A method for tracking national progress towards climate change adaptation

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Abstract

Adaptation tracking is now an important means to characterise, report, and monitor progress towards reducing vulnerability to climate change. The means and methods for adaptation tracking are challenging and diverse due to differing purposes and sectors and scales of analysis, difficulties in classifying activities as adaptation of one kind or another, and challenges in defining and measuring progress. Here we report on the approach and method used to develop the Australian Adaptation Database. With 600 adaptation activities initially coded, the database is a repository for learning from the efforts of others, helps to track progress in adaptation activities across all sectors and scales in Australia, and helps responsible authorities to meet reporting obligations. The paper describes the method to develop the database and focusses on an approach to assess progress in adaptation within and between sectors and jurisdictions. We propose adaptation progress is the degree to which adaptation activities move towards interventions that affect changes intended to reduce vulnerability. This approach enables adaptation stocktakes to infer progress from the nature of adaptation activities, with those that are closer to the 'intervention' stage being closer to reducing vulnerability than those that are precursors to intervention. Though the nature of adaptation makes all such exercises imperfect, the result, we propose, is a framework and method that serves the purposes of characterising, reporting, and monitoring progress towards adaptation within a country.

Key words: Australian Adaptation Database, intervention, progress, stocktake

1. Introduction

In 2023, the United Nations Framework Convention on Climate Change (UNFCCC) completed the first global stocktake to track progress towards the three goals of the Paris Agreement (Article 7): including the global goal on adaptation (UNFCCC, 2018). This process has stimulated governments, not-for-profits, international organisations and researchers to catalogue and assess the current state of adaptation within their jurisdictions. Yet research on adaptation tracking shows there is a lack of agreement on what information should be included in an adaptation stocktake (Nalau et al., 2024). There are few papers documenting existing methodologies, and of these purposes and methods differ substantially (Berrang-Ford et al., 2021; Chen et al., 2016; Incerti and Barnett, 2024; Jenkins et al., 2022; Jeudy-Hugo et al., 2022; Laurent and Duvat, 2024; Lorenz et al., 2019; Palutikof et al., 2019a; Song et al., 2025; Tompkins et al., 2018). This is because measuring adaptation is extremely challenging, for at least three major reasons (UNFCCC Secretariat, 2022).

First, the way in which adaptation is conceptualised and included in a stocktake is itself a major challenge. Many processes not labelled 'adaptation' can be said to reduce vulnerability and so might plausibly be included in a stocktake (Tompkins et al., 2018). For example, improving educational attainment yields a host of benefits to individuals that reduces their vulnerability (Lutz et al., 2014), as does improving universal human rights (Hall and Weiss, 2012). Neither are called 'adaptation', however, and could easily be excluded from stocktakes. Moreover, some activities that reduce vulnerability may emanate from beyond the borders of the jurisdiction for which a stocktake is being conducted, for example decreases in the price of corn in the USA can lead to reduced deforestation in the Amazon and therefore greater scope for Indigenous peoples there to adapt (Nepstad et al., 2008). There are also many activities that are only partly justified by adaptation imperatives and so require judgements about their degrees of relevance to adaptation (Bird et al., 2012). In our research we have also discovered there are activities that are taken for the purposes of adaptation, but which are not labelled as such due to political sensitivities associated with the words 'climate change' and 'adaptation'. For these reasons, a meaningful adaptation stocktake must both define the basis for inclusion and recognise that its results will only ever be a sample of the full suite of activities that reduce (or increase) vulnerability in a jurisdiction.

A second major challenge with adaptation stocktakes concerns evidence. Ideally, an adaptation stocktake includes evidence from an array of activities from the public sector, civil society and private sector, but in practice this is very difficult (Canales et al., 2023). Extensive information about the type and nature of an adaptation activity is rare, particularly if stocktakes rely only on online information (Berrang-Ford et al., 2021; Canales et al., 2023; Laurent and Duvat, 2024). There are many disincentives to the sharing of information about adaptation including the inherently political nature of adaptation (Craft and Fisher, 2018). Much adaptation is undertaken by government

bodies, who are subject to public scrutiny and face political risks from disclosure about the cost, scope, and effectiveness (or not) of adaptation activities. This is not helped by the challenges of knowing how effective an adaptation activity has been. Moreover, there are transaction costs associated with reporting and evaluation of adaptation given that these are rarely integral to adaptation processes. Finally, adaptation conducted by the private sector may be commercially confidential (Gibbs, 2016).

A final major challenge concerns determinations about the state of adaptation when analysed in aggregate across different scales, sectors, and climate risks. Any measure of progress requires determination of some baseline and a consistent standard for measuring activities against it, which might be measures of spending, the quantity of activity, the quality of processes, or the efficacy of outcomes (Dupuis and Biesbroek 2013, Ford et al., 2013; Jenkins et al., 2022; Tompkins et al., 2018). Yet there is currently a lack of consensus about definitions, suitable baselines and approaches for measuring progress (Bours et al., 2014a; Craft and Fisher, 2018; Leiter, 2019).

