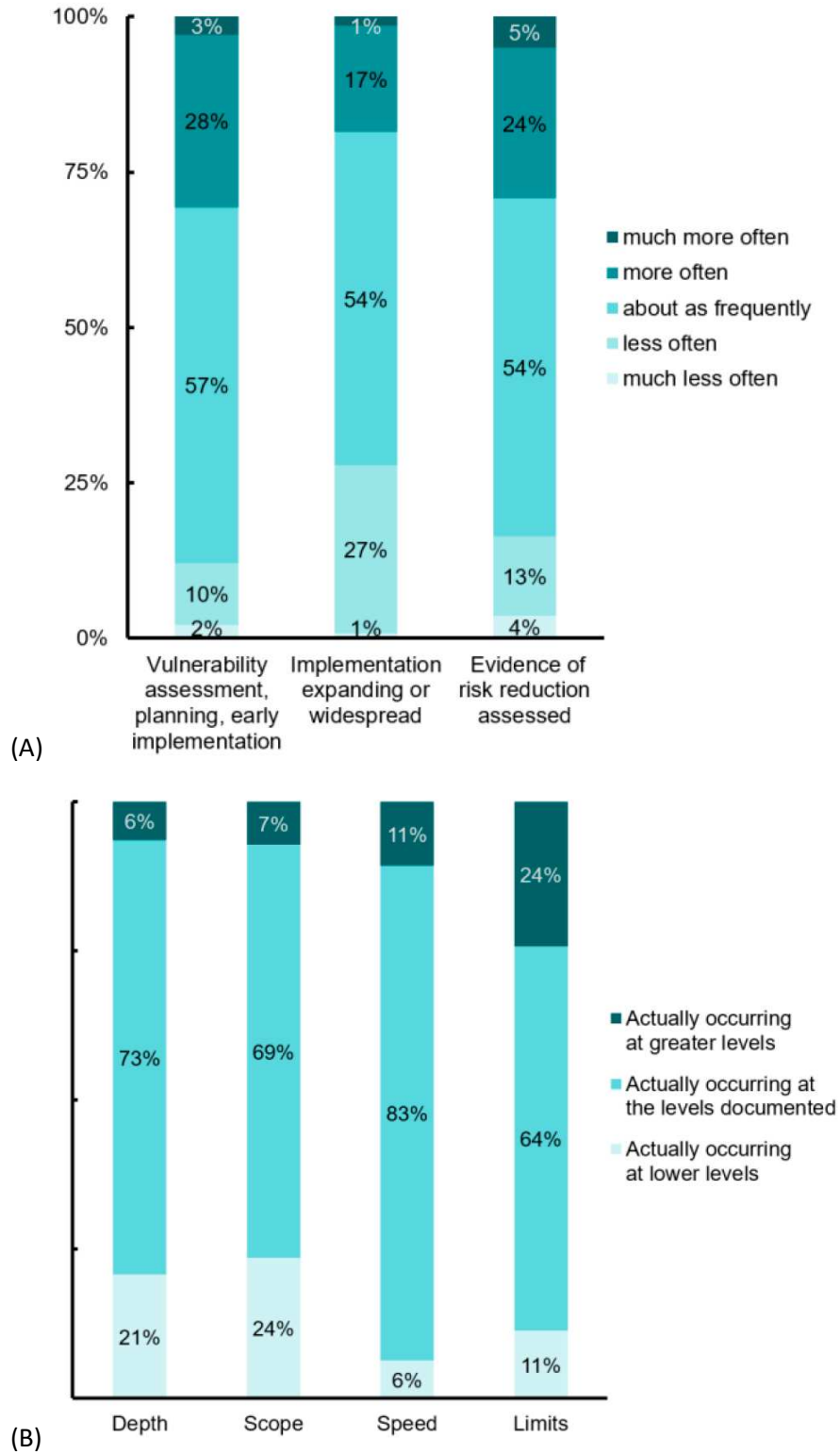


Figure 1: Results of expert elicitation exercise, assessing confidence in results of the stage of adaptation (A) and the four dimensions of transformational adaptation (B).

