

OPINION

Documenting the state of adaptation for the global stocktake of the Paris Agreement

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Article 7, paragraph 14 of the Paris Agreement to the United Nations Framework Convention on Climate Change commits Parties to create a five yearly assessment of observed adaptation to track progress and enable appropriate future commitments through the Nationally Determined Contributions and National Adaptation Plans. No large-scale study exists that shows the types of adaptation, the spatial distribution of types of adaptation, and the numbers of people engaging in that adaptation. To address this gap, and to feed into debates about the modalities for the global stocktake, in this paper we propose a new “stocktaking” approach to document the spectrum and prevalence of observed adaptation over large scales. The four-step stocktaking approach focuses on: (a) obtaining consensus on the objectives of adaptation; (b) agreeing the sources of evidence; (c) agreeing the search method; and (d) categorizing the adaptations. By focusing on documenting rather than evaluating adaptation, the simple approach avoids some of the adaptation heuristic traps. With guidance to countries on how to operationalize, this approach could improve the transparency of adaptation data collection and analysis, ensure comparability of findings across space and time, and inform the Adaptation Communications (Article 7.10)—a prerequisite to strengthening future ambition commitments within the Paris Agreement.

This article is categorized under:

Policy and Governance > International Policy Framework

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global stocktake, monitoring and evaluating adaptation, observed adaptation, Paris Agreement, tracking adaptation

1 | INTRODUCTION

Many governments are planning adaptation actions and allocating resources to support adaptation to climate variability and change (Intergovernmental Panel on Climate Change [IPCC], 2014). Adaptation policy at national and regional scales is increasingly evident in regions, for example in the European Union (Remling, 2018) and within Africa and Asia (Ford, Berrang-Ford, Bunce, et al., 2015). Agreement to develop improved adaptation planning and action has advanced through the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement. This agreement commits both developed and developing countries to adapt to climate change, as well as to keep the global temperature increase below 2 °C in the twenty-first century, and to pursue efforts to limit the increase to 1.5 °C (UNFCCC, 2016).

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For most countries, national adaptation policy exists in the absence of large-scale assessments of how people are actually adapting. Developed nations are increasingly focusing on climate risk mapping (Brown et al., 2018), but lack in-depth information about actual adaptation practice. The latter would enable adaptation gaps to be identified, and a more accurate analysis of the costs and benefits of specific adaptation practices (Tompkins et al., 2010). In other policy areas, making significant investment decisions without baseline data about behaviors of the target population would be inconceivable, yet in the area of adaptation this often is the reality. This lack of evidence of the distribution and prevalence of adaptation in practice not only constrains effective policy making on adaptation, but is also a significant gap in knowledge.

Article 7, paragraph 14 of the Paris Agreement outlines the purpose of the global stocktake, which includes recognizing what adaptations have been undertaken, and evaluating the effectiveness of those adaptations. The commitments of country Parties will thus be documented, and progress toward a global goal can be monitored. With this evidence base in place, Parties could be held accountable for their adaptation obligations, the effectiveness of adaptation could be assessed, better estimates of the costs of adaptation could be generated, and adaptation finance could be better targeted to those areas and people most in need and where insufficient adaptation is occurring. This evidence base will also inform the next round of Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs), which, according to the ambition commitment (Article 3), should build on previous efforts. Current discussions relating to Article 7.10¹ on improved Adaptation Communications and reporting are exploring opportunities for communicating the results of the stocktake, for example, through NDCs, NAPs, or other Adaptation Communications (United Nations Environment Programme, 2017).

While national greenhouse gas inventories are an accepted method to monitor mitigation progress (through NDCs), an analogous accepted method to document adaptation baselines does not exist. For example, the UNFCCC operates a Non-State Actor Zone for Climate Action portal and the Lima-Paris Action Agenda. Both platforms enable pledges of action on climate change to be made (mostly mitigation, but some on building resilience), and mitigation action to be tracked. Many other efforts to inform the global stocktake have focused on monitoring and evaluating the quality, adequacy or effectiveness of adaptations (e.g., Brooks, Anderson, Ayers, Burton, & Tellam, 2011; IIED, 2016; United Nations Environment Programme, 2017). Negotiations on modalities, that is how the stocktaking should be undertaken, are due to be complete by end of 2018, reflecting the pressing political concern around this issue. This paper aims to contribute to the debate, by offering a way forward in how to undertake a global stocktake.

Documenting adaptation to create a baseline understanding of what is occurring is not without its challenges. Three key problems have been identified that prevent advancements in documenting the state of adaptation: (a) methodological: no clear method exists to effectively document adaptation; (b) empirical: adaptation databases are rare; and (c) conceptual: there is limited agreement on what constitutes adaptation (Ford, Berrang-Ford, Biesbroek, et al., 2015; United Nations Environment Programme, 2017). As a consequence, baseline assessments of observed adaptations do not yet exist for countries, regions, or for social-ecological hotspots that have been identified as highly vulnerable to climate impacts, such as glacier-fed systems, semi-arid regions, and mega-deltas (Cochrane et al., 2017). Documenting the spectrum and prevalence of adaptation at these large scales remains a particularly challenging problem. We argue that documenting adaptation is a separate task from monitoring and evaluating adaptation, but is equally important, if not a foundational step. We also argue that documenting adaptation is an important part of the global stocktake that should not be overlooked in the process of developing modalities for communicating adaptation, for example, through the Adaptation Communications.