In this paper we explain how we have addressed these challenges in the development of the Australian Adaptation Database (australianadaptationdatabase.unimelb.edu.au). The database is one example of a way to track adaptation across all sectors and jurisdictions within a country, recognising that this is a specific response to identified needs, and an extremely empirically and conceptually challenging task. Here we explain the approach and method we used to develop the database, with a particular emphasis on how we have conceived of and propose to assess progress, as this is the most challenging step in adaptation tracking. For this purpose, we propose progress can be mapped as a continuum from the precursors to adaptation through to 'interventions' that aim to directly reduce vulnerability to climate change.

The rest of the paper is structured as follows. In the next section we explain the development of the Australian Adaptation Database, which is necessary to contextualise the way we propose to assess progress. We then explain the approach we have classified activities in the database to enable us to assess progress in adaptation across sectors and jurisdictions. Finally, we discuss this typology and how it relates to the state of knowledge about progress in adaptation. We do not here provide analysis of adaptation, or its progress in Australia based on the database, rather this paper describes its logic, approach and methods.

2. The Australian Adaptation Database

2.1. Context: Adaptation in Australia

As a developed country with a range of natural hazards and a diversity of climate-sensitive ecosystems and peoples across a large area, Australia was a relatively early mover on research and policy on climate change adaptation. The beginnings of

purposeful adaptation activity in Australia can be traced to the 1992 National Greenhouse Response Strategy (NGRS), and the 1998 National Greenhouse Strategy (NGS). However, while both strategies referred to adaptation the major focus was on mitigation, so there were likely few adaptation initiatives in the 1990's (Waller and Barnett, 2015). The first coordinated national adaptation policy was the 2004 A$14 million, four-year National Climate Change Adaptation Program (NCCAP). We can assume that, at a minimum, there is twenty years of adaptation activities in Australia that have not yet been catalogued. Thus far analysis of any of this adaptation work has been rare and piecemeal at best. Given this length of time, and the method used to collect data, the Australian Adaptation Database has struggled to capture these past activities, and its record of activities is dominated by those in the recent past and present.

It is generally understood that adaptation in Australia is government-led, though significant activity from civil society has increased over time. Knowledge of activities in the private sector is limited. The Australian system of government is directed by a constitution that establishes the relationship between the federal government and six states and two territories. Though there is constant friction between the states and territories and the Australian Government, the former are largely responsible for many of the key sectors that pertain to adaptation, including agriculture and other primary industries, planning, health, and many aspects of natural resource management.

The Australian system of government also includes some 566 local governments, which are created by Acts of state and territory parliaments. Local governments administer many key adaptation tasks, including those relating to planning (Waller and Barnett; 2015). There is a strong understanding, at least among local governments and researchers, that historically state and territory governments have shifted economic, political, and transaction costs of adaptation on to local governments, without commensurate increases in resources and other forms of support (MacIntosh 2013; McDonald 2014; O'Donnell 2019). Among other things, this means that one would expect many adaptation activities to be conducted by local governments, and that this should be reflected in stocktaking exercises (Maloney and McLaren 2018).

A key characteristic of adaptation in the Australian system of government is that it has been approached as a discrete activity, with distinct organisations, actors, policies, and programs, rather than something to be mainstreamed across government (Waller and Barnett, 2015). In that context, momentum in the development of adaptation policy and programs has been uneven over time. Local governments have a long history of developing risk and vulnerability assessments for key communities and assets but have faced challenges in funding and implementing adaptation planning (Mukheibir et al, 2013). State and Territory governments have in recent years begun to address these challenges through state-wide adaptation plans, however there are significant variations in scope, purpose and funding for meaningful action among these plans. The

Australian Government is intending to release its first National Adaptation Plan in 2025/6, which underscores the importance of capturing the full range of purposeful adaptation activities and developing a consistent approach to understanding progress.

For all this activity, there have been very few attempts to systematically take stock of adaptation in Australia. There have been various synopses (Waller and Barnett, 2015; Palutikof et al., 2019a; Waters et al., 2023), more systematic assessments of actions by discrete actors (Denham et al., 2025; Fallon and Sullivan, 2014; Maloney and McLaren, 2018), and one assessment based on the peer-reviewed academic literature (Pearce et al., 2018). Other ad-hoc assessments have also been undertaken by governments over time, but these have rarely been made public and are typically lost during changes in governments and organisational restructuring. For its part, the Australian Adaptation Database has been developed to satisfy several practical purposes, as suggested by a range of end users, as explained in the following section.

2.2 The Aims and Approach of the Database

The Australian Adaptation Database was developed to meet the needs of a range of users – including all three levels of government – and so aligns with the institutional structures, styles of government, and state-society relations within Australia, helping to make it a legitimate and sustainable output to which organisations are willing to contribute data (Njuguna et al., 2022). A key practical aim of the database is to serve as a searchable repository of activities that others can consult as they seek to implement adaptation. Another is to support reporting, including the Australian Government's commitment to report to the UNFCC on the collective process of adaptation within the country. It also enables the identification of gaps in action across sectors and jurisdictions, the tracking of trends in adaptation action over time, analysis of factors that seem to enable adaptation, and a better sampling of activities for deeper analysis (for example for impact evaluations). It has also been discussed as a means to improve climate risk assessments as it enables accounting of adaptation actions to better understand 'residual' climate risks after adaptation (and in turn support better assessment of potential losses and damages). Finally, the more climate risks are factored into insurance markets and sovereign credit ratings the more important it is to know the extent of adaptation activities as these can help lower premiums and maintain credit ratings (Bernhofen et al., 2024; Zhou et al., 2023).