Table 1: Example open-ended responses – stages of adaptation

Sector	Region	Assessment	Judgment option]	Briefly describe your reasoning for the relative frequency you selected.
Health, well-being, and communities	Africa	Vulnerability assessment, adaptation planning, and early implementation	much more often	Adaptation responses in the health sector are at different stages. For instance, the distribution of mosquito nets is widely implemented because this initiative is worldwide funded, while others are more localised (e.g., traditional practices) and context-specific.
Ocean & coastal ecosystems	Asia	Vulnerability assessment, adaptation planning, and early implementation	more often	I believe most adaptation-related responses to climate change in Asia are in the vulnerability assessment or early implementation stages. The underrepresentation in this category may be due to the high number of cases in India & Bangladesh, where adaptation is proceeding more rapidly than in other areas in Asia.
Ocean & coastal ecosystems	Australasia	Vulnerability assessment, adaptation planning, and early implementation	more often	Findings from this package are too few to make a conclusive statement about on-going vulnerability assessment and adaptation going on in this region.
Cities, settlements, and key infrastructure	Central and South America	Vulnerability assessment, adaptation planning, and early implementation	about as frequently	I agree with the synthesis statement and especially the contextualization it provides, in that most strategic approaches on national levels are still being developed and have not reached a widespread implementation stage. The majority of adaptive response activities have been driven from a sub-national and mostly regional and local government level. The implementation at the local level is mostly dispersed and focused on few sub-sectors.
Food, fibre, and other ecosystem products	Africa	Implementation expanding or widespread	less often	In food sector, there is a recognition and acceptance of adaptation imperative. However, this recognition is not fully translated into a coordinated adaptation planning and mainstreaming of adaptation into decision-making process at all scales. Many African LIDS countries are yet to submit their NAP document.
Terrestrial & freshwater ecosystems	Asia	Evidence of risk reduction	more often	As Asia is the most disaster-prone region in the world, several structural or non-structural options for water sector have been widely implemented, even before climate change adaptation has become a concern. In Asia, to date, most water resource management has been dominated by structural interventions. Though most of these practices were found to be effective in the current and historical context, I would expect to see more evidence of risk reduction associated with adaptation efforts.
Health, well-being, and communities	Asia	Evidence of risk reduction	about as frequently	I agree that the EVIDENCE of risk reduction is about as frequent as reported, but the actual risk reduction with small-scale efforts (say integrate camels into a cattle herd for milk in drought conditions for community health impacts) helps perhaps that pastoral family or community but the evidence is hard to capture. So this is two fold, I think that the risk reduction is occurring on small scales but is difficult to capture and assess. So the evidence component I agree is the lowest occurring category, but the risk reduction may be happening more than we are able to find and report it.

Table 2: Example open-ended responses – stages of adaptation

Sector	Region	Select the statement that best describes your judgment:	Briefly describe your reasoning:
Ocean & coastal ecosystems	Central and South America	3) Adaptation in this sector/region is actually occurring at lower depth as compared to adaptation efforts described in the synthesis package. That is, response activities in practice are less new, novel, and different than the synthesis package would suggest.	actions are just responsive to observed effects (disaster events such as floodings, landslides, or fisheries reduction or change), no real change in the underlying values and norms, for example livelihood diversification may be more influenced by market opportunities than climate change effects, and in places where floodings and landslides have become common still residents are unwilling to move away (with or without reallocation plans).
Ocean & coastal ecosystems	Small Island States	2) Adaptation in this sector/region is actually occurring at the depth documented for adaptation efforts described in the synthesis package.	The high frequency of both low and high depth adaptation-related activities makes sense in the context of SIDS' ocean ecosystems. Often, the only choices are to "cope" by changing existing practices or "transform" those practices by relocating or switching livelihoods, for example.
Food, fibre, and other ecosystem products	North America	2) Adaptation in this sector/region is actually occurring at the scope documented for adaptation efforts described in the synthesis package.	The distribution of this (into the two ends of the spectrum) initially surprised me, but makes sense based on the literature and in reality contexts. It is either small scale (farmer-level) or large scale (policy changes) - while a middle ground is less frequent.
Cities, settlements, and key infrastructure	Central and South America	2) Adaptation in this sector/region is actually occurring at the speed documented for adaptation efforts described in the synthesis package.	<p>Especially on a household/community level, adaptive response activities are implemented as a slow adjustment process that involves changes in behaviours, logic and habits that occur over a longer period of time, often involving new generations and their exposure to new ways of thinking through better access to education.</p> <p>Larger technological and infrastructural projects potentially occur at a higher speed than described, but they are highly dependent on political will and thus political cycles, with the potential to significantly extend, postpone or cancel implementation schedules, but at the same time also to speed them up. In the context of the institutional level, I agree with the synthesis statement that there is a higher degree of uncertainty.</p>
Water & sanitation	Central and South America	2) Adaptation in this sector/region is actually approaching limits about as often as documented for adaptation efforts described in the synthesis package.	Limits are widespread in the water arena, especially human capacity, governance, and financial related challenges. However, I'm unaware of many instances where these limits are being actively challenged or approached.