2 | CHALLENGES TO DETERMINING THE STATE OF ADAPTATION

Although there is consensus on the need for adaptation, there is little evidence of the extent to which adaptation is occurring, who is adapting and what drives adaptation. Part of the challenge of documenting adaptation comes from disagreement about what constitutes adaptation. Adaptations to coastal inundation in deltas, for example, comprise a different set of actions by different people and in response to different stresses compared with adaptations to increased rainfall variability in semi-arid zones. Further, adaptation to climate change is built on a long history of adaptation to climate variability (e.g., monsoon cycles or El Niño variations) and adaptation to other social, economic, or environmental stresses (e.g., global food price changes or erosion and land subsidence in deltas). Hence, climate adaptation fits into a wider continuum of actions taken by societies as they develop and change.

The conceptual ambiguity of the nature of adaptation is both reflected in, and reinforced by, the implicit understanding of adaptation in the global policy sphere under the UNFCCC (Khan & Roberts, 2013). The Convention has neither an Article dedicated to adaptation, nor a definition and, unlike mitigation, adaptation commitments are not legally binding (Hall & Persson, 2017). Past UNFCCC activity on adaptation has focused on: (a) identifying and prioritizing adaptation needs (through the Least Developed Countries [LDC] Fund, Special Climate Change Fund, and Adaptation Fund); (b) evaluating adaptation options (articulated in the 2011 Cancun Adaptation Framework), and more recently (c) on evaluating collective progress on

adaptation, through the Paris Agreement (Christiansen, Martinez, & Naswa, 2018). Lack of consensus on the nature of adaptation is highlighted by the focus on planning through instruments such as the National Adaptation Programmes of Action and, more recently, the NAPs. NAPs have focused on reducing vulnerability to climate change and facilitating the integration of adaptation into policies and programs (LDC Expert Group, 2012). However, they have done so without first generating a baseline assessment of the types and distribution of adaptation practice. Attention has been given to financing adaptation as outlined in the NAPs, without due consideration of the effectiveness (or equity) of the plans in enabling adaptation (Persson & Remling, 2014; Remling & Persson, 2014). The Paris Agreement advances a broader framing of adaptation, that is within the content of multiple stressors, but provides little detail on what this means in practice (Lesnikowski et al., 2017).

Conceptual challenges are exacerbated by unstated normative assumptions about the nature of adaptation and its effectiveness. Preston and colleagues argue that assumptions about adaptation such as “adaptation should generate positive benefits,” “adaptation is different to coping,” or “reactive adaptation is inefficient” create confusion over the interpretation of the term, and constrain research and practice (Preston, Mustelin, & Maloney, 2015). Undefined relationships between concepts such as development, coping, and maladaptation add to the confusion, leading to questions such as: should development initiatives that address the current adaptation deficit be considered as adaptation, and should coping, maladaptations, and serendipitous adaptations be included as adaptations (Agrawal & Lemos, 2015; Berman, Quinn, & Paavola, 2012; Dilling, Daly, Travis, Wilhelmi, & Klein, 2015)? Answers to these questions have, in the past, influenced how wide the net is cast and what is included as an adaptation. We argue that lack of clarity on these questions should not impede progress on documenting a baseline of adaptation.

Yet, to date, without conceptual consistency on adaptation, it has proven difficult to develop a methodology for empirical analysis. The vast majority of documented adaptations come from individual research projects and programs, for example, as documented in IPCC Fifth Assessment Report by Working Group II on Impacts, Adaptation and Vulnerability (Field et al., 2014). The IPCC reviews some adaptations, but it neither describes the spectrum nor the prevalence of actions. Attempts have been made to document the nature and distribution of adaptation, notably by the UNFCCC, which has created databases of examples of adaptation. For example, the Adaptation Knowledge Portal, through the Nairobi Work Programme, documents examples of adaptation by theme and region; the Private Sector Initiative database compiles examples of private action on adaptation; and the local coping strategies database provides examples of household and community adaptations. Yet all of these databases rely on voluntary submissions of evidence. They thus suffer from being self-selecting and are not comprehensive, hence preventing any assessment of the frequency or the spatial spread of adaptation activity.

Methods used for adaptation reporting have been criticized for focusing on vulnerability assessments and intention to act, rather than observed adaptation (Berrang-Ford, Ford, & Paterson, 2011). For example, researchers document assets deemed to create adaptive capacity, without consideration of whether and how such latent capacity translates into adaptation outcomes (Mortreux & Barnett, 2017). In comparison researchers focusing on tracking, monitoring, and evaluating adaptation tend to prioritize measuring progress toward delivery of adaptation policy or the effectiveness of the process, and not on documenting evidence of the amount and distribution of adaptation by individuals, communities, or sectors (Brooks et al., 2011; GEF, 2014; Leiter, 2017; Lesnikowski, Ford, Biesbroek, Berrang-Ford, & Heymann, 2016).