An iterative and experimental approach has been taken over the course of two years to develop and test a suitable methodology to satisfy these aims, while acknowledging the significant challenges of adaptation stocktaking. The data in the database itself is not presented in this paper, rather, we describe the process by which the database was developed to better explain how we propose to use it to assess progress on adaptation.

The development of the database began with assessment of the academic literature on adaptation tracking (Berrang-Ford et al., 2019; Berrang-Ford et al., 2021; Canales et al., 2023; Craft and Fisher, 2018; Jenkins et al., 2022; Jeudy-Hugo et al., 2022; Nalau et al., 2024; Palutikof et al., 2019a; Tompkins et al., 2018). Reports from the International Panel on Climate Change were also reviewed; with a particular focus on their way of categorising adaptation into infrastructure and technological, institutional, nature based and behavioural and cultural (IPCC, 2023). Our review also included examining research on assessing adaptation progress, which is discussed in section 5. Important lessons from the reviews guided the design of the stocktake.

2.3 Methods

We took a cumulative approach to data collection, which began in July 2023 and is ongoing. Data collection started with a short survey designed to capture input from adaptation practitioners and academics, asking them to identify initiatives they would expect to see in an adaptation stocktake. The survey included ten brief questions focused on a key example of adaptation, the type of hazard it addressed, and the nature of the activity. The number of questions was kept to a minimum to help maximise the response rate.

This approach of drawing on insight from experts in the field was used to begin the data collection with grounded examples of adaptation and to test the scope and range of responses to inform the development of inclusion criteria. The survey was initially shared with attendees at the Climate Adaptation 2023 conference in Adelaide, Australia, and was later distributed to additional participants via email, who were identified through existing contacts, their workplaces and snowballing methodologies. Target participants included staff in local, state and federal government departments, private sector practitioners (such as in consulting and insurance), researchers, and people working for not for profits.

In total over 440 attendees at the conference, and over 830 email recipients were invited to participate in the survey in the period between July and September 2023. The survey returned 103 responses during this period, which equates to approximately an 8% response rate. The survey has since been used as an ongoing method to collect data and has continued to be shared at other Australian conferences and workshops where the research team is presenting.

The survey was complimented by discussions with key stakeholders from across Australia. This began with a presentation on the project to the national Adaptation Working Group, comprised of representatives from federal, state and territory governments, key statutory bodies, and the Australian Local Government Association. From this, invitations to meet with the research team were sent to representatives from relevant state, territory and federal government departments, as well as to local

government associations. Throughout 2024 the project team met with these and other interested parties to provide an overview of the adaptation database and invite contributions about their adaptation activities, either directly or via the survey. As publicity surrounding the database increased the project team was increasingly contacted by other stakeholders, mostly other government departments, who wished to learn more and contribute data.

The consultation with key stakeholders was a reciprocal opportunity to learn about the needs of various end-users for a national adaptation dataset, which informed revisions in the design of the database and its outputs. Stakeholders spoke of the growing obligation for adaptation reporting, a lack of consistency across jurisdictions, and the absence of a central repository of evidence for reporting. Throughout the project data has been made available to stakeholders for their own uses, and a commitment was made to ensure the database was publicly available by the end of the project's first iteration (EOY 2025). The database is a living work, and so consultations continue, including with a focus on key industry bodies, the private sector, social service providers, not-for-profit organisations, and private philanthropists. This process will continue subject to funding.

Further planned work includes online searching to identify adaptation examples from the websites of Australia's 566 local government areas, in addition to meetings with local government associations not yet contacted. Web-based searches are also being used to identify additional adaptation activities, and to supplement information about activities identified through the survey and consultations where available. Using Google Advance Search capabilities, we searched the Australian Broadcasting Corporation (ABC) News website (a free to access, national news database which draws on a network of local news outlets in regional towns and major cities), for key words 'climate' and 'adapt' in conjunction with terms related to hazards, climate events or variability. Each media article found was screened for mention of climate change adaptation and key details about adaptation actions were extracted. If climate change adaptation was not explicitly mentioned, smaller-scale actions (e.g. farmers switching from livestock to crops) that relate to adaptation were also considered. This approach also yielded additional examples of government-led adaptation efforts.

So far, the stocktake has identified 988 discrete adaptation actions, of which 600 have been investigated, coded and included in the on-line database launched in March 2025. Coding of the remainder is ongoing and will continue as new activities are identified. Of these, the activities recorded are biased by the methods of data collection and so include many activities by state and territory agencies, as well as local and federal governments, and few from civil society organisations, the private sector, and households. This problem of bias based on who reports and their capabilities and incentives is well recognised in the research on adaptation tracking (Elstow et al., 2024).