SUPPLEMENTARY FILE 5

Search concepts and strings

Database	Concept 1	Concept 2	Date & document type restrictions	Approximate N. documents retrieved
Key concepts & scope	Climate change	Adaptation	Articles, reviews, data papers, and letters only. Date range: 2013-2020	n/a
Web of Science	TS= (climat* or "global warming")	AND TS: (adapt* or resilien* or (risk NEAR/3 manag*) or (risk NEAR/3 reduc*))	Refined by: DOCUMENT TYPES: (Article OR Data Paper OR Database Review OR Letter OR Review) Timespan: 2013-2019. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.	39,626
Scopus	TITLE-ABS-KEY (climat* or "global warming")	AND TITLE-ABS-KEY (adapt* or resilien* or (risk W/3 manag*) or (risk W/3 reduc*))	AND (LIMIT-TO(PUBYEAR, 2019) OR LIMIT-TO(PUBYEAR , 2018) OR LIMIT-TO PUBYEAR, 2017) OR LIMIT-TO(PUBYEAR, 2016) OR LIMIT-TO(PUBYEAR, 2015) OR LIMIT-TO(PUBYEAR, 2014) OR LIMIT-TO(PUBYEAR, 2013)) AND (LIMIT-TO(DOCTYPE, "ar") OR LIMIT-TO(DOCTYPE, "re") OR LIMIT-TO(DOCTYPE, "dp") OR LIMIT-TO(DOCTYPE, "le"))	36,183
MEDLINE	TS= (climat* or "global warming")	AND TS: (adapt* or resilien* or (risk NEAR/3 manag*) or (risk NEAR/3 reduc*))	Refined by: DOCUMENT TYPES: (Article OR Data Paper OR Database Review OR Letter OR Review) Timespan: 2013-2019. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.	8,973

SUPPLEMENTARY FILE 6

Category	Topic	Number	Question	Instructions	Codes	Definitions
Include	Include	N/A	N/A	Select yes.	Yes	All documents are pre-screened so you should be able to select yes.
					No	If it seems the document slipped through pre-screening but is not relevant, then select no and we will verify its relevance. Select no if the document is a book, book chapter, or conference proceeding. We will only code articles from peer reviewed journals.
Coder initials	Coder initials	0.1	N/A	Enter coder initials	Open text	
Summarize	Summarize	0.2	Briefly describe the response	Summarize in one sentence	Open text	Describe the component of the paper that empirically describes a response in human systems or human-assisted responses in natural systems.
Sufficiency	Sufficiency	0.3	Is there sufficient information to continue coding?	Select one.	Yes	Sufficient means there is at least half a page of content about the response.
					No	
1. General	Geography	1.1	What is the geographic focus of reported responses in this document?	Select all that apply. There may be some overlap in response options. If the document focuses on country or sub-national levels, write the country name in the open field.	Africa	Africa, Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Chad, Comoros, Congo, Cote d'Ivoire, Ivory Coast, Djibouti, Egypt, Eritrea, Eswatini, Swaziland, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe

					Asia	Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei, Cambodia, China, Cyprus, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Laos, Lebanon, Malaysia, Maldives, Mongolia, Myanmar, Burma, Nepal, Korea, Oman, Pakistan, Palestine, Philippines, Qatar, Russia, Saudi Arabia, Singapore, Sri Lanka, Syria, Taiwan, Tajikistan, Thailand, Timor-Leste, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam, Yemen
					Australasia	Australia, Tuvalu, Solomon Island, French Polynesia, Cocos Keeling Island, Wallis Futuna, Niue, Nauru, Fiji, Tonga, Pitcairn Island, New Zealand, Christmas Island, Vanuatu, Tokelau, Kiribati, Cook Island, Western Samoa, Papua New Guinea, New Caledonia
					Central and South America	Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela
					North America	United States, Canada, Mexico, Greenland