The conceptual and methodological ambiguity has constrained discussion on the collation of evidence of adaptation at a large scale (e.g., national or ecosystem scale). No formal guidance exists on how to search for, collate and document adaptations. This has consequences for the international policy process and, particularly, how the global stocktake will be undertaken. Although the debate on the meaning of adaptation may continue, it should not hinder development of a replicable and usable method to document who is (and how many are) adapting to what and why, and where this adaptation is occurring.

3 | CHARTING A WAY FORWARD

Given that the Paris Agreement mandates a global stocktake, this leads us to ask: what opportunities are there for improving documentation of adaptation at large scales, for example, across nations, regions and social-ecological zones? Emerging research into adaptation heuristics attempts to create conceptual consistency by asking researchers to clarify the objectives, purpose, and expectations of adaptation (Ford & Berrang-Ford, 2016; Preston et al., 2015). Instead of focusing on the usual heuristics (e.g., “adaptation is local,” “predict and respond”), and being constrained by the notion that adaptation has to be “incremental,” we propose a way forward by seeking consensus on the broadly agreed objectives of adaptation to multiple stressors: (a) to reduce socioeconomic vulnerability, (b) to address disaster risk, and (c) to support social-ecological resilience. Starting with these accepted objectives avoids becoming enmeshed in debates about defining adaptation that have remained unresolved since the 1990s, and that continue to stall progress on documenting and understanding adaptation. These three objectives are also consistent with principles of sound development, as espoused in the Paris Declaration on Aid Effectiveness

(2005), and support core elements of the 2030 Sustainable Development Goals (such as 1: No Poverty; 11: Sustainable Communities, and 13: Climate Action).

4 | THE “STOCKTAKING” APPROACH

To provide a starting point to create baselines of adaptation that can say something about the range and prevalence of adaptation, we propose a “stocktaking” approach. This approach comprises four steps to track and monitor observed adaptation over large scales: (a) Step 1: obtain consensus on the objectives of adaptation; (b) Step 2: agree sources of evidence; (c) Step 3: agree search methods; and (d) Step 4: categorize the adaptations (Figure 1). By focusing on documenting rather than evaluating adaptation, the simple framework avoids some of the challenges documented above that hinder progress. The stocktaking approach acknowledges two key aspects of adaptation data collection: (a) the numbers of people who adapt and (b) where and by whom the adaptation occurs. Combined, this information allows some weighting as to the distribution of the adaptation. The second aspect further allows the adaptations to be linked to spatial databases allowing both visualization and potentially other forms of analysis. This shows how starting the stocktaking approach could develop and incrementally lead to growing insight and linkages with other adaptation and development activities.

4.1 | Step 1: Obtaining consensus on the objectives of adaptation

Debates about what constitutes adaptation have continued for decades. Instead of requiring a specific definition of adaptation, there are merits in focusing on the objectives of adaptation, where more consensus exists as to what are worthwhile goals (Eakin, Tompkins, Nelson, & Anderies, 2009; Ensor & Berger, 2009; McGray, Hammill, & Bradley, 2007). Adaptation objectives broadly include: (a) reducing socioeconomic vulnerability, (b) addressing disaster risk, and/or (c) supporting social-ecological resilience. The first two elements have been widely reported in IPCC reports since 2001 (Adger et al., 2007; Noble et al., 2014; Smit et al., 2001), although evidence of measures to support or enhance social-ecological resilience is limited (Ranger, Reeder, & Lowe, 2013). Collectively these three elements describe the broad scope of adaptation and can be linked as shown in Figure 2.

Reduction of present vulnerabilities is the foundation of adaptation as it focuses on reducing poverty by addressing structural issues which, evidence shows, inhibit adaptation action (Duncan, Tompkins, Dash, & Tripathy, 2017). Despite this empirical evidence, it appears that much adaptation action is having little impact on vulnerability (Atteridge & Remling, 2018). Vulnerability reducing actions may look very different according to the social, political, hazard, or environmental