For this reason, the ongoing data collection is focussed on these underrepresented sectors and actors.

Once data collection was underway, the research team began investigating the identified examples and coding them for entry into a database. For each adaptation activity, information was collected on its intended purpose, the relevant adaptation category (as defined by the IPCC), as well as its geographical location, lead actor, scale, year, sector, and funding. Importantly, we also recorded any publicly available monitoring or evaluation associated with each activity. However, to transform this data into a meaningful adaptation stocktake—and to assess progress across sectors or jurisdictions—a clear typology was needed to classify each activity consistently.

The typology of progress presented below is the result of an ongoing process, built on existing understanding in the literature and tested through trial and error with 600 adaptation interventions. It is proposed as a method to understand and draw conclusions about adaptation progress and will be tested via public engagement with the Australian Adaptation Database.

3. A typology of progress towards adaptation

The IPCC defines *adaptation* as the process of adjustment to actual or expected climate and its effects (IPCC, 2023). In practice, it is a social-political process that drives individual and organizational responses to simultaneously occurring environmental and social changes (Eriksen et al., 2015). It is this idea of adaptation as a *process* that informs our approach to assessing progress in adaptation through the Australian Adaptation Database.

This approach to adaptation stocktaking is distinct from the more challenging task of evaluating adaptation 'success' or effectiveness, which is challenging for many now well-known reasons, leading to limited evaluations of adaptation actions, as well as differences in proposed methodologies for such purposes (Adger et al., 2005; Bartelet et al., 2025; Berrang-Ford et al., 2021; Bours et al., 2014a; Bours et al., 2014b; Craft and Fisher, 2018; Moser and Boykoff, 2013, Scott and Moloney, 2022). The challenges in evaluating climate change adaptation mean that analysts instead revert to measuring and reporting on adaptation processes or outputs and rarely evaluate outcomes (Chu and Cannon, 2021; Coggins et al., 2021; Doubleday et al., 2020; Seyisi et al., 2023).

We suggest adaptation stocktaking exercises are not intended to answer such evaluation questions about the quality of processes, outputs, outcomes or impact. Rather, stocktakes such as ours serve to collect data and monitor activity in such a way that allows for future evaluation to occur (through the creation of indicators or metrics, applied to baseline data and compared over time). Because the challenges of outcome and impact evaluations of adaptation are so great and require so much time, and

because very few activities in the Australian Adaptation Database have end point evaluations we can utilise, we cannot hope to meaningfully assess adaptation progress, at this scale, in terms of reduction in vulnerability outcomes.

Adaptation is about change over time, yet very few studies have compared adaptation progress over time, with a notable exception being that of Canosa and colleagues' (2020) assessment of progress on adaptation in the Arctic based on assessment of the peer-reviewed literature in two different time periods. The Australian Adaptation Database is arguably too small, and the data about commencement dates insufficiently reliable (especially relative to the history of adaptation in Australia), to show trends in activities over the time period captured in the data. Instead, however, we seek to infer progress from the nature of activities, reasoning, as explained below, that those that are closer to the 'intervention' stage are closer to reducing vulnerability than those that are precursors to intervention.

There is broad agreement on the common stages of the intentional adaptation process, an example of which is illustrated below (LDC Expert Group, 2012; Moser and Ekstrom, 2010; Palutikof et al., 2019b; Stafford-Smith et al., 2022). Though the specific nomenclature and sequencing of activities varies across described processes, they typically propose a rational adaptation cycle comprised of initial assessments and the establishment of governance instruments, leading to more purposeful activities such as communications and consultation to build consensus, adjustments to or the creation of new organisations and institutions, and then to interventions that change environments or practices, followed by monitoring and evaluation. The assessment of progress we propose here assumes that the adaptation process in some way reflects reality and is good, and so, as suggested by Dupuis and Biesbroek (2013), we use it as a standard against which we assess progress in adaptation.

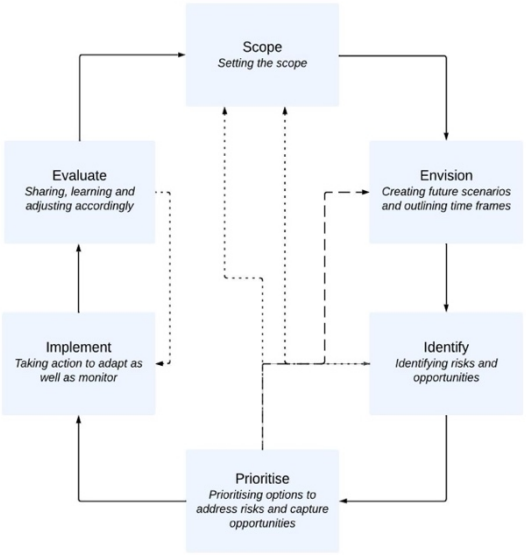

Figure 1: *The steps of the adaptation process as summarised by Stafford-Smith et al. While the adaptation process is often illustrated in this circular style, these steps are not necessarily sequential, are iterative and often need to be revisited (Stafford-Smith et al., 2022).*

We recognise that the steps of the adaptation process are iterative, and such processes are rarely as sequential or logical as the cycle might wish them to be. As a result, the adaptation process can take different forms depending on the adaptation activity being carried out and may be repeated many times before a suitable adaptation outcome is reached (Stafford-Smith et al., 2022).

