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Mainstreaming climate change adaptation: An incremental approach to disaster risk management in Australia

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ARTICLE INFO

Article history:
Received 4 January 2013
Received in revised form
7 May 2013
Accepted 14 May 2013
Published on line 3 July 2013

Keywords:
Climate change adaptation
Disaster risk management
Resilience
Rational policy making
Brisbane floods

ABSTRACT

In this paper we argue that rationalist 'predict then act' approaches to disaster risk management (DRM) policy promote unrealistic public expectations of DRM provisions, the avoidance of decision making by political elites, an over-reliance on technical expertise and engineering solutions to reducing exposure to natural events, and a reactive approach to DRM overall. We propose an alternative incrementalist approach that focuses on managing uncertainties rather than reducing them and building resilience not simply through the reduction of hazard exposure, but also through the ongoing reduction of community vulnerability, the explicit consideration of normative priorities, and more effective community engagement in climate risk debates.

1. Introduction

Disaster risk management (DRM) poses complex challenges for communities around the world (IPCC, 2012; Mechler, 2004: 1). DRM requires governments to build community resilience against extreme events under conditions of high uncertainty, which include both known and unknown unknowns in our understanding of the frequency, location, scale, and timing of those events. Hurricane Katrina's impact on New Orleans in 2005 (Burby, 2006; Schneider, 2005), for example, demonstrated not only the limits of preventative infrastructure planning and the disaster response capabilities of even well resourced governments, but in particular the difficulties of managing the many uncertainties surrounding the timing and nature of extreme weather events. Indeed, uncertainty increases significantly under climate change, particularly in terms of regional and local impacts on natural events such as flooding, drought and bushfires (IPCC, 2007, 2012). Increasing recognition among DRM and climate researchers of both the scale and irreducibility of many of these uncertainties over recent years has led to a stronger focus on adaptation approaches to manage the

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1462-9011/$ – see front matter
http://dx.doi.org/10.1016/j.envsci.2013.05.009

anticipated, but still largely unknown, future impacts of climate change (Porfiriev, 2009; Wilby and Dessai, 2010; Barnett, 2010; Beck, 2011).

In line with the 2005 'Hyogo Framework for Action's focus on increasing resilience to natural disasters' (UN, 2005) we propose that DRM can more effectively cope with the uncertainties and challenges posed by climate change if its practices and planning also become more focused on adaptive, resilience-building strategies and priorities. In Australia, governments have adopted the 'National Strategy for Disaster Resilience' (NSDR) with the explicit aim of building a ''whole-of-nation resilