1.1 **ARE WE ADAPTING TO CLIMATE CHANGE? RESEARCH AND METHODS FOR EVALUATING PROGRESS**

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ABSTRACT

Adaptation is rapidly becoming a mainstream policy response for addressing biophysical and social vulnerabilities to climate change. Significant capital resources are currently and will continue to be invested in autonomous and anticipatory adaptation processes across a range of geopolitical scales. However, the institutional arrangements for the evaluation of adaptation processes, policies and measures are still in their developmental infancy. Therefore, though adaptation is undoubtedly proceeding, mechanisms for the development of an evidence base for evaluating its success are lacking.

A review of a diverse suite of adaptation decision frameworks and action plans revealed a range of gaps that may impede efforts to evaluate adaptation. Although evaluation and monitoring are often advocated within adaptation decision-making frameworks, methods for undertaking such work are rarely articulated. As a consequence, adaptation action plans often neglect this important component of adaptation policy development. Furthermore, adaptation plans frequently fail to acknowledge the importance of core design principles for adaptation policies and measures such as efficacy, efficiency and equity. The ultimate implication of such evaluation gaps is that communities of adaptation researchers and decision-makers are ill-equipped to track systematically progress and learning on adaptation.

As a step toward addressing these shortcomings, a general guiding framework for the evaluation of adaptation has been developed based upon tools commonly employed in development assistance projects and programs. Output and outcome-oriented evaluation methods are an intuitive and direct approach to assessing progress toward societal goals with respect to vulnerability reduction. However, difficulties in the attribution of outcomes to specific adaptation actions and outputs are likely to confound such approaches. As a supplement, the concept of adaptive capacity can be operationalised through input-oriented evaluation methods. For example, investments of capital, quality control of data and information, and the adoption of principles such as efficacy, equity and efficiency in the selection and implementation of adaptation options can provide a useful evidence base for evaluating the likelihood of adaptation actions contributing to successful outcomes.

Advancing beyond such conceptual frameworks for evaluation to their application in the development of robust evaluation protocols is dependent upon a range of future advances in adaptation research and tool development. These include the construction of databases of adaptation action plans, policies and measures; the development of adaptation metrics (both input and outcome) that can be utilised for evaluation purposes; longitudinal studies of adaptation; and the critical review of existing provisions for evaluation across a range of scales.

1. INTRODUCTION

The rapid development of adaptation as a mainstream strategy for addressing climate vulnerability and capitalising upon opportunities afforded by a changing climate is evidenced by a broad range of adaptation policy development and adaptation planning at different geopolitical scales. For example, at the international level, the UNFCCC has established a Climate Adaptation Fund, currently administered by the World Bank, to fund adaptation programs and projects in developing nations. In addition, the Global Environment Facility has initiated an adaptation pilot program to fund additional climate projects as a foray into the adaptation realm. At national scales, developing nations have completed

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National Adaptation Programs of Action that represent frameworks for prioritising adaptation needs. Developed nations have also commenced national adaptation planning. Australia, for example, has developed a National Climate Change Adaptation Framework and has made significant investments in adaptation science through the National Climate Change Adaptation Research Facility and the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Climate Adaptation Flagship research initiative. Finally, adaptation research and planning is also evidenced at the state/province and local government /municipal scale across a number of both developing and developed nations.

The United Nations has estimated that by 2030, investments of US$130 billion will be needed annually to meet the global demand for adaptation. While it is unclear how much of this represents the costs of meeting the UN's Millennium Development Goals versus the additional burdens placed on nations by climate change, it provides a sense of the scale of the adaptation challenge as well as the magnitude of the investments that may be made in adaptation in the years ahead. If the financing and actual implementation of adaptation is to become a mainstream component of public policy, then formal frameworks for evaluating adaptation processes and outcomes will be increasingly important. More specifically, there are three key reasons why evaluation is important:

1) **Ensuring reduction in societal vulnerability** – One of the key goals of climate adaptation is to reduce the vulnerability of human and natural systems to the effects of climate variability and change (or, in other words, the avoidance of 'dangerous' climate change) (UNFCCC, 1992; O'Neill and Oppenheimer, 2002; Mastrandrea and Schneider, 2004). Ensuring such vulnerability has, in fact, been reduced requires methods for evaluating and tracking adaptation outcomes. In particular, such evaluation must ensure the benefits of adaptation policies and measures outweigh the costs (broadly defined) and that additional negative externalities are not created, such as the spatial and temporal displacement of vulnerability or the generation of outcomes that are otherwise inequitable.

2) **Learning and adaptive management** – Climate adaptation is fundamentally a process of social learning. Yet, in the absence of methods for evaluating adaptation, opportunities for learning are lost. By tracking the successes and failures of different adaptation initiatives, institutions can identify effective, efficient and equitable policies and measures. This enables the development of more robust adaptation policy over time in the spirit of adaptive management (Holling, 1978) and adaptive governance (Brunner et al., 2005). Furthermore, such knowledge can be shared.

3) **Need for accountability in an evidence-based policy environment** – From a governance standpoint, investments in adaptation and the outcomes they achieve should be transparent. This is true for all aspects of the adaptation process, from the development of public communication initiatives, the execution of a regional vulnerability or risk assessment, the reform of a given planning policy, or infrastructure upgrades. For example, the CSIRO's Climate Adaptation Flagship has set a target of a net benefit of AUS$3 billion per year to the Australian economy. Such concrete outcome targets are desirable within a policy context, but it is unclear the extent to which such targets can be measured. Operationalising adaptation actions within a policy environment will benefit from formal definition of criteria for success, metrics for measuring that success and the transparent reporting to stakeholders.