					Europe	Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia, Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Kosovo, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, Macedonia, Norway, Poland, Portugal, Romania, Russia, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, U, Ukraine, United Kingdom, UK, England, Scotland, Wales, Vatican
					Small Island States	Anguilla, Aruba, Antigua, Barbuda, Bahamas, Bahrain, Barbados, Bermuda, British Virgin Islands, Cayman Islands, Marianas, Belize, Comoros, Cuba, Dominica, Grenada, Guyana, Haiti, Jamaica, Saint Kitts, Nevis, Saint Lucia, Saint Vincent, Grenadines, Suriname, Trinidad, Tobago, Cabo Verde, Curacao, Comoros, Guinea, Maldives, Mauritius, São Tomé, Príncipe, Seychelles, Singapore, Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia, Nauru, Niue, Palau, Samoa, Solomon Islands, Seychelles, Timor, Tonga, Tuvalu, Vanuatu, French Polynesia, Guadeloupe, Guam, Martinique, Montserrat, New Caledonia, Puerto Rico, SaintMartin/Sint Maarten, Turks and Caicos, Virgin Islands
					Open field	Write country if country or sub-national level. If not applicable then write N/A.
	Sector	1.2	Which sectors/systems are relevant to this document?	Select all that apply.	Terrestrial & freshwater ecosystems	Freshwater, lake, river, watershed, pond, wetland, stream, terrestrial, taiga, tundra, grasslands, forest, tropical, temperate

					Ocean & coastal ecosystems	Marine, mangrove, tidal, estuary, lagoon, reef, coral, sea, ocean, benthic, salt, coast
					Water and sanitation	Water, hydrology, basin, watershed, flood, drought, landslide, sanitation
					Food, fibre, and other ecosystem products	Food, fibre, nutrition, medicine, aquaculture, fisheries, agroforestry, agroecology
					Cities, settlements, and key infrastructure	Cities, urban, infrastructure, industry, settlements
					Health, well-being, and communities	Health, wellbeing, well-being, wellness, disease, illness, medicine, epidemics, vector, vectorborne, vector-borne, cardiovascular, respiratory, allergies, mental health, heat stress, psychosocial, nutrition, asthma, displacement, cultural integrity, migration, cultural heritage, identity, social capital, mobility, conflict, war
					Poverty, livelihoods, and sustainable development	Poverty, livelihood, sustainable development, wealth, resilience, justice, equity, discrimination, conflict, diversification
	Cross-cutting topics	1.3	Are there cross-cutting topics relevant to this document?	Select all that apply.	Polar regions	Polar, Arctic, Antarctica

					Mountains	Mountains, alpine, Himalayas, Andes, Alps, Rockies, Appalachians, Rwenzori, Pyrenees, Atlas, Urals, Hindu Kush, Cascades
					Tropical forests	Tropical forests, Amazon, rainforests
					Cities and settlements by the sea	Cities, urban areas, urban infrastructure, urban industry, urban settlements, coastal settlements, delta settlements
					Biodiversity hotspots	Biodiversity
					Mediterranean	Mediterranean
					Deserts, semi-arid areas and desertification	Deserts, semi-arid or arid areas
					None	
	Indigenous knowledge	1.4	Is there reference to contributions from Indigenous knowledge?	Select one.	Yes	Traditional Indigenous knowledge refers to knowledge and practices of Indigenous communities that have developed over time and are often passed from one generation to the next.
	Local knowledge	1.5	Is there reference to contributions from local knowledge?	Select one.	Yes	Local knowledge refers to knowledge based on experience and rooted in community practices, relationships, institutions, etc. that often develops over time.