FIGURE 1 Proposed “stocktaking” approach to documenting observed adaptation

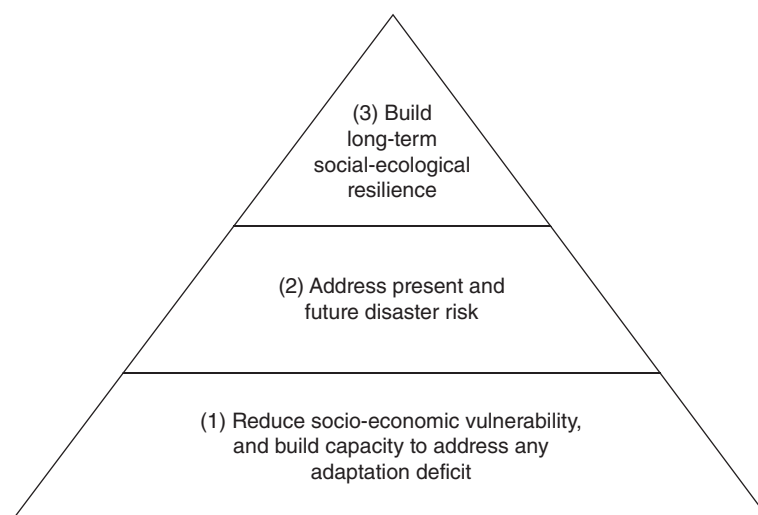


FIGURE 2 The three building blocks for adaptation

context. For example, reducing vulnerability to drought in Iran or Niger (Asfaw, Pallante, & Palma, 2018; Keshavarz, Malek-saeidi, & Karami, 2017) looks very different to addressing physical vulnerability in Grenada (Canevari-Luzardo, Bastide, Choutet, & Liverman, 2017). Following Roberts and Pelling (2018), we argue that reducing vulnerability by addressing the structural issues that entrench poverty can create the space for individuals to build adaptive capacity (Duncan, Dash, & Tompkins, 2017). Indeed, without this, Atteridge and Remling (2018) argue that vulnerable communities could become more marginalized due to risks or vulnerabilities being transferred to them through others' adaptation actions. Once vulnerability reduction is occurring, it becomes more effective to engage in present and future disaster risk reduction (DRR). Together, these actions collectively form the foundation to build and enhance long-term social-ecological system resilience. All of these elements, we argue, are worth documenting as adaptations.

Obtaining consensus on these concepts is a vital first step. Clarity over objectives also helps generate the key words and synonyms, for the search for evidence on adaptation. To capture the range of adaptations, a comprehensive and replicable search should use search terms that represent the objectives of adaptation. Tiered searches, where terms from each tier are combined, may be the most useful to ensure that the population of literature is identified. A first tier could comprise synonyms for the area/social-ecological system under review (e.g., nation, regional, or ecosystem). A second tier might consider variations of the terms for adaptation, for example, adapt, risk, vulnerability, coping. A third tier might consider the nature of the hazards, for example, weather, hazard, climate, variability, change.

4.2 | Step 2: Agree the sources of evidence

Adaptation is documented in a variety of media, online, offline, and printed, including technical reports from the private, third, and public sectors; journal articles; academic and multilateral agency working papers; and various submissions to the UNFCCC, to name a few. We propose that all secondary sources of information are searched to deliver a complete baseline assessment of adaptation. The success of the search comes from triangulating sources to reduce the risks of misrepresentation and double-counting. Adaptation can occur in any sector, at any scale, and be undertaken by any actor or system prior to, or in response to, a variety of climate-related and nonclimate drivers. This messiness of adaptation adds to the complexity of documentation. For the initial stocktake to reduce the complexity of the task, the search could be narrowed to focus on weather-sensitive and natural resource-dependent sectors and locations. Example sectors include agriculture; forestry; fisheries; water resources and flood management; DRR/management; coastal zone management; public health, waste, and sanitation; urban infrastructure and utilities; and rural development (Bierbaum et al., 2014; H.M. Government, 2012).

4.3 | Step 3: Agree search methods

We identify three main methods to search for evidence of observed adaptation at a large scale: the “systematic review” approach, the “call for evidence” approach, and the “inventory” approach.

Using established methods (e.g., Moher, Liberati, Tetzlaff, & Altman, 2009), the “systematic review approach” can synthesize findings from a wide range of empirical adaptation research (Berrang-Ford et al., 2011; Berrang-Ford, Pearce, & Ford, 2015). The approach uses predefined search terms and search methods, and applies formal inclusion and exclusion criteria to the search (see, e.g., Biesbroek, Klostermann, Termeer, & Kabat, 2013, and Porter, Dessai, & Tompkins, 2014). Focusing only on high-quality published literature means that the systematic review has the narrowest scope of the three approaches; it is least likely to capture unpublished private sector, individual, household, or community level adaptation activity. This approach may be able to offer some insights into spatial distribution of types of adaptation, but is unlikely to offer detail on numbers of people adapting.

The “call for evidence” approach requires adaptation researchers and practitioners to respond to a call to submit evidence of adaptation, such as within IPCC assessments. IPCC chapter authors review submissions in conjunction with their own literature search to assess evidence of adaptation (IPCC Secretariat, n.d.). There is no requirement to document the search method, and outputs of this approach summarize types of adaptation, but do not provide insight into prevalence or distribution of adaptation.

The “inventory” approach, developed by Tompkins et al. (2010), searches multiple sources, including private and public sector gray literature and documents the adaptations using a predefined template shaped around the core questions asked by Smit et al. (2001). For example, questions could be: how are people and systems adapting; how many people are adapting; where are people adapting; what is the purpose and form of the adaptation; what is the temporal and spatial prevalence and distribution of adaptation; who is delivering the adaptation and who is adapting (provider and beneficiary); to what are people adapting/what is driving the adaptation; are there side effects/co-benefits from the adaptation; and what is the cost of delivering the adaptation? By using the broadest interpretation of “literature” and by focusing on collecting spatially and temporally

explicit evidence from multiple data sources, this method has the potential to document spatial spread and distribution of adaptation, although it requires careful triangulation to avoid overreporting of adaptation (Tompkins et al., 2010).