At present, the extent to which adaptation planning is proceeding is a matter of polarised opinion. Some researchers have argued that human beings are inherently adaptive and the history of the species is one characterised by continual adjustment and adaptation to changing conditions and learning about the success and failure of different livelihood and management strategies (Easterling et al., 2004). This is supported by research regarding the response of natural ecosystems and other species to observed changes in climate that suggests a range of species are already attempting to adapt to a changing climate (Parmesan and Yohe, 2003; Root et al., 2003). Meanwhile, the Intergovernmental Panel on Climate Change has

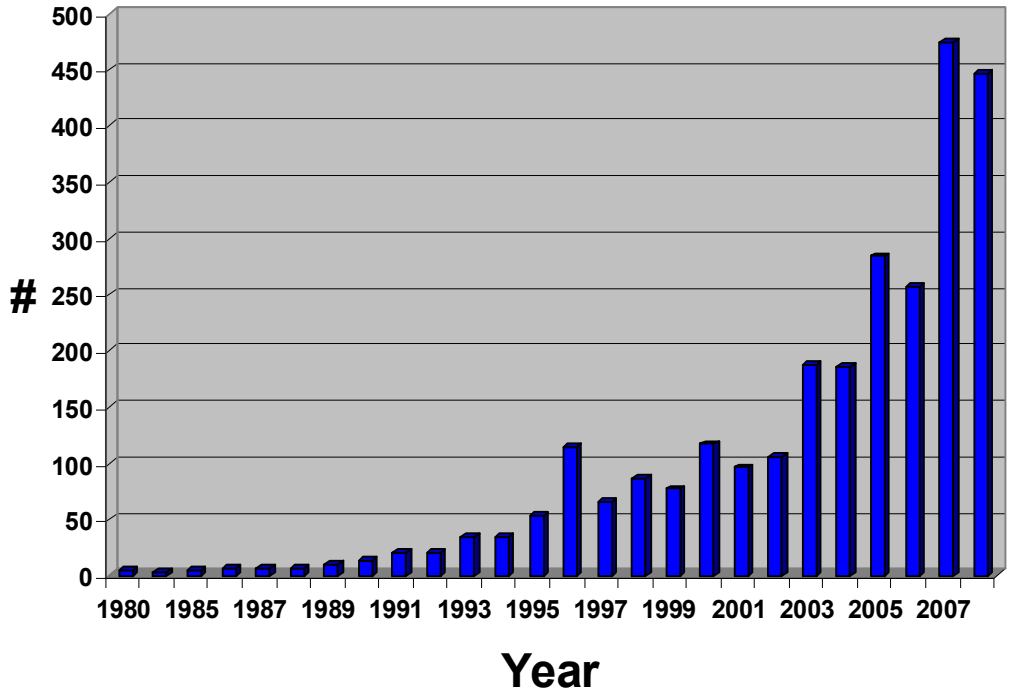


Figure 1. *Key word search of publications within the ISI Web of Knowledge associated with the terms "climate change" and "adaptation" (1980-2008). Search date: 16 December, 2008*

noted that society is adapting to climate change through both reactive and planned decision-making, although it cautions that such behaviour remains limited (Adger et al., 2007):

> *"There are now also examples of adaptation measures being put in place that take into account scenarios of future climate change and associated impacts. This is particularly the case for long-lived infrastructure which may be exposed to climate change impacts over its lifespan or, in cases, where business-as-usual activities would irreversibly constrain future adaptation to the impacts of climate change."*

On the other hand, other researchers have identified significant gaps in adaptation planning, noting a range of examples where adequate planning has not been conducted for known climate risks in the present day, much less years to decades in the future (Repetto, 2008):

> *"Despite a half century of climate change that has significantly affected temperature and precipitation patterns and has already had widespread ecological and hydrological impacts, and despite a near certainty that the United States will experience at least as much climate change in the coming decades, just as a result of the current atmospheric concentrations of greenhouse gases, those organizations in the public and private sectors that are most at risk, that are making long-term investments and commitments, and that have the planning, forecasting and institutional capacity to adapt, have not yet done so."*

Similarly, Easterling et al. (2004), while not as critical of the progress on adaptation to date, cite instances where adaptation actions have not failed entirely, but were not implemented in the most efficient manner possible. As such, they conclude that climate adaptation is likely to progress through a long-term process of 'muddling-through' with occasional winners and losers manifesting on a somewhat ad hoc basis. Hence, there appears to be ample scope to mature adaptation science and applications to address those areas where adaptation has yet to occur and improve upon the 'muddling through' paradigm to secure efficacy, efficiency and equity in adaptation planning and implementation (Kelly and Adger, 2000).

This paper summarises some of the current efforts regarding the incorporation of evaluation standards and methods into adaptation processes, policies and measures. This is followed by the identification of a plausible set of criteria for

evaluating adaptation planning based upon a suite of guidance instruments and an example of how such criteria can be applied to evaluate individual formal planning schemes. The paper concludes with the discussion of several research areas within adaptation science that would be of significant utility in supporting future evaluation efforts.

2. PRIOR WORK ON EVALUATING ADAPTATION

A range of publications and researchers have identified evaluation and monitoring of adaptation as core components of climate risk management and adaptation planning. For example, one of the stages in the UNDP's Adaptation Policy Framework consists of "*implementing, monitoring, evaluating, improving and sustaining the initiatives launched by the adaptation project*" (Lim et al., 2005). Meanwhile, Australia's climate risk management guidance for business and government states that "*all steps of the risk management process must be kept under review*" (AGO, 2006). Emphasis on evaluation and monitoring of adaptation programs and projects also appears frequently in a range of other guidance instruments for adaptation planning (see below).

Despite such efforts, it is clear that a systematic approach to evaluating and monitoring for adaptation has yet to emerge (although a range of models exist), and the capacity to undertake such monitoring and incorporate it into adaptation policy is lacking. It is also important to note that existing efforts are biased toward the developing world. While acute vulnerability to climate variability and change may be more acute within the developing world, formal mechanisms for program and project evaluation are often integral to overseas development assistance and emerging programs for climate adaptation. For example, the guidelines for the preparation of National Adaptation Program's of Action require NAPA's to identify the methods by which evaluation and monitoring will be conducted (UNFCCC, 2002). Similarly, development assistance through the Global Environment Facility and World Bank undergoes routine evaluation. Such scrutiny flows from the development context in which much of international adaptation policy has evolved.

In contrast, there currently appears to be an implicit assumption that the adaptive capacity of the developed world, including the robustness of institutions and governance systems, is sufficiently high that evaluation and monitoring of climate adaptation will emerge autonomously. This assumption is quite tenuous given ample evidence that historic responses to known vulnerabilities to climate variability have been less than effective or efficient (Easterling et al., 2004; Repetto, 2008) and emerging insights into the knowledge gaps that exist across a range of geopolitical scales in regard to adaptation and how to incorporate adaptation actions into public policy (Preston et al., 2008; Smith et al., 2009).