2. Who is responding?	Actors/Institutions	2.1	Who is reported as engaging with the response activities reported in this document?	Select all that apply. Engaging can mean leading, financing or enabling. If other, specify in the open field (Other). Copy relevant text into second open field.	International or multinational governance institutions	Global or regional treaty body or agency (e.g. UN institutions/organizations, EU institutions, Organization of American States, African Union)
					Government (national)	Countries officially recognized by the UN
					Government (sub-national)	Domestic, sub-national governing unit. Terms include state, province, territory, department, canton, Lander
					Government (local)	Terms include municipality, local government, community, urban, urban regions, rural
					Private sector (corporations)	Large national or international companies
					Private sector (SME)	Small- and medium-enterprises
					Civil society (international, multinational, national)	Voluntary civil society organizations. Includes charities, non-profits, faith-based organizations, professional organizations (e.g. labour unions, associations, federations), cultural groups, religious groups, sporting associations, advocacy groups (e.g. NGOs).
					Civil society (sub-national or local)	Formal community associations
					Individuals or households	Including informal community networks
					Other	Other

					Open field (Other)	If answered other, specify here. If not applicable then write N/A.
					Open field	Copy relevant text here.
	Equity/justice - planning	2.2	Is there evidence that particularly vulnerable groups were included in response planning?	Select all that apply. If other, specify in the open field (Other). Copy relevant text into second open field.	Women	Minority status based on sex or gender expression (e.g. transgender)
					Youth	Individuals age 0 to 18
					Elderly	Individuals age 65 and over, also referred to as senior populations.
					Low-income	Individuals and/or groups from economically marginalized backgrounds. Lack access to basic services and experience episodes of periodic or ongoing resource scarcity. Includes homeless populations.
					Disability	Individuals with persistent physical, sensory, or cognitive disabilities
					Migrants	Place of origin, ancestry, cultural heritage. Refers to both to domestic migrants and individuals with an immigrant or undocumented status
					Indigenous	Self-identified Aboriginal groups, native peoples, first people, and tribal groups
					Ethnic minorities	Individuals and/or groups with a visible minority status
					Other	Other
					None	No evidence of inclusion

					Open field (Other)	If answered other, specify here. If not applicable then write N/A.
					Open field	Copy relevant text here.
	Equity/justice - targeting	2.3	Is there evidence that particularly vulnerable groups were targeted in the responses?	Select all that apply. If other, specify in the open field (Other). Copy relevant text into second open field.	Women	Minority status based on sex or gender expression (e.g. transgender)
					Youth	Individuals age 0 to 18
					Elderly	Individuals age 65 and over, also referred to as senior populations.
					Low-income	Individuals and/or groups from economically marginalized backgrounds. Lack access to basic services and experience episodes of periodic or ongoing resource scarcity. Includes homeless populations.
					Disabled	Individuals with persistent physical, sensory, or cognitive disabilities
					Migrants	Place of origin, ancestry, cultural heritage. Refers to both to domestic migrants and individuals with an immigrant or undocumented status
					Indigenous	Self-identified Aboriginal groups, native peoples, first people, and tribal groups
					Ethnic minorities	Individuals and/or groups with a visible minority status
					Other	Other
					None	No evidence of inclusion

					Open field (Other)	If answered other, specify here. If not applicable then write N/A.
					Open field	Copy relevant text here.
3. What responses are documented?	Types of responses	3.1	What category of adaptation is reported?	Select all that apply. Copy relevant text into second open field.	Behavioural/cultural	Enabling, implementing, or undertaking lifestyle and/or behavioural change
					Ecosystem-based	Enhancing, protecting, or promoting ecosystem services
					Institutional	Enhancing multilevel governance or institutional capabilities
					Technological/infrastructure	Enabling, implementing, or undertaking technological innovation or infrastructural development
					Open field	Copy relevant text here.
	Implementation tools	3.2	What types of implementation tools are reported?	Describe in first open field and copy/paste relevant text in second open field.	Open field	What types of response tools/measures/mechanisms/instruments are reported as used? These might include, for example, implementation of an adaptation strategy, an educational outreach program; building infrastructure (e.g. a dam or flood control); ecosystem restoration; launching a local cooperative of fishers to change fishing behaviour; new regulation, policy, or legislation (e.g. land use zoning, legal restrictions); subsidies or incentives for avoiding development in flood plains or undertaking less risky livelihood strategies; implementation of early warning systems; autonomous adaptations by households or individuals.
					Open field	Copy relevant text here
	Hazards	3.3	What hazards is the response aimed at?	Select all that apply. If other, specify in the first open field (Other). Copy relevant text	Sea level rise	Includes coastal flooding and storm surges

				into second open field.		
					Extreme precipitation and inland flooding	
					Increased frequency and intensity of extreme heat	Includes urban heat island effect
					Precipitation variability	
					Drought	
					Rising ocean temperature and ocean acidification	Includes loss of coral cover
					Loss of Arctic sea ice	
					General climate impacts	No specific hazard identified
					Other	Other
					No information or not assessed	
					Open field	If answered other, specify here. If not applicable then write N/A.
					Open field	Copy relevant text here.