The adaptation process is an ideal against which we can assess adaptation activities in Australia. We propose adaptation progress is the degree to which adaptation activities move towards interventions that affect changes intended to reduce vulnerability. This does not mean we assume every step in the adaptation process is a necessary condition for adaptation progress rather, that for any given sector or jurisdiction the distribution of activities at various points in the ideal adaptation process indicates the degree to which adaptation is moving towards intervention. The closer these collectively are to intervention, the more progress is being made. This is a recognised approach to assessing progress (Dupuis and Biesbroek, 2013; Ford and Berrang-Ford, 2016), that is based on process (Hinkel, 2011), and has been applied in some stocktakes, for example that of Gagnan-Lebrun and Agrawala (2007).

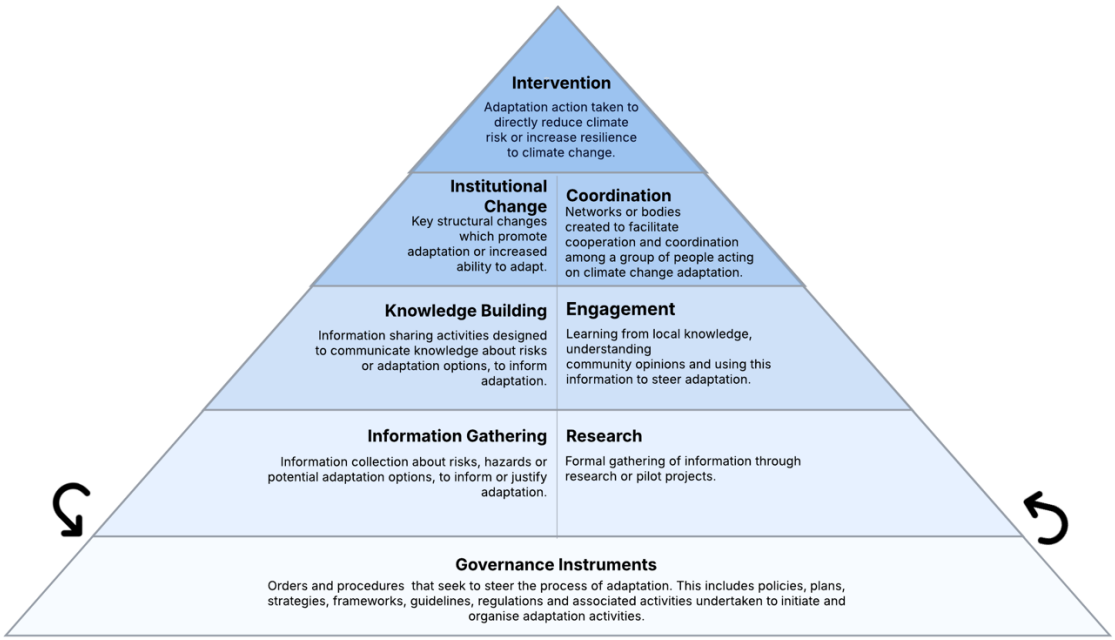

Figure 2: *The proposed typology for progress in adaptation actions, represented as a pyramid which progressively builds to adaptation interventions that directly address climate risks to reduce vulnerability.*

In recognition of the breadth of important work conducted under the remit of climate change adaptation, this typology is represented as a pyramid that builds from foundational activities or preconditions, through to tangible adaptation actions (Figure 2). The different types of adaptation activities are those considered necessary to move in an idealised sequence towards the ultimate aim of reduced vulnerability or increased resilience. The sequence is idealised in recognition that not all preconditions are necessary for the next step in the progression, nor that all actions are necessary to achieve an adaptation. Rather, the typology enables us to classify activities in a way that is consistent with the idea that the more the set of activities in a jurisdiction or sector move towards intervention the more progress there is towards achieving adaptation outcomes (Dupuis and Biesbroek, 2013).

It should not be implied that any given adaptation action is not worthy or valuable if its evolution does not conform to the idealised process or has not culminated in an intervention. Indeed, we do not propose this method be used to evaluate discrete actions. Rather, the typology can be used to classify individual actions along a spectrum of intervention in order to assess if a set of adaptation actions in a jurisdiction or sector is progressing beyond foundational activities. We note that research has shown adaptation is most efficient when it is well planned, coordinated, mainstreamed across all sectors and scales, and commenced as soon as possible (Schipper et al., 2022), and so it may be that interventions that are implemented without any preceding actions may be more at risk of maladaptation.

4. The many purposes of adaptation

In the database we coded adaptation activities based on a typology of 'purposes' explained below and shown in Figure 2. These purposes reflect the nature of adaptation activities that have been conducted and their intended outputs. Confirming these outputs have been complete is a more precarious task. Each action was coded against up to two different 'purposes' to more realistically represent the nature of adaptation work, which often has more than a single purpose.