Regardless of whether one focuses on a developed or developing world context, the need for evaluation and monitoring systems for climate adaptation is increasingly recognised. For example, one of the conclusions from the 2008 International Conference on Evaluating Climate Change and Development was,

> *"a continuing effort must take place to exchange experiences and look for emerging best practices and frameworks."*[2]

The following section therefore outlines a broad framework for framing evaluation and monitoring challenges for climate adaptation.

3. FRAMING EVALUATION AND MONITORING FOR ADAPTATION

While climate change has emerged as a core environmental management challenge over the past few decades, from an adaptation perspective, there is little about climate change that is truly novel in regard to planning. For example, risk management of extreme climatic events and disaster mitigation are routine practices. Meanwhile, reducing social and ecological vulnerability, the improvement of institutions and governance networks, economic development, and overall improvements of the capacity of communities and governments to cope with stress are core principles within the development community. Therefore, a range of existing evaluation and monitoring frameworks that are currently in use to address other environmental and/or development challenges can provide a useful foundation for developing frameworks relevant to climate adaptation.

Adaptation planning effectively represents social and decision processes. Practitioners of the policy sciences recognise decision processes as

[2] http://www.esdevaluation.org/

being comprised of three stages: pre-decision, decision, and post-decision (Lasswell, 1956; Clark, 2002). This conceptualisation recognises the fact that there are a range of activities that occur prior to a decision event, which may include learning, communication and deliberation, and the establishment of a process by which the decision will, in fact, be made. Similarly, there are a range of activities that occur post-decision that are often associated with the actual implementation of that decision, resolution of disputes associated with implementation, appraisal of decision outcomes and, ultimately, determination of whether a decision will be upheld or reversed. What this framing of decision processes emphasises is that in the evaluation of a decision or plan of action, the common inclination to focus on outcomes may be problematic. For example, Clark (2002) states,

> *"'Successful' outcomes do not necessarily indicate good processes and may reflect the values of those doing the appraisals more than those of the communities involved in or affected by the programs."*

The focus on procedural aspects of decision-making and the events leading up to decision-making is also found within the literature on evaluation of development programs and projects. For example, one of the classic models for evaluation across a range of policy disciplines is the use of Logic Frameworks. Logical Framework Analysis (LFA) has formed the foundation for evaluation in development for decades as evidenced by the evaluation protocols for the United States Agency for International Development as well as the Australian Agency for International Development (USAID, 1973; Cummings, 1997; AusAid, 2005). Analogous to decision processes in the policy sciences, LFA generally divides evaluation into three components (Figure 2), which are summarised as follows:

- **Inputs** – Inputs represent the materials, resources, assets and liabilities that are present prior to a decision-making event (e.g., the onset of adaptation planning). Inputs may include concrete and quantifiable resources such as financial wealth, people, or access to technology. In addition, inputs include less tangible characteristics such as laws, regulations and norms, social capital, and the broader context and worldview of decision-makers.
- **Processes** – Processes represent the activities associated with the implementation of decision-making or planning in pursuance of an identified objective or outcome. This can include the definition of those objectives, the analytical and deliberative aspects of deciding upon appropriate decisions and policies and the necessary steps associated with implementation (e.g., changes in laws and regulations, design and delivery of infrastructure, or training of personnel).
- **Outputs/Outcomes** – Outputs and outcomes represent the consequences of a decision, program or project, which may emerge over the near-term or long-term. Outputs generally represent the more proximal, tangible, and concrete consequences (e.g., increased service delivery). Meanwhile, outcomes represent the broader, more ultimate implications of a decision or intervention (e.g., improved health and well-being, enhanced security, or learning).

The potential pitfall identified by Clark (2002) with respect to over-emphasis on outcomes has also appeared in critiques of LFA as an approach to evaluation. In the development context, such critiques have ranged from arguments regarding the metrics used in the assessment of outputs and outcomes being too top-down and selected to serve donors as opposed to recipients. In addition, evaluations have been criticised for being too focused on outputs over outcomes and providing insufficient opportunities for community participation in evaluation. Furthermore, there are often significant challenges associated with the attribution of outcomes to specific interventions. Evaluations often target what Herbert Simon (1976) refers to as the substantive rationality of an intervention – does the behaviour (i.e., an intervention) achieve a specified goal. However, the inherent difficulties in making such a determination of attribution (what Laville, 2000 refers to as "cognitive limitations") in a development context suggests that assessing procedural rationality – the appropriateness of methods used to determine an appropriate behaviour or course of action – may be a more robust (or at least a useful alternative) point of evaluation.

Table 1. *Examples of research and initiatives relevant to the evaluation of adaptation.*

Activity	Sponsoring Organisation	Contribution to Evaluation of Adaptation
National Communications	UNFCCC	The guidelines for the preparation of national communications to the UNFCCC require nations to report on their efforts with respect to the development and implementation of adaptation policies and measures.
Adaptation Policy Framework	UK Department of Environment, Food, and Rural Affairs	The UK's Adaptation Policy Framework was developed to improve knowledge regarding the state of climate adaptation efforts in the UK, define adaptation objectives and establish a framework for measuring progress.
Monitoring and Evaluation Framework for Adaptation to Climate Change	United Nations Development Program/Global Environment Facility	The framework represents a demonstration of an approach to monitoring and evaluation of programs and projects under the GEF's Special Climate Change Fund and Least Developed Countries Fund.
National Adaptation Programs of Action	UNFCCC	The NAPAs provide a vehicle to assist least developed nations in the prioritisation of adaptation needs. In so doing, the guidelines for the preparation of NAPAs require nations to report on the mechanisms for the monitoring and evaluation of priority projects.
Expert Consultation on Adaptation Metrics	Institute for Global Environmental Strategies/World Bank	The expert consultation was developed to "*improve adaptation planning in the most vulnerable sectors of developing countries*." This has been facilitated through discussions of the technical and methodological challenges associated with metric development and the research needs to address such challenges.
International Conference on Evaluating Climate Change and Development	Global Environment Facility	This conference provided participants an opportunity to learn from past efforts in evaluation to inform future climate change evaluation activities for mitigation and adaptation as well as outline an agenda for action to advance evaluation practice.
Evaluation of Adaptation to Climate Change from a Development Perspective	Institute for Development Studies/Global Environment Facility	This report was developed as a background document for the International Conference on Evaluating Climate Change and Development and provides "*an overview of approaches relevant to or used for the evaluation of interventions intended to support adaptation to climate change and to identify main gaps in evaluation of adaptation interventions*."
Piloting an Operational Approach to Adaptation	Global Environment Facility	This project represents a pilot program by GEF to participate in funding of adaptation projects in developing nations. A total of 50 projects have been funded. At the completion of the program, a comprehensive evaluation will be conducted to assess successes and failures and inform the development of future GEF adaptation programs.