All three approaches have been used to document adaptation, yet all three approaches suffer from weaknesses. These include the potential for: *double-counting* the same adaptation that occurs in multiple sources; *sectoral bias* as some sectors may document adaptation more thoroughly than others, such as water supply and coastal hazard responses; and *publication bias*, whereby only adaptations that are published in the sources selected are included. To reduce the risk of publication bias, we propose the use of the systematic review combined with the inventory approach, as together they would include a wide variety of literature, can be applied by non-experts, and can be cross-checked to avoid double-counting. The first search using this approach will inevitably be time consuming; however, if the search is documented carefully (the search engine, the key words and synonyms, the combinations of search terms, and explicit exclusion criteria), then it can be repeated and updated more easily in later years.

4.4 | Step 4: Categorize the adaptations

We suggest that the spectrum and prevalence of adaptations are best identified by categorizing adaptation by its objectives (i.e., reducing socioeconomic vulnerability, addressing disaster risk, or building social-ecological resilience—see Figure 2). Drawing on several decades of work on sustainable livelihoods, DRR, and ecosystem services, we argue that: (a) following Department for International Development [DFID] (1999) vulnerability reduction can be measured by changes in people's stocks of assets; (b) following UNISDR (1994) DRR can be measured by investment in disaster mitigation, preparedness, response, and recovery; and (c) following Millennium Ecosystem Assessment (2005) social-ecological resilience can be measured by changes in ecosystem services, that is, provisioning, regulating, habitat, and cultural services. Collectively these 13 components can describe the broad range of adaptations (see Figure 3). In addition to being well-known and extensively trialed, a further merit to categorizing adaptation in this way is the ability to capture changes in both stocks and flows of assets and services that occur as part of adaptation. Careful definition of the three main objectives of adaptation is needed (in step 1) to clarify where to place different adaptations. For example, unless it is clearly explained that natural capital represents stocks of assets that people use, and provisioning services relate to the flows of services that people obtain from ecosystems, there could be confusion between the two categories.

Over the past two decades significant research has been undertaken in each of these three areas, with advances made in categorizing types of activity. The five capital assets within the sustainable livelihoods approach (SLA) reveal the stocks of assets that people draw on to sustain livelihoods, that is, access to: the environment (natural capital); health, education, and well-being (human capital); networks and connections (social capital); money and finance (financial capital); and technology and built resources (physical capital). The four components of the DRR framework within the Hyogo and Sendai Frameworks for DRR (UNISDR, 2005, 2015) identify changes in both the stocks and flows of DRR: mitigation of long term hazard risk; regular preparatory activity for known hazards; response planning for hazards; and planned post disaster recovery. The four ecosystem services within the Millennium Ecosystem Assessment (2005) recognize the flows of services that ecosystems provide.

Intellectually, each of the three approaches builds on significant conceptual and empirical work dating back at least two decades: SLA (DFID, 1999; Scoones, 1998), DRR (UNISDR, 1994), and ecosystem services (Costanza et al., 1997). In that

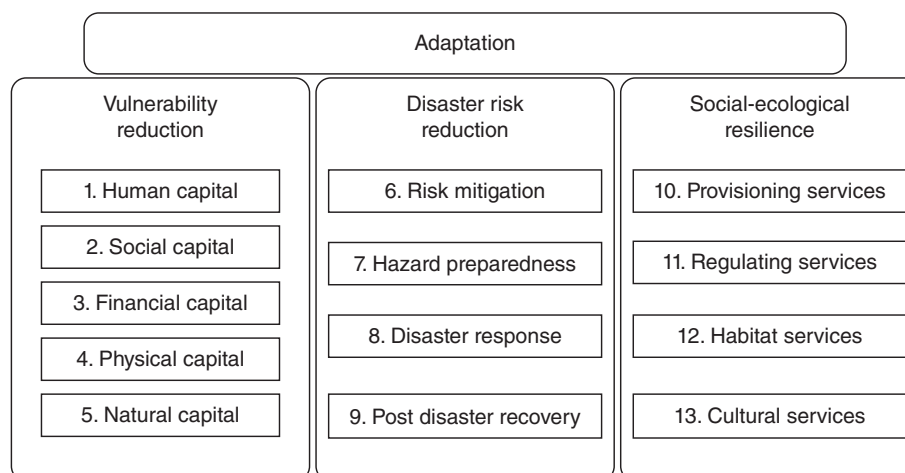


FIGURE 3 Components of adaptation

time, each approach has not only been critiqued but also counter-critiqued (e.g., Scoones, 2009, on the SLA, and Schröter et al., 2014, on ecosystem services), leading to improved versions of each. Further, all have been applied to document human-environment interactions in a multitude of spatial and temporal settings, in relation to a variety of environmental shocks and stresses. To create an initial baseline of adaptation, these extensively tested frameworks potentially provide a useful 13 component categorization of types of adaptation to support the global stocktake (Figure 3).

5 | CONCLUSION

With the first global stocktake under the Paris Agreement due to be completed by 2023, and agreement on modalities required by December 2018, continued debates about the definition of adaptation can no longer hamper progress on documenting adaptation. Moving beyond definitional arguments, and using widely agreed objectives of adaptation, we propose a replicable, transparent, and comparable four-step process for tracking and monitoring the state of adaptation. It requires a broad understanding of adaptation before data collection can begin, but it can integrate multiple adaptation types if these are found, leading to a comprehensive assessment of the type of adaptation, who is adapting, where adaptation is occurring and what is driving the adaptation. With careful guidance to countries on how to operationalize this stocktaking approach, this method would improve transparency of process, and enable comparability of findings across space and time. It would also create an analyzable baseline data set on the state of adaptation, and enable tracking and monitoring of progress with adaptation—a prerequisite to strengthening future ambition commitments within the Paris Agreement.