4.1 Governance Instruments

Governance instruments form the foundation of the progress pyramid. These include orders and procedures that seek to steer the process of adaptation, such as policies, plans, strategies, frameworks, guidelines, laws, and regulations.

Governance instruments are likely necessary for progress, but on their own are insufficient, and their proliferation without subsequent implementation may indeed point to the existence of barriers that persistently impede adaptation progress. Further, the relevance and intention of governance instruments varies greatly. Adaptation mainstreaming means increased inclusion of climate change adaptation planning into governance instruments that primarily serve other purposes such as for urban planning, or for disaster risk reduction. Some governance instruments are symbolic, serving to demonstrate that obligations to adapt are being met, but which otherwise do nothing to affect intervention (Dupuis and Biesbroek, 2013; Waters et al., 2023). Others are used to impel action, such as leveraging pre-existing laws and regulations that were not developed for adaptation to justify a responsibility to adapt (McDonald and McCormack, 2021).

In the database, all policies, plans, strategies and other relevant documents which had a clear or conceivable link to climate change adaptation have been coded against a typology of contiguous, contributive, intentional and actionable policies, building on that proposed by Dupius and Biesbroek (2013) (discussed later in section 5). This will allow a subsequent analysis to separate contiguous initiatives which have influence on adaptation but are not directly aimed at adaptation outcomes and have limited impact on reducing vulnerability from concrete, actionable plans which are likely to enable good adaptation action.

4.2 Information Gathering and Research

Collection of information needed to inform adaptation actions is the focus of many activities, including risk and vulnerability assessments, as well as assessments of possible adaptation options. This often includes analysis of climate, environmental or

ecological information that creates risk in a given context. Those activities we have described as 'information gathering' have typically been conducted in an ad-hoc manner as needed to inform policy, planning and investment in adaptation options.

This is closely linked to research activities, which are often conducted in a more formal and discrete manner by research institutions. Thus far the broad set of academic research on adaptation is not reflected in the database, because while these may feed into adaptation planning and interventions, it is difficult to discern if their outputs influence or are part of an intentional adaptation process. Instead, the database includes empirical research activities associated with an intended adaptation intervention, such as pilot studies, or models that seek to simulate the impact of interventions.

4.3 Knowledge Building and Engagement

Knowledge building activities are those that focus on communicating and sharing information to enable adaptation interventions. These activities can fulfill several purposes, such as: building the knowledge of adaptation professionals in governing organisations, informing communities in the hope of affecting behaviour change, and building a mandate to increase acceptance of or reduce resistance to future adaptation interventions. Such activities can take many forms, including workshops, webinars, training, information resources, and simulation games, depending on the intended audience.

Engagement has become a term widely used to describe activities that seek to inform and learn from parties that may be affected by or hold a stake in adaptation interventions. Somewhat like policies, engagement can be more or less substantive and range from simple 'consultation' whereby stakeholders are informed of an intervention but are given minimal given opportunity to express concerns, through to very active participation that allows stakeholders to have a valued and important voice in decision making (Few et al., 2007). It is difficult to make these distinctions in the database without proper review and evaluation, so it should be assumed to include activities from both ends of the spectrum.

Because engagement activities can and should be conducted as part of the adaptation cycle and as a precursor to intervention, and because they are often required by governance instruments, we position it in the pyramid (Figure 2) closer to 'intervention' than 'information' and 'research and governance instruments'.

4.4 Institutional Change and Coordination

Coordination is a largely institutional activity. In recent years, increased climate change funding has been used to create communities of practice and networks of various

kinds, including those that span multiple local government areas, and those that connect governments with communities. These exist at all scales but are particularly prevalent at the local government level. Primarily these groups share a geographic region and seek to collaborate on climate change adaptation activities (including joint advocacy to state and federal governments), or to share knowledge and resources to enable collective action. In the database, most 'coordination' activities are coded against a secondary purpose as well, depending on the purpose of the collaboration (e.g. knowledge building).

Institutional changes are changes to formal social structures to help progress adaptation. This can be wide-ranging and can include changes to laws, the creation of new laws and regulations, new investment, the creation of dedicated adaptation organisations, or establishing new positions within organisations that have responsibility for adaptation. By making these changes an institution is better equipped to support, implement or regulate climate change adaptation activities. These kinds of changes are the output of a body of adaptation work, are often preceded by planning and advocacy, and are a significant change. Despite this, they do not directly increase resilience but promote further adaptation action or increased adaptive capacity.

4.5 Intervention

Tangible activities that directly address climate risks to reduce vulnerability (or increase resilience) are classified as 'interventions'. These encompass many on-ground adaptation projects, often in the form of infrastructure, but also behavioural based changes, regulations that are enforced, nature-based solutions, and other technological interventions. For example, building resilient infrastructure, or implementing coastal protection structures, and new practices such as early warning systems. While these activities may be more easily linked to an outcome of greater resilience to climate change, they are the culmination of many other actions.

4.6 Examples of the typology

Table 1 gives examples of how various climate change adaptation activities might be categorised according to the proposed typology. The examples that are given are drawn from the Australian Adaptation Database.