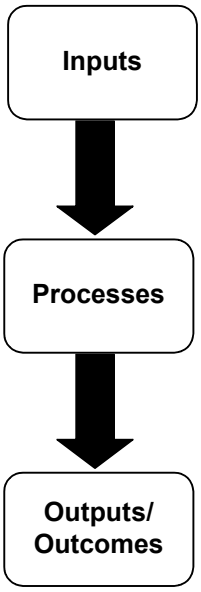


***Figure 2**. Core components of LFA conceptualisation of evaluation.*

The widespread use of LFA as an approach to evaluation suggests its general utility as a potential approach to evaluating climate adaptation. However, in order to operationalise this framework, more specific information is needed regarding the nature of inputs, processes and outputs/outcomes that should be incorporated into adaptation planning. In the absence of agreement regarding a sound suite of criteria that underpin each component of the LFA paradigm, different evaluation approaches will likely select different criteria, reducing confidence in robust evaluations and limiting comparability among evaluations. On the other hand, one must also be wary of over-prescribing evaluation criteria. To be broadly applicable across different geopolitical scales and sectors, criteria for evaluating adaptation must be based upon core concepts that are sufficiently flexible to accommodate diverse applications.

To identify appropriate criteria for adaptation planning for each of the three target components of evaluation, A desktop review of the adaptation guidance instruments was undertaken to establish common "adaptation concepts". A suite of 20 guidance instruments for adaptation planning were interrogated (Figure 3;Table 2). These included adaptation planning guides for developed and developing nations, across a range of geopolitical scales, but was restricted to English-language resources. The majority of these instruments were chosen due to their primary focus on adaptation to climate change. Nearly half of the instruments were produced specifically for local government, while others are targeted either at a single sector or more widely at any organisation that is undertaking adaptation. Guidance instruments were reviewed to identify key concepts associated with adaptation planning that could serve as useful criteria for evaluation. This was an inherently iterative process, such that the list of concepts evolved as the review progressed. The adaptation concepts are thought of as representing shared or recurring practice across the adaptation frameworks that are currently available. It was assumed that they are therefore concepts that should be considered by any individual or organisation involved in adaptation planning. This implies that they represent some sort of overarching framework that can subsequently be used as criteria for evaluating adaptation strategies and plans. However, selected criteria were not necessarily labelled as 'best practice' as there may be additional concepts that would improve the adaptation process but which have not typically been included in the adaptation literature to date. This process led to the development of 19 criteria – 5 pertaining to inputs, 10 pertaining to processes, and 4 pertaining to outputs/outcomes.

As part of this process, the adaptation frameworks themselves were evaluated against the adaptation concepts (Table 2). The task of judging which adaptation frameworks make reference to which adaptation concepts is recognised as highly subjective. In this analysis, the interest lay only in whether or not the framework discusses each concept, and this is recorded as a simple positive ('yes') or negative ('no') response. A positive response means that the framework was judged to include guidance on the concept and/or provide methods and approaches by which that concept can be addressed. A negative response indicates that the concept is not mentioned (or at least is sufficiently marginal or hidden that it is not found during a desktop review).

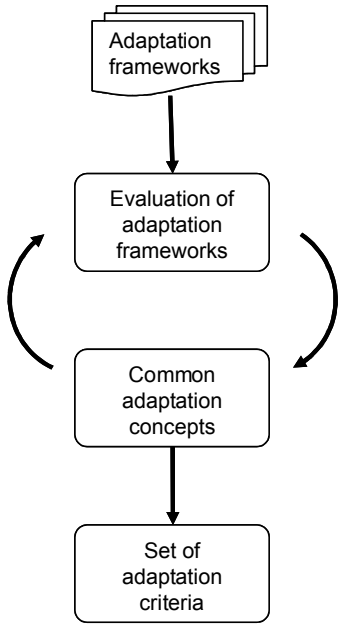


***Figure 3**. The method used to evaluate adaptation frameworks and establish adaptation criteria.*

This approach did attempt to assess the level of detail offered for each concept. This is partly because the aim of the exercise was primarily to establish a list of criteria rather than evaluate the frameworks themselves, and partly because the quantity of information provided is not always a reliable guide to its quality. It also does not distinguish between explicit and implicit mentions of the various adaptation criteria. A positive response is recorded whenever an adaptation concept is discussed, with little consideration of the precise context or language used. This explains why concepts were sought as the basis for adaptation criteria rather than specific approaches, methods or keywords. It should also be noted that 'best practice' emerges over time through iterative development, application, learning and refinement. As such, the selected criteria are recognised to be one proposition and future critical analysis and evolution is anticipated and encouraged.

Despite the diversity of instruments that were considered, there was a high level of similarity across instruments with respect to identified concepts and criteria, with individual instruments capturing an average of 80% of relevant criteria. However, some concepts were absent from a significant proportion of instruments. For example, assessments of natural, physical and financial capital were not included in 10, 7 and 7 of the instruments, respectively. With respect to processes, a number of instruments did not explicitly address issues of identifying criteria for success or stating assumptions and uncertainties inherent in the planning process. With respect to outcomes, the most commonly overlooked concept was the need to articulate the roles and responsibilities associated with the implementation of an adaptation plan.

The fact that different instruments emphasise different concepts and components of adaptation planning highlights the fact that reliance upon a single guide to develop a robust planning approach may be ill-advised. However, the vast majority of the instruments identified the importance of social capital, stakeholder engagement and communication; the importance of vulnerability and risk assessment (including non-climatic drivers); the importance of weighing different management alternatives; and evaluation, monitoring and review. Collectively, these criteria represent a more targeted framework for evaluating specific adaptation plans and strategies.