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CONFLICT OF INTEREST

The authors have declared no conflicts of interest for this article.

ENDNOTE

¹In pursuit of Decision 1/CP.21 §45 of the Paris Agreement, the UNFCCC Adaptation Committee (established out of the Cancun Adaptation Framework) and Least Developed Countries Expert Group have so far focused on reviewing adequacy and effectiveness of adaptation, and not on measuring the distribution and frequency of adaptation activity.

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REFERENCES

- Adger, W. N., Agrawala, S., Mirza, M. M. Q., Conde, C., O'Brien, K., Pulhin, J., ... Takahashi, K. (2007). Assessment of adaptation practices, options, constraints and capacity. In M. L. Parry, O. F. Canziani, J. P. Palutikof, C. E. Hanson, & P. J. van der Linden (Eds.), *Climate change 2007: Impacts, adaptation and vulnerability*. (Vol. 2, pp. 719–743). Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, England: Cambridge University Press.
- Agrawal, A., & Lemos, M. C. (2015). Adaptive development. *Nature Climate Change*, 5, 185–187. <https://doi.org/10.1038/nclimate2501>

- Asfaw, S., Pallante, G., & Palma, A. (2018). Diversification strategies and adaptation deficit: Evidence from rural communities in Niger. *World Development*, 101, 219–234.
- Atteridge, A., & Remling, E. (2018). Is adaptation reducing vulnerability or redistributing it? *WIREs Climate Change*, 9, e500. <https://doi.org/10.1002/wcc.500>
- Berman, R., Quinn, C., & Paavola, J. (2012). The role of institutions in the transformation of coping capacity to sustainable adaptive capacity. *Environmental Development*, 2, 86–100. <https://doi.org/10.1016/j.envdev.2012.03.017>
- Berrang-Ford, L., Ford, J. D., & Paterson, J. (2011). Are we adapting to climate change? *Global Environmental Change*, 21(1), 25–33. <https://doi.org/10.1016/j.gloenvcha.2010.09.012>
- Berrang-Ford, L., Pearce, T., & Ford, J. D. (2015). Systematic review approaches for climate change adaptation research. *Regional Environmental Change*, 15(5), 755–769. <https://doi.org/10.1007/s10113-014-0708-7>
- Bierbaum, R., Lee, A., Smith, J., Blair, M., Carter, L. M., Chapin, I., ... Seyller, E. (2014). Adaptation. In J. M. Melillo, T. T. C. Richmond, & G. W. Yohe (Eds.), *Climate change impacts in the United States: The third national climate assessment* (pp. 670–706). Washington, DC: U.S. Global Change Research Program.
- Biesbroek, G. R., Klostermann, J. E. M., Termeer, C. J. A. M., & Kabat, P. (2013). On the nature of barriers to climate change adaptation. *Regional Environmental Change*, 13, 1119–1129. <https://doi.org/10.1007/s10113-013-0421-y>
- Brooks, N., Anderson, S., Ayers, J., Burton, I., and Tellam, I. (2011) *Tracking adaptation and measuring development* (IIED Climate Change Working paper no. 1). London, England: IIED.
- Brown, K., DiMauro, M., Johns, D., Holmes, G., Thompson, D., Russell, A., & Style, D. (2018). Turning risk assessment and adaptation policy priorities into meaningful interventions and governance processes. *Philosophical Transactions of the Royal Society A*, 376(2121), 20170303.
- Canevari-Luzardo, L., Bastide, J., Choutet, I., & Liverman, D. (2017). Using partial participatory GIS in vulnerability and disaster risk reduction in Grenada. *Climate and Development*, 9(2), 95–109.
- Christiansen, L., Martinez, G., & Naswa, P. (Eds.). (2018). *Adaptation metrics: Perspectives on measuring, aggregating and comparing adaptation results*. Copenhagen, Denmark: UNEP DTU Partnership.
- Cochrane, L., Cundill, G., Ludi, E., New, M., Nicholls, R. J., Wester, P., ... Landry, M.-E. (2017). A reflection on collaborative adaptation research in Africa and Asia. *Regional Environmental Change*, 17(5), 1553–1561. <https://doi.org/10.1007/s10113-017-1140-6>
- Costanza, R., D'Arge, R., Groot, R. d., Farber, S., Grasso, M., Hannon, B., ... Belt, M. v. d. (1997). The value of the world's ecosystem services and natural capital. *Nature*, 387(6630), 253–260.
- Department for International Development. (1999). *Sustainable livelihoods guidance sheets*. London, England: Department for International Development.
- Dilling, L., Daly, M. E., Travis, W. R., Wilhelmi, O. V., & Klein, R. A. (2015). The dynamics of vulnerability: Why adapting to climate variability will not always prepare us for climate change. *WIREs Climate Change*, 6, 413–425. <https://doi.org/10.1002/wcc.341>