Table 1: Adaptation purpose from our typology, common outputs and examples drawn from the Australian Adaptation Database (Brullo et al.,2025)

Adaptation Purpose	**Common Outputs**	**Case Study: Extreme Heat**	**Case Study: Riverine Flood**
Governance Instruments	Adaptation plan Adaptation strategy Planning workshops	Adelaide Urban Greening Strategy: a strategy aiming to increase tree canopy coverage and green spaces throughout metropolitan Adelaide. https://australianadaptationdatabase.unimelb.edu.au/adelaide-urban-greening-strategy	City of Playford Storm Water Management Plans: plans for each catchment area accounting for stormwater management under different climate change scenarios. https://australianadaptationdatabase.unimelb.edu.au/city-of-playford-storm-water-management-plans
Research	Academic paper Research project Pilot projects New technology Research and Development Climate impact modelling	City of Adelaide Safe Worker in the Heat Program: a pilot program to analyse local heat and human physiological responses and establish a system for safe outdoor working in the future. https://australianadaptationdatabase.unimelb.edu.au/city-of-adelaide-safe-working-in-the-heat-program	CRATER: Climate Adaptation using Terrain Evaluation Results, a spatial analysis evaluation tool to assist decision makers identify flooding risks around mines. https://australianadaptationdatabase.unimelb.edu.au/crater-climate-adaptation-using-terrain-evaluation-results
Information Gathering	Pilot project Risk assessment Vulnerability Assessment Literature reviews	Adelaide Urban Heat and Tree Mapping Project: multispectral imagery, LiDAR technology and thermal imagery to map tree canopy, green spaces, built environment and urban heat islands across the entire metropolitan Adelaide. https://australianadaptationdatabase.unimelb.edu.au/adelaide-urban-heat-and-canopy-mapping	Tasmania Strategic Flood Mapping Project: High resolution digital terrain modelling using LiDAR to support flood risk assessments, land use planning and evacuation planning for at-risk communities. https://australianadaptationdatabase.unimelb.edu.au/tasmanian-strategic-flood-mapping-project
Knowledge-Building	Explanatory videos Explanatory documents Flyers Newsletters Social media posts Reports	Which Plant Where Website: an interactive database which demonstrates climate resilient plant species suitable to a given location in Australia. https://australianadaptationdatabase.unimelb.edu.au/which-plant-where	Western Australia's Floodplain Mapping Tool: a public resource used to view floodplain maps and flood levels for household land use planning, insurance decision-making and other household uses.

	Guidelines Seminars Presentations		https://australianadaptationdatabase.unimelb.edu.au/floodplain-mapping-tool
Engagement	Community workshops Interviews Focus groups Community forums Locally-led project planning and implementation	Melbourne 'City Engine' Urban Systems Heat Vulnerability Analysis: A pilot project to assess the impact of extreme heat on critical interconnected urban systems, including 2 workshops and one-on-one interviews with key stakeholders. https://australianadaptationdatabase.unimelb.edu.au/city-engine-urban-systems-heat-vulnerability-analysis	Northern Rivers Living Lab: a community engagement and planning space developed by researchers in Lismore, to help facilitate conversations about climate change adaptation following severe flooding in 2022. https://australianadaptationdatabase.unimelb.edu.au/living-lab-northern-rivers
Institutional Change	New laws, regulations or standards Changed laws, regulations or standards New grants or funding New adaptation jobs or roles Changes in investment Created of dedicated adaptation bodies or departments (within an institution)	Australian Capital Territory (ACT) Minimum Energy Efficiency Standards for Rentals: new regulation on minimum standards for ceiling insulation in rental properties commenced in 2023. https://australianadaptationdatabase.unimelb.edu.au/australian-capital-territory-minimum-energy-efficiency-standards-for-rentals	River Murray Flood Resilience Code Amendment (South Australia): updates to planning and design codes to increase resilience to future 1-in-100 year floods following 2022 flooding event. https://australianadaptationdatabase.unimelb.edu.au/river-murray-flood-resilience-code-amendment
Coordination	Cross-jurisdiction networks Regional networks Communities of Practice	Green Adelaide: A government led 'urban environmental organisation', they coordinate regional activities across all 17 Adelaide metropolitan local government areas and other key stakeholders, as well as provide funding and educate local community on urban greening. https://australianadaptationdatabase.unimelb.edu.au/green-adelaide	National Emergency Management Agency: a government body that works to develop, lead and coordinate Australia's emergency preparedness and response, for various hazards. https://australianadaptationdatabase.unimelb.edu.au/national-emergency-management-agency
Intervention	Urban Greening Seawall Early warning app. Change in agricultural practice	$2 Summer Dips Initiative: a program subsidising the cost of public swimming pool entry in Brisbane City Council to help families stay cool during heatwaves.	Katherine Flood Mitigation Project: building levee banks and upgrading drainage to protect residents against 1-in-20 year flooding.

	Retreat or relocation	https://australianadaptationdatabase.unimelb.edu.au/2-summer-dips-initiative	https://australianadaptationdatabase.unimelb.edu.au/katherine-flood-mitigation-project

5. Discussion and Conclusions

Adaptation stocktaking assessments are imperfect exercises, but when done well can help share knowledge about adaptation practices, better understand the scale, scope and nature of adaptation in a sector or jurisdiction, observe patterns, and help assess adaptation progress. Yet for any given sector or jurisdiction such knowledge is hard to come by.