4. TOWARD CRITICAL EXAMINATION OF ADAPTATION PLANNING

The past decade has been associated with several trends with respect to the incorporation of adaptation into climate policy. First and foremost, attention to adaptation planning, which traditionally has largely been a characteristic of developing nations, has evolved rapidly in the developed world. Second, the number of formal adaptation plans and strategies has grown exponentially as institutions have recognised the important role that adaptation plays in reducing current and future climate risk (Figure 4). A review of publicly released adaptation plans from four countries (United States, Canada, United Kingdom and Australia), led to the identification of at least 62 different adaptation plans, over half of which were released in 2008. This number is likely to at least double by the end of 2009 as plans currently under development are finalised. For example, the Australian Department of Climate Change is currently funding climate risk assessments and adaptation planning in 50 local government areas through its Local Adaptation Pathways program. Additional adaptation plans at the state and municipal level in the Unites States are also scheduled for release in 2009 (Pew Center, 2008). Such programs are also indicative of a third key trend in adaptation policy, which is the proliferation

of adaptation policy at smaller spatial scales, including state/province and municipal policy adaptation planning.

The suite of 62 adaptation plans from four nations represents a useful study group for evaluating the manner in which adaptation is being framed within current planning instruments emerging from developed nations. In addition, interrogation of the various plans with the evaluation criteria provides an opportunity to assess the relative degree of comprehensiveness with which planning is being conducted. To accomplish this evaluation process, a database of adaptation plans is being assembled. Each record of the database provides basic information on each adaptation plan (e.g., year of publication, author/agency responsible for its development, country of origin) as well as a qualitative score for each of the 19 evaluation criteria identified from adaptation planning guidance instruments (Figure 5). Scores are developed based upon a simple qualitative scale (see also Perkins et al., 2007), with comments justifying the score and a reference to where relevant information within the plan can be located. This system allows for a searchable database of adaptation plans that can be readily analysed to infer conclusions regarding the state of adaptation planning. In addition, the system can be updated readily as new adaptation plans emerge.

At the time of writing, this database is still under development with the first iteration scheduled for completion in April, 2009. The first iteration will contain records for all 62 of the adaptation plans identified to date. However, subsequent iterations will be developed as additional plans emerge. At present, it is premature to draw conclusions regarding what adaptation plans suggest regarding the nature and quality of adaptation planning. However, as seen with the adaptation planning guidance instruments (Table 2), it is highly likely that the suite of adaptation plans will be quite heterogeneous with respect to their consideration of individual evaluation criteria. Of particular interest will be the presence of systematic gaps across the majority of adaptation plans that will be indicative of failures to account for aspects of planning that are of critical importance.

5. RESEARCH AGENDA

While the application of proposed evaluation criteria to existing adaptation plans represents one approach to elucidating the state of adaptation science and planning at a range of scales, this represents just one component of a broader research agenda which is needed to progress toward the development of robust adaptation planning and evaluation. Five key areas of research are described further below.

5.1 Development and maintenance of adaptation databases

The systematic evaluation of adaptation efforts necessitates the collection and consistent assessment of adaptation efforts. As such, the development and maintenance of adaptation databases represents an important research tool that can be used not only for analytical purposes, but also communication and capacity building among stakeholders. In addition to the work described here, other adaptation databases have been or are currently being developed. For example, the UK's Climate Impacts Program maintains an internet-based database of adaptation actions in the UK which can be searched based upon region, sector, or type of adaptation (e.g., "building adaptive capacity" or delivering adaptation action").[3] Meanwhile, the Climate Impacts Group at the University of Washington is developing the CASES (Climate Adaptation caSE Studies) database.[4] CASES is a searchable database that provides basic information on state and local adaptation planning efforts anywhere in the world. Users can query the database using a range of criteria including location, population size, climate impacts, and adaptation activities. In addition, users can contribute to database development by submitting new records directly over the internet.

Such databases represent repositories of knowledge regarding adaptation practice. However, consideration also needs to be given to quality control of such databases including indications of which actions and approaches are more or less useful under different contexts. This will ensure such databases are not simply clearinghouses of information, but also tools to facilitate appropriate learning and to track the evolution of adaptation planning. Furthermore it is important to acknowledge adaptation failures and maladaptation as well as successes.

[3] http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=286
[4] http://cses.washington.edu/cig/cases

Table 2. *Evaluation criteria represented within a range of climate change adaptation planning guidance instruments.*