- Duncan, J. M., Tompkins, E. L., Dash, J., & Tripathy, B. (2017). Resilience to hazards: Rice farmers in the Mahanadi Delta, India. *Ecology and Society*, 22(4), 3. <https://doi.org/10.5751/ES-09559-220403>
- Duncan, J. M. A., Dash, J., & Tompkins, E. L. (2017). Observing adaptive capacity in Indian rice production systems. *AIMS Agriculture and Food*, 2(2), 165–182.
- Eakin, H., Tompkins, E. L., Nelson, D. R., & Anderies, J. M. (2009). Hidden costs and disparate uncertainties: Trade-offs involved in approaches to climate policy. In W. N. Adger, I. Lorenzoni, & K. L. O'Brien (Eds.), *Adapting to climate change: Thresholds, values, governance* (pp. 212–226). Cambridge, England: Cambridge University Press.
- Ensor, J., & Berger, R. (2009). *Understanding climate change adaptation: Lessons from community-based approaches*. London, England: Practical Action.
- Field, C. B., Barros, V. R., Mach, K. J., Mastrandrea, M. D., Aalst, M. v., Adger, W. N., ... Yohe, G. W. (2014). Technical summary. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White (Eds.), *Climate change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY: Cambridge University Press.
- Ford, J., & Berrang-Ford, L. (2016). The 4Cs of adaptation tracking: Consistency, comparability, comprehensiveness, coherency. *Mitigation and Adaptation Strategies for Global Change*, 21, 839–859. <https://doi.org/10.1007/s11027-014-9627-7>
- Ford, J. D., Berrang-Ford, L., Biesbroek, R., Araos, M., Austin, S. E., & Lesnikowski, A. (2015). Adaptation tracking for a post-2015 climate agreement. *Nature Climate Change*, 5(11), 967–969. <https://doi.org/10.1038/nclimate2744>
- Ford, J. D., Berrang-Ford, L., Bunce, A., McKay, C., Irwin, M., & Pearce, T. (2015). The status of climate change adaptation in Africa and Asia. *Regional Environmental Change*, 15(5), 801–814.
- GEF. (2014). *Tracking tool for climate change adaptation projects*. Washington, DC: GEF. Retrieved from <https://www.thegef.org/documents/gef-climate-change-adaptation-tracking-tool>
- H.M. Government. (2012). *UK climate change risk assessment 2012*. Presented to Parliament pursuant to Section 56 of the Climate Change Act 2008. London, England: H.M. Government.
- Hall, N., & Persson, A. (2017). Global climate adaptation governance: Why is it not legally binding? *European Journal of International Relations*, 1–27. <https://doi.org/10.1177/1354066117725157>
- IIED. (2016). *Reviewing the adequacy and effectiveness of adaptation and support. The International Institute for Environment and Development's submission on the Adaptation Committee and Least Developed Countries Expert Group mandates stemming from decision 1/CP.21, paragraph 45(b)*. UNFCCC, September 2016. Retrieved from <https://unfccc.int/sites/default/files/697.pdf>
- Intergovernmental Panel on Climate Change. (2014). Summary for policymakers. In O. Edenhofer, R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel, & J. C. Minx (Eds.), *Climate change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects*. (pp. 1–32). Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, England and New York, NY: Cambridge University Press.
- IPCC Secretariat. (n.d.). *Appendix A to the principles governing IPCC work. The procedures for the preparation, review, acceptance, adoption, approval and publication of IPCC reports*. Retrieved from <http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles-appendix-a-final.pdf>
- Keshavarz, M., Maleksaeidi, H., & Karami, E. (2017). Livelihood vulnerability to drought: A case of rural Iran. *International Journal of Disaster Risk Reduction*, 21, 223–230.
- Khan, M., & Roberts, J. T. (2013, 2013). Adaptation and international climate policy. *WIREs Climate Change*, 4, 171–189. <https://doi.org/10.1002/wcc.212>
- Least Developed Countries Expert Group. (2012). *National adaptation plans: Technical guidelines for the national adaptation plan process*. Bonn, Germany: UNFCCC. Retrieved from https://unfccc.int/files/adaptation/cancun_adaptation_framework/application/pdf/naptechguidelines_eng_high_res.pdf
- Leiter, T. (2017). The adaptation M&E navigator: A decision support tool for the selection of suitable approaches to monitor and evaluate adaptation to climate change. In J. I. Uitto, J. Puri, & R. D. van den Berg (Eds.), *Evaluating climate change action for sustainable development* (pp. 327–341). Cham, Switzerland: Springer International Publishing.
- Lesnikowski, A., Ford, J., Biesbroek, R., Berrang-Ford, L., & Heymann, J. (2016). National level progress on adaptation. *Nature Climate Change*, 6, 261–264. <https://doi.org/10.1038/nclimate2863>