Ford and Berrang-Ford (2016) propose principles to ensure that adaptation stocktakes are done in a manner that makes them consistent, comparable, comprehensive and coherent. Many studies recognise the challenges of differing purposes, scopes, and data sources, trade-offs between the diversity and breadth of data, and the commensurability of data for the purposes of analysis (particularly with respect to the comparability of units of analysis) (Dupuis and Biesbroek, 2013; Elstow et al., 2024; Ford et al., 2013; Ford and Berrang-Ford, 2016; Laurent and Duvat, 2024; Lorenz et al., 2019; Njuguna et al., 2022; Song et al., 2025). These are very useful principles that have guided the development of the Australian Adaptation Database. Key among these is the need for transparency in approach and method, which is a major reason for this paper.

In terms of Ford and Berrang-Ford's criteria (2016), a strength of the Australian Adaptation Database is its comprehensiveness, whereas a weakness, perhaps, concerns the comparability within the database and between it and other stocktakes given the diversity of jurisdictions and actors it includes (Ford and Berrang-Ford, 2016). Offsetting this, the Australian Adaptation Database is strong in institutional fit, because it was developed to satisfy several practical purposes, as suggested by a range of end users (Dupuis and Biesbroek, 2013; Njuguna et al., 2022).

A well-recognised challenge in adaptation stocktakes is deciding what to include and classify as 'adaptation'. Dupuis and Biesbroek (2013) call this the 'dependent variable problem' that arises because the scope and boundaries of adaptation are indistinct. They offer a typology of policies based on criteria of intentionality and substantiality, saying that those that are both low in intention and substance may help reduce vulnerability but are nevertheless contiguous in that they connect with or help affect more substantial and intentional policies. They refer to policies that are high in intention but low in substance as being 'symbolic', and those that are low in intention but high in substance as being 'contributive'. Finally, they identify policies that are substantial and intentional with respect adaptation as being 'concrete'. This classification is very helpful, and we have applied it in the Australian Adaptation Database to classify various of the governance instruments included in the stocktake. However, the database also includes a wide range of activities that contribute to adaptation, but which are not in any sense 'policies', including community engagement activities, communication exercises, strategies, and tangible interventions.

The method we use for eliciting adaptation actions, combined with the progress typology against which we code them, determines our response to the dependent variable problem. In short, because most actions in the database were recommended to us by practitioners, we assume that the experts who recommended them know that they have positive adaptation characteristics sufficient to justify inclusion (Dilling et al., 2019). Indeed, when the research team examined these, it rarely found a clear reason to reject an activity given that almost all were in some way plausibly likely to reduce vulnerability. The result is a set of activities that are, in Dupuis and Biesbroek's (2013) terms 'intentional', and by Bird and colleagues' (2012) classification, of 'high' or 'medium' relevance to adaptation. Nevertheless in a few instances actions were not included, because they were duplicates, or because their relevance was marginal. For example, activities conducted to mitigate greenhouse gas emissions rather than adapt to climate risks.

The Australian Adaptation Database provides an approach to knowing the extent of purposeful adaptation in Australia. It is a concept and method that has been proven. We have classified activities in the database in a way that enables an assessment of progress. This is based on the extent to which the sum of activities in any given sector or jurisdiction moves the adaptation process towards interventions that affect changes in environments or practices that are intended to reduce vulnerability to climate change.

Neither the database nor the progress typology are perfect. The literature is clear that adaptation stocktakes entail trade-offs between the quality, diversity and breadth of data, and in turn the commensurability of data for the purposes of analysis. Our own experience has demonstrated the vast challenges of having numerous individuals consistently categorise data with minimal human error. The database is not applicable for every context, and we do not advocate for its universal application. However, we contend that it works in the Australian context, and that the approach we have taken may be useful for other national or multinational contexts.

Assessing progress towards adaptation is vexing, even at the level of impact evaluations of discrete activities, let alone across a large body of actions. Given this, we regard our method as being an entrée and foundation, albeit one that is logical, consistent with some ideas in the literature, and feasible given the standard of evidence available.

Between them, the database and the progress typology can help answer key questions concerning adaptation. They can help understand the extent to which different sectors and jurisdictions are acting, the nature of their actions, and the extent to which these are symbolic or substantive. They can help explain if risk perception explains adaptation responses, and if theories about the adaptation process explain practices. Ultimately, with enough time and evidence, they can help explain how much of what kinds of adaptation reduce vulnerability to climate change.

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7. Author Contributions

Tia Brullo: conceptualisation, methodology, investigation, visualisation, writing - original draft, writing – review and editing, project administration.
Jon Barnett: conceptualisation, methodology, investigation, resources, supervision, writing – original draft, writing - review and editing funding acquisition,
Elissa Waters: conceptualisation, methodology, investigation, writing – review and editing, funding acquisition.
Sarah Boulter: conceptualisation, methodology, supervision, writing - review and editing, funding acquisition, project administration.

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