Guidance Instrument	Inputs					Processes										Outputs			
● Criterion present ■ Criterion absent	Assessment of human capital	Assessment of social capital	Assessment of natural capital	Assessment of physical capital	Assessment of financial capital	Stakeholder / community engagement	Objectives, goals and priorities	Identification of success criteria	Identification of climate drivers	Identification of on-climate drivers	Impact, vulnerability and risk assessment	Acknowledgement of assumptions and uncertainties	Options appraisal	Exploitation of synergies	Mainstreaming	Communication and outreach	Definition of roles and responsibilities	Implementation	Monitoring, evaluation and review
IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations	●	●	●	●	●	●	●	●	●	●	●	●	●	■	■	●	■	■	●
Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies	●	●	●	●	●	●	●	■	●	●	●	●	●	●	■	●	■	■	●
Coastal Adaptation To Climate Change: Can the IPCC technical guidelines be applied?	●	●	●	■	■	●	●	●	●	●	●	●	●	●	■	●	■	●	●
Annotated Guidelines for the Preparation of National Adaptation Programmes of Action	●	●	■	■	●	●	●	●	●	●	●	●	●	●	●	■	●	●	●
Climate adaptation: Risk, uncertainty and decision-making	●	●	■	■	●	●	●	●	●	●	●	●	●	●	■	●	■	●	●
Adaptation Policy Frameworks for Climate Change	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Surviving Climate Change in Small Islands – A guidebook	●	●	●	●	●	●	●	■	●	●	●	●	●	●	●	●	●	●	■
Adapting to Climate Change: An introduction for Canadian Municipalities	●	●	●	●	●	●	■	■	●	●	●	■	●	●	●	●	■	■	●
Climate Change Impacts & Risk Management: A guide for business and government	●	●	■	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Adapting to Climate Change: A Queensland Local Government guide	●	●	■	●	■	●	●	■	●	●	●	■	●	●	■	●	●	●	●
Adapting to Climate Variability and Change: A guidance manual for development planning	●	●	■	●	■	●	■	■	●	●	●	●	●	●	●	●	●	●	●
Climate Change Adaptation Actions for Local Government	■	●	■	■	■	●	●	■	●	●	●	■	●	●	●	■	■	●	■
Preparing For Climate Change: A guidebook for local, regional, and state governments	●	●	■	●	●	●	●	●	●	●	●	●	●	●	●	●	■	●	●
Climate Change Adaptation and Mitigation in the Tourism Sector: Frameworks, Tools and Practices	●	●	●	●	●	●	■	●	●	■	●	■	●	■	●	●	●	●	●
Coastal Hazards and Climate Change: A guidance manual for local government in New Zealand	●	●	●	●	■	●	●	●	●	●	●	●	●	■	●	●	■	■	●
Developing an Action Plan	●	●	■	●	●	●	●	●	●	■	●	■	●	●	●	●	●	●	●
Planning in a Changing Climate: The strategy	●	●	■	■	●	●	●	●	●	■	●	■	●	●	●	●	●	●	●
Preparing for climate change: A guide for local government in New Zealand	■	●	●	■	■	●	●	■	●	●	●	●	●	●	●	■	■	●	●
UKCIP Adaptation Wizard	●	●	■	■	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters	●	●	●	●	●	●	■	■	●	●	●	■	●	●	●	●	●	●	■

Table 3. *Description of various evaluation criteria identified in the current study.*

Component	Criterion	Description
INPUTS Take stock of existing adaptive capacity	Assessment of human capital	Consideration of the human population that is exposed to climate risks and/or the skills, knowledge and experience of individuals responsible for adaptation planning and implementation.
	Assessment of social capital	Consideration of the institutional and policy arrangements exposed to climate risks and/or the robustness of governance networks informed by trust, collaboration and prior adaptation experiences and the associated capacity of and entitlements to adapt.
	Assessment of natural capital	Consideration of natural resource stocks and environmental services which are sensitive to climate and/or integral in the management of climate risks.
	Assessment of physical capital	Consideration of material culture, assets and infrastructure that is sensitive to climate and/or integral in the management of climate risks.
	Assessment of financial capital	Consideration of stocks and flows of financial resources and obligations within and among individuals and institutions including cash revenue, credit and debt and mechanisms for financial risk management.
PROCESSES Establish objectives, assess risks, and identify adaptation options	Articulation of objectives, goals and priorities	Establishing the objectives, goals and priorities for adaptation.
	Identification of success criteria	Consideration of what successful adaptation will look like and how it will be measured.
	Identification of climate drivers	Consideration of historical climate trends, current climate variability and future climate projections.
	Identification of non-climate drivers	Consideration of variability and trends in other environmental and socioeconomic factors.
	Stakeholder engagement	Engagement of relevant stakeholders and communities throughout the adaptation process.
	Impact, vulnerability and risk assessment	Assessment of the impact of changes in climate, vulnerability or resilience to those changes and the relative importance of climate and non-climate risks.
	Acknowledgement of assumptions and uncertainties	Transparency about the assumptions made to establish those impacts and risks and the uncertainties involved in their estimation.
	Options appraisal	Identification and comparison of different adaptation options and a means for selecting between them.
	Exploitation of synergies	Identification of where opportunities exist to implement adaptation in a manner that promotes synergies with existing policies or plans, including mitigation.
	Mainstreaming	Identification of ways in which climate change adaptation can be institutionalised or embedded into existing or new policies and plans.
OUTPUTS Implement, communicate and evaluate	Communication and outreach	Communication and dissemination of adaptation outputs and outcomes to the appropriate stakeholders and communities.
	Definition of roles and responsibilities	Establishing who is responsible for different aspects of an adaptation strategy.
	Implementation	Establishing the mechanisms that will allow implementation of adaptation measures.
	Monitoring, evaluation and review	Establishing a system of monitoring and evaluation that allows the performance of adaptation to be assessed against success criteria and for review of inputs and procedures.