- Lesnikowski, A., Ford, J., Biesbroek, R., Berrang-Ford, L., Maillet, M., Aroas, M., & Austin, S. E. (2017). What does the Paris Agreement mean for adaptation? *Climate Policy*, 17(7), 825–831. <https://doi.org/10.1080/14693062.2016.1248889>
- McGray, H., Hammill, A., & Bradley, R. (2007). *Weather the storm. Options for framing adaptation and development*. Washington, DC: World Resources Institute.
- Millennium Ecosystem Assessment. (2005). *Ecosystems and human well-being: Scenarios. Findings of the scenarios working group*. Washington, DC: Island Press.
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, 151, 264–269. <https://doi.org/10.1371/journal.pmed.1000097>
- Mortreux, C., & Barnett, J. (2017). Adaptive capacity: Exploring the research frontier. *WIREs Climate Change*, 8, e467. <https://doi.org/10.1002/wcc.467>
- Noble, I. R., Huq, S., Anokhin, Y. A., Carmin, J., Goudou, D., Lansigan, F. P., ... Villamizar, A. (2014). Adaptation needs and options. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White (Eds.), *Climate Change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects* (pp. 833–868). Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel of Climate Change. Cambridge, United Kingdom and New York, NY: Cambridge University Press.
- Persson, A., & Remling, E. (2014). Equity and efficiency in adaptation finance: Initial experiences of the adaptation fund. *Climate Policy*, 14(4), 488–506. <https://doi.org/10.1080/14693062.2013.879514>
- Porter, J. J., Dessai, S., & Tompkins, E. L. (2014). What do we know about UK household adaptation to climate change? A systematic review. *Climatic Change*, 127(2), 371–379. <https://doi.org/10.1007/s10584-014-1252-7>
- Preston, B. L., Mustelin, J., & Maloney, M. C. (2015). Climate adaptation heuristics and the science/policy divide. *Mitigation and Adaptation Strategies for Global Change*, 20(3), 467–497. <https://doi.org/10.1007/s11027-013-9503-x>
- Ranger, N., Reeder, T., & Lowe, J. (2013). Addressing “deep” uncertainty over long-term climate in major infrastructure projects: Four innovations of the Thames Estuary 2100 Project. *EURO Journal on Decision Processes*, 1(3), 233–262. <https://doi.org/10.1007/s40070-013-0014-5>
- Remling, E. (2018). Depoliticizing adaptation: A critical analysis of EU climate adaptation policy. *Environmental Politics*, 27(3), 1–21.
- Remling, E., & Persson, A. (2014). Who is adaptation for? Vulnerability and adaptation benefits in proposals approved by the UNFCCC adaptation fund. *Climate and Development*, 7(1), 16–34. <https://doi.org/10.1080/17565529.2014.886992>
- Roberts, E., & Pelling, M. (2018). Climate change-related loss and damage: Translating the global policy agenda for national policy processes. *Climate and Development*, 10(1), 4–17.
- Schröter, M., Zanden, E. H., Oudenhoven, A. P., Remme, R. P., Serna-Chavez, H. M., Groot, R. S., & Opdam, P. (2014). Ecosystem services as a contested concept: A synthesis of critique and counter-arguments. *Conservation Letters*, 7(6), 514–523. <https://doi.org/10.1111/conl.12091>
- Scoones, I. (1998). *Sustainable rural livelihoods: A framework for analysis* (IDS Working paper 72). Brighton: IDS.
- Scoones, I. (2009). Livelihoods perspectives and rural development. *The Journal of Peasant Studies*, 36(1), 171–196. <https://doi.org/10.1080/03066150902820503>
- Smit, B., Pilifosova, O., Burton, I., Challenger, B., Huq, S., Klein, R. J. T., ... Smith J. (2001). Adaptation to climate change in the context of sustainable development and equity. In J. J. McCarthy, O. F. Canziani, N. A. Leary, D. J. Dokken, & K. S. White (Eds.), *Climate change 2001. Impacts, adaptation, and vulnerability*. Cambridge, England: Cambridge University Press.
- Tompkins, E. L., Boyd, E., Nicholson-Cole, S., Adger, W. N., Weatherhead, K., & Arnell, N. W. (2010). Observed adaptation to climate change: UK evidence of transition to a well-adapting society? *Global Environmental Change*, 20, 627–635. <https://doi.org/10.1016/j.gloenvcha.2010.05.001>
- UNFCCC. (2016). *Report of the Conference of the Parties on its twenty-first session, held in Paris from November 30 to December 13, 2015. Addendum part two: Action taken by the Conference of the Parties at its twenty-first session, FCCC/CP/2015/10/Add.1*. Bonn, Germany.
- UNISDR. (1994). *Yokohama strategy and plan of action for a safer world*. Guidelines for Natural Disaster Prevention, Preparedness and Mitigation. World Conference on Natural Disaster Reduction, Yokohama, Japan, UN Department of Humanitarian Affairs.
- UNISDR. (2005). *Hyogo framework for action 2005–2015: Building the resilience of nations and communities to disasters*. World Conference on Disaster Reduction 18–22 January 2005, Kobe, Hyogo, Japan. Geneva: International Strategy for Disaster Reduction.
- UNISDR. (2015). *Sendai framework for disaster risk reduction 2015–2030*. Geneva: International Strategy for Disaster Reduction.
- United Nations Environment Programme. (2017). *The adaptation gap report 2017*. Nairobi, Kenya: United Nations Environment Programme.

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