Exposure/vulnerability	3.4	What aspects of exposure or vulnerability is the response aimed at?	Select all that apply. If other, specify in the open field (Other). Copy relevant text into second open field.	Poverty	Social protection for the poor and vulnerable, accessibility of basic services and supports to people harmed by climate-related extreme events and other economic, social and environmental shocks and disasters
				Food security	Accessibility of safe, nutritious and sufficient food at all times of the year. Related to sustainable food production systems and resilient agricultural practices; equitable access to land, technology and markets and international cooperation on investments in infrastructure and technology to boost agricultural productivity.
				Health & wellbeing	Major health priorities, including reproductive, maternal and child health; communicable, non-communicable and environmental diseases; universal health coverage; accessibility to safe, effective, quality and affordable medicines and vaccines; research and development, health financing, and capacity for health risk reduction and management
				Education	Accessibility to, and quality of, education to early childhood development, care, and education across all levels, with particular emphasis on eliminating gender disparities in education
				Gender equality	Gender inequality depriving women and girls of their basic rights and opportunities. Related to legal frameworks, deeply rooted gender-based legal discrimination, unfair social norms and attitudes, decision-making on sexual and reproductive issues and low levels of political participation.

					Inequalities (other than gender)	Relates to income inequalities, social/economic/political/legal inclusion, enhanced representation for vulnerable populations, and orderly, safe, and responsible migration/mobility, equitable development assistance and financial flows
					Clean water & sanitation	Accessibility to safe water and sanitation; sound management of freshwater ecosystems essential to human health and to environmental sustainability and economic prosperity. Related to growing demand for water, threats to water security and the increasing frequency and severity of droughts and floods resulting from climate change
					Energy security	Concerns universal access to affordable, reliable, and modern energy services, including renewable energy, energy efficiency, and sustainable energy infrastructure
					Work and economic growth	Concerns economic growth through technological innovation, development-oriented policies, diversification, global resource efficiency, and work equity
					Industry, innovation, and technology	Relates to the development of sustainable infrastructure and industrialization, and research and technological development to promote equity and human well-being.
					Sustainable cities & communities	Concerns the development of safe, resilient, and sustainable cities and human settlements, including affordable and safe housing, sustainable and accessible transport, equitable participation in urban planning, protection of cultural and natural heritage, responsible waste management, universal access to safe public spaces, and sustainable building

					Consumption & production	Related to sustainable management and efficient use of natural resources, reducing food waste and post-harvest loss, sound management of wastes & chemicals, reduction across all waste streams (recycling, reducing, reusing), sustainable production practices, sustainable tourism, and market restructuring to create incentives for sustainable consumption & production.
					Marine & coastal ecosystem services	Relates to marine pollution (including debris and nutrient pollution), sustainable management of marine & coastal ecosystems, minimization of ocean acidification, regulating harvesting and ending overfishing, restoration of fish stocks, and conservation of coastal and marine areas
					Terrestrial & freshwater ecosystem services	Relates to protection, restoration, and promotion of sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
					Peace, justice, and strong institutions	Concerns promotion of peaceful and inclusive societies for sustainable development, access to justice for all, and building effective, accountable, and inclusive institutions at all levels
					Other	Other
					No information or not assessed	
					Open field	If answered other, specify here
					Open field	Copy relevant text here.

	Link to risk	3.5	What is the stated (or implied/assumed) link to reduction in risk?	Comment in first open field and copy/paste text into second open field.	Open field	Do the authors describe or justify why the particular response is expected to reduce risk (e.g. theory of change, assumptions about how the response might reduce risk)? If so, please describe. Note if your answer is based on the authors stating this, or if you had to infer this from the document. For example: "Authors do not describe how the sanitation program will reduce risk due to climate change. It is inferred (and assumed) that an improved sanitation program will reduce exposure or vulnerability to the impacts of climate change on extreme events and precipitation variability."
					Open	Copy relevant text here
4. Extent of adaptation responses	Implementation	4.1	What is the general stage of the response activities described in the document?	Select one. Copy relevant text into the open field.	Vulnerability assessment and/or early planning	The impacts of climate change are known as least indicatively (qualitative information), taking account of the uncertainty involved in climate change scenarios. There is some evidence of vulnerability assessment. There may be evidence that some adaptation measures have been identified and plans may be made for their implementation. There is limited evidence of implementation, or only small and ad hoc adaptation implementation.
					Adaptation planning and early implementation	There is widespread recognition among decision-makers of the need for adaptation measures. Impacts and vulnerability are well understood. Adaptation measures have been identified and there is evidence of at least some coordinated implementation, though measures may still be ad-hoc.