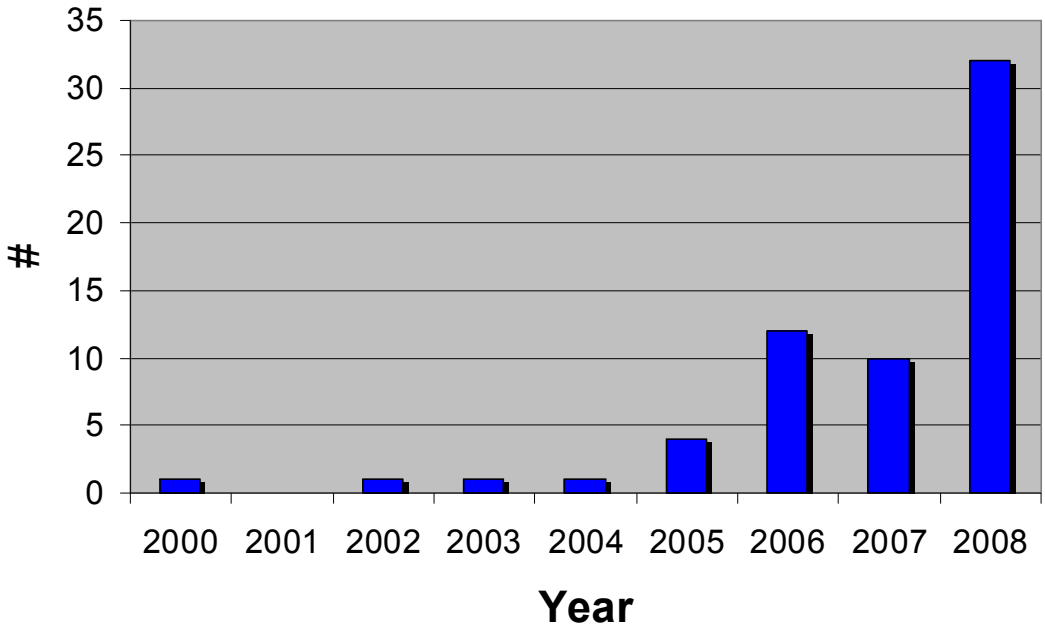
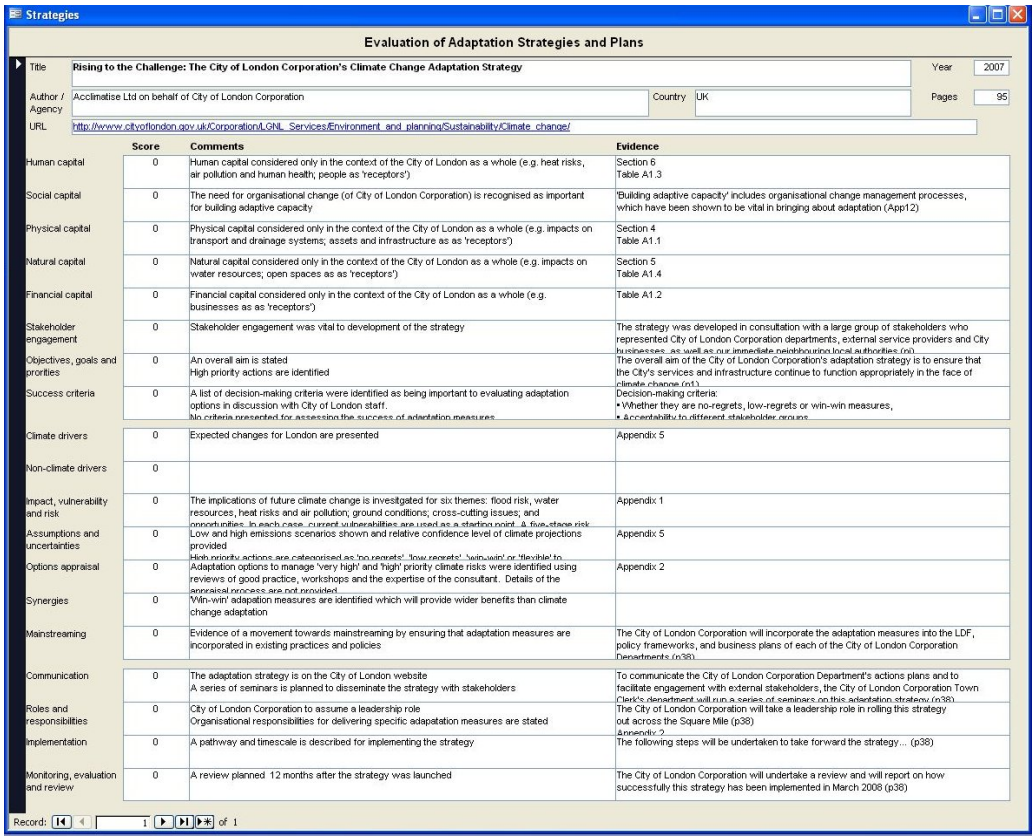


***Figure 4**. Annual number of identified adaptation plans published in the United States, Canada, United Kingdom, and Australia (200-2008). n=62.*


Strategies

Evaluation of Adaptation Strategies and Plans

Title	Rising to the Challenge: The City of London Corporation's Climate Change Adaptation Strategy	Year	2007
Author / Agency	Acclimatise Ltd on behalf of City of London Corporation	Country: UK	Pages: 95
URL	http://www.cityoflondon.gov.uk/Corporation/LGNL_Services/Environment_and_planning/Sustainability/Climate_change/		

	Score	Comments	Evidence
Human capital	0	Human capital considered only in the context of the City of London as a whole (e.g. heat risks, air pollution and human health; people as 'receptors')	Section 6 Table A1.3
Social capital	0	The need for organisational change (of City of London Corporation) is recognised as important for building adaptive capacity	'Building adaptive capacity' includes organisational change management processes, which have been shown to be vital in bringing about adaptation (App12)
Physical capital	0	Physical capital considered only in the context of the City of London as a whole (e.g. impacts on transport and drainage systems; assets and infrastructure as as 'receptors')	Section 4 Table A1.1
Natural capital	0	Natural capital considered only in the context of the City of London as a whole (e.g. impacts on water resources; open spaces as as 'receptors')	Section 5 Table A1.4
Financial capital	0	Financial capital considered only in the context of the City of London as a whole (e.g. businesses as as 'receptors')	Table A1.2
Stakeholder engagement	0	Stakeholder engagement was vital to development of the strategy	The strategy was developed in consultation with a large group of stakeholders who represented City of London Corporation departments, external service providers and City businesses, as well as our immediate neighbouring local authorities (p6)
Objectives, goals and priorities	0	An overall aim is stated High priority actions are identified	The overall aim of the City of London Corporation's adaptation strategy is to ensure that the City's services and infrastructure continue to function appropriately in the face of climate change (p1)
Success criteria	0	A list of decision-making criteria were identified as being important to evaluating adaptation options in discussion with City of London staff. No criteria presented for assessing the success of adaptation measures	Decision-making criteria: • Whether they are no-regrets, low-regrets or win-win measures, • Acceptability to different stakeholder groups
Climate drivers	0	Expected changes for London are presented	Appendix 5
Non-climate drivers	0		
Impact, vulnerability and risk	0	The implications of future climate change is investigated for six themes: flood risk, water resources, heat risks and air pollution; ground conditions; cross-cutting issues; and opportunities. In each case, current vulnerabilities are used as a starting point. A five-stage risk	Appendix 1
Assumptions and uncertainties	0	Low and high emissions scenarios shown and relative confidence level of climate projections provided High priority actions are categorised as 'no regrets', 'low regrets', 'win-win' or 'flexible' to	Appendix 5
Options appraisal	0	Adaptation options to manage 'very high' and 'high' priority climate risks were identified using reviews of good practice, workshops and the expertise of the consultant. Details of the appraisal process are not provided.	Appendix 2
Synergies	0	'Win-win' adaptation measures are identified which will provide wider benefits than climate change adaptation	
Mainstreaming	0	Evidence of a movement towards mainstreaming by ensuring that adaptation measures are incorporated in existing practices and policies	The City of London Corporation will incorporate the adaptation measures into the LDF, policy frameworks, and business plans of each of the City of London Corporation Departments (p38)
Communication	0	The adaptation strategy is on the City of London website A series of seminars is planned to disseminate the strategy with stakeholders	To communicate the City of London Corporation Department's actions plans and to facilitate engagement with external stakeholders, the City of London Corporation Town Clerk's department will run a series of seminars on this adaptation strategy (p38)
Roles and responsibilities	0	City of London Corporation to assume a leadership role Organisational responsibilities for delivering specific adaptation measures are stated	The City of London Corporation will take a leadership role in rolling this strategy out across the Square Mile (p38) Appendix 2
Implementation	0	A pathway and timescale is described for implementing the strategy	The following steps will be undertaken to take forward the strategy... (p38)
Monitoring, evaluation and review	0	A review planned 12 months after the strategy was launched	The City of London Corporation will undertake a review and will report on how successfully this strategy has been implemented in March 2008 (p38)