					Implementatio n expanding	There is widespread recognition and acceptance of the need for adaptation measures and coordinated planning. There is evidence that adaptation has been incorporated (mainstreamed) into decision-making processes. Implementation of adaptation measures are more likely to be coordinated as part of a coherent strategy than ad-hoc.
					Implementatio n widespread	Adaptation measures are implemented and coordinated consistently across all relevant sectors and regions, with adaptation planning standard practice and well-established within legal/institutional/cultural/social frameworks and norms.
					Evidence of risk reduction associated with response has been assessed	There is moderate to substantial evidence that key indicators of vulnerability and/or risk have declined, as well as (qualitative or quantitative) evidence that adaptation efforts have contributed to these reductions. Evidence may be attribution-based or based on robust narratives and theories of change.
					Open field	Copy relevant text here
	Adaptation finance	4.2	Is there any information in the document on who financed the response?	Select one.	Yes	
					No	
	Adaptation costs	4.3	Is there any information in the document on the costs of the response?	Select all that apply.	Cost of response	

					Cost savings from response	
					None	
	Depth	4.4	What the depth of change from the responses is reported in the document?	Summarize in first open field and copy/paste relevant text in second open field.	Open field	The depth of a response relates to the degree to which a change reflects something new, novel, and different from existing norms and practices. A change that has limited depth would follow business-as-usual practices, with no real difference in the underlying values, assumptions and norms. This would include responses that are largely based on expansion of existing practices rather than consideration of entirely new practices. In-depth change, in contrast, might involve radically changing practices by altering frames, values, logics, and assumptions underlying the system. This might involve deep structural reform, complete change in mindset by governments or populations, radical shifts in public perceptions or values, and changing institutional or behavioural norms.
					Open field	Copy relevant text here
	Scope	4.5	What is the scope of the activity described in the document?	Summarize in first open field and copy/paste relevant text in second open field.	Open field	The scope of a response typically refers to the scale of change. A small scope might refer to local initiatives, or activities restricted to particular neighbourhoods, communities, groups, or projects. Broad scope would refer to large-scale and system-wide changes that might involve an entire organization, a country or large region, and large population. While changes of small scope might involve isolated efforts, broad scope might be multi-dimensional, multi-component, and/or multi-level. Development of networks, inter-organizational coordination, and social relations within a response are more likely to lead to changes of broader scope.

					Open field	Copy relevant text here
	Speed	4.6	What speed of change typifies the responses reported in the document?	Summarize in first open field and copy/paste relevant text in second open field.	Open field	The speed of change refers to the dimension of time within which changes are happening. A slow or incremental change might include small changes in incremental steps, or a series of small shifts. Faster change might involve rapid jumps or what might be called 'transformative' changes in terms of relatively sudden shifts in views, perceptions, attitudes, and norms.
					Open field	Copy relevant text here
5. MRE, learning, and effectiveness	Reduced risk	5.1	Is there any evidence (implicitly or explicitly) provided that activities successfully reduced risk or vulnerability?	Select one. If yes, describe the approach in the open field. If no write "None" in open field.	Yes	The change must be documented to respond 'yes' for this question. Anticipated or expected reduction is not sufficient for this question. Note that these don't need to be quantitative, but could involve theory of change, narrative justifications of change, or other.
					No	
					Open field	If answered yes, copy relevant text here. If none write "None."
	Indicators	5.2	Do actors or institutions undertaking the response identify (implicitly or explicitly) indicators of success?	Select one. If yes, describe in open field. If no write "None" in open field.	Yes	
					No	
					Open field	If answered yes, copy relevant text here. If none write "None."

	Maladaptation	5.3	Do actors or institutions undertaking the response consider (implicitly or explicitly) risks or maladaptation associated with the response?	Summarize in first open field and copy/paste relevant text in second open field.	Open field	If none write "None."
					Open field	Copy relevant text here. If none write "None."
	Co-benefits	5.4	Do actors or institutions undertaking the response consider (implicitly or explicitly) co-benefits?	Summarize in first open field and copy/paste relevant text in second open field.	Open field	The main focus of this question is about mitigation-adaptation co-benefits. Does adaptation have co-benefits for mitigation, or vice versa?
					Open field	Copy relevant text here. If none write "None."

6. Adaptation limits	Limits	6.1	Does the article/document identify and describe constraints or limits to adaptation?	Select one.	Yes	Constraints are defined as: “factors that make it harder to plan and implement adaptation actions.” (IPCC AR5 WG2, Chap. 16, pg. 923). Constraints can be categorized as: (1) Economic: existing livelihoods, economic structures, and economic mobility; (2) Social/cultural: social norms, identity, place attachment, beliefs, worldviews, values, awareness, education, social justice, and social support; (3) Human capacity: individual, organizational, and societal capabilities to set and achieve adaptation objectives over time including training, education, and skill development; (4) Governance, Institutions & Policy: existing laws, regulations, procedural requirements, governance scope, effectiveness, institutional arrangements, adaptive capacity, and absorption capacity; (5) Financial: lack of financial resources; (6) Information/Awareness/Technology: lack of awareness or access to information or technology; (7) Physical: presence of physical barriers; and (8) Biological: temperature, precipitation, salinity, acidity, and intensity and frequency of extreme events including storms, drought, and wind.
					No	

	Limits describe	6.2	If yes to Q6.1, comment on the constraints or limits noted.	Comment in open field. If no to Q6.1, write N/A.	Open field	Constraints can be categorized as: (1) Economic: existing livelihoods, economic structures, and economic mobility; (2) Social/cultural: social norms, identity, place attachment, beliefs, worldviews, values, awareness, education, social justice, and social support; (3) Human capacity: individual, organizational, and societal capabilities to set and achieve adaptation objectives over time including training, education, and skill development; (4) Governance, Institutions & Policy: existing laws, regulations, procedural requirements, governance scope, effectiveness, institutional arrangements, adaptive capacity, and absorption capacity; (5) Financial: lack of financial resources; (6) Information/Awareness/Technology: lack of awareness or access to information or technology; (7) Physical: presence of physical barriers; and (8) Biological: temperature, precipitation, salinity, acidity, and intensity and frequency of extreme events including storms, drought, and wind.
	Hard/soft	6.3	If yes to Q6.1, are constraints or limits hard or soft?	Comment in open field.	Open field.	Hard constraints/limits are intractable, while soft constraints/limits are moveable. For example, governance and financial constraints, such as lack of institutional arrangements and funding, may result in insufficient or ineffective adaptation measures. This may lead to a soft limit that could be changed over time with improved governance and funding.

	Approach limits	6.4	If yes to Q6.1, is there evidence to indicate whether responses approach, challenge, or exceed constraints/limits? Justify your response.	Select one. If yes, justify answer in the open field. If no to Q6.1, select N/A.	Yes	If yes, justify in open field.
					No	
					N/A	
					Open field	If yes, justify here. If no or N/A, write "N/A."
7. Confidence in evidence	Methods	7.1	Are methods sufficient to answer the research question?	Comment in open field.	Open field	Are there any major sources of bias in the data collection/ analysis/ interpretation of results, and are findings adequately and sufficiently substantiated by empirical data (qualitative or quantitative data)?
	Coherence	7.2	Did the article provide sufficient information to answer all of your coding questions?	Comment in open field.	Open field	Was there limited information or unclear evidence provided? Were there divergent results or outliers that made it hard to answer or that the authors seemed to ignore? Was the paper/document not really directly relevant to the questions you were asking?

	Adequacy	7.3	Please comment on the quantity and quality of data upon which the findings in this article/document are based (e.g. sample size and/or depth of research).	Comment in open field.	Open field	This question will help us assess confidence in findings. We are less confident about a finding when the underlying data only come from a small number of participants, locations, or settings, or in the case of case-studies do not contain sufficient detail/richness to make a meaningful assessment.
	Relevance	7.4	Are the results of this study relevant to a particular context only?	Comment in open field.	Open field	Are the results relevant only to a particular region, population, or context? Describe the context within which these results are valid/relevant in the open field.