Record: 1 of 1

***Figure 5**. Sample draft database entry for the City of London climate change adaptation strategy (Mayor of London, 2008).*

5.2 Development of adaptation metrics

A major component of adaptation planning and evaluation is the development of suitable metrics for tracking successes and failures. Consistent with LFA and other evaluation tools, explicit metrics are needed by which the effectiveness, efficiency and equity of adaptation actions can be judged. Furthermore, metrics are needed for all three types of evaluation criteria: inputs, processes, and outputs/outcomes.

The UNDP's *Draft Monitoring and Evaluation Framework for Adaptation to Climate Change*, presents a range of specific metrics that could be utilised in adaptation planning and evaluation. However, the report itself remains in draft form, and it approaches evaluation from a strict developing world perspective. A broader discussion of adaptation metrics has commenced through the Expert Consultation on Adaptation Metrics sponsored by the Institute for Global Environmental Strategies. Reports from various consultations have highlighted the importance of developing such metrics, but also reflect the numerous challenges. For example, the fact that adaptation actions will emerge across a range of contexts including both developing and developed nations, different geopolitical scales, different sectors, and different communities with heterogeneous values and preferences makes comprehensive and robust metrics somewhat elusive. Hence, it may be more profitable for researchers to focus on the development of rigorous processes for selecting metrics that can be applied in a range of contexts rather than attempting to prescribe specific metrics.

5.3 Critical review of existing provisions for evaluation and monitoring

Given the organic manner in which adaptation planning and the implementation of adaptation actions evolves, developing a robust understanding of the provisions that are being made for evaluation and monitoring of adaptation is quite challenging. Many adaptation actions may not be labelled as such, and much of the adaptation response at any given geopolitical scale is likely to be reactive rather than strategic or anticipatory. For example, Roberts et al. (2008) estimate the investment in global adaptation efforts between 2000 and 2006 at $600 million, much of which is comprised of traditional disaster mitigation. However, this reflects adaptation funds associated with development assistance and therefore neglects entirely efforts by developed nations. There is no comprehensive estimate of what is undoubtedly significant investment in climate science, vulnerability assessment and adaptation planning that is occurring in the developed world, nor is there an estimate of what the benefits of those actions may be with respect to avoided damages and social learning. Undoubtedly, a number of the 62 adaptation plans mentioned previously fail to acknowledge the importance of evaluation and monitoring to adaptation planning or articulate a methodology for how such evaluation and monitoring could be conducted. Therefore, it is important that researchers and decision-makers critically examine ongoing adaptation planning efforts to assess the extent to which evaluation and monitoring is currently incorporated and identify approaches for bolstering this component of policy development.

5.4 Longitudinal studies of adaptation

One potentially profitable means of evaluating adaptation is to examine the process from 'start-to-finish.' However, given it is arguable whether adaptation is every finished, in practical terms pursuing this concept is more a function of monitoring the social processes and learning associated with adaptation over an extended period of time. Such longitudinal studies can be pursued for very specific actions such as a discrete risk or vulnerability assessment, reform of a particular policy or planning provision, or the design and construction of a given infrastructure unit. Alternatively, it may be appropriate to track adaptation more generally such as monitoring learning within an institution or community and/or identifying shifts in policy, attitudes or values. In either pursuit, some over-arching issues would be the availability of various forms of capital (social, financial, natural, physical) and how capacity gaps are addressed; how scientific and technical information is acquired and utilised, and to what extent were the goals achieved and what information or evidence was utilised to make that determination. Similar types of studies could also be done retrospectively by examining how humans and/or other species have adapted (or failed to adapt) to past climate challenges.

5.5 Institutions for evaluation

Routinising the evaluation of adaptation is dependent upon the development of formal

processes and, in some instances, institutions for ensuring evaluation and monitoring. For example, both GEF and the World Bank contain evaluation divisions for the purposes of conducting program and project evaluations and developing evaluation practice. The formation of such institutions that can house expertise in evaluation and provide independent oversight of evaluation efforts can be of significant benefit to practitioners and organisations undertaking adaptation. In particular, the developing of consulting services focused on adaptation evaluation could assist in quality control of adaptation efforts and in the facilitation of best practice.

6. CONCLUSIONS

Adaptation science is a burgeoning discipline within the community of climate change researchers, yet one which is inherently linked to practice, policy development and implementation. As adaptation policy evolves across a range of geopolitical scales, adaptation science has a role to play in placing such policy on a robust foundation. As policy evaluation, monitoring and reporting is a core component of public policy, methodological approaches and institutional arrangements for evaluation need to be implemented.

This paper represents a quite modest effort to gain insights into the state of formal, anticipatory adaptation planning within a developed country context. A significant and robust body of literature has emerged over the past decade that represents a knowledge pool that can inform best practice for adaptation planning. Efforts are underway to utilise this knowledge to systematically evaluate formal, anticipatory adaptation planning and assemble an international database of planning instruments. It is anticipated that this effort will assist in identifying the strengths and weaknesses of current adaptation planning, which subsequently can be used to improve social learning on adaptation 'best practice'. Yet ensuring a robust future for adaptation planning necessitates concerted effort by adaptation researchers and practitioners along a number of pathways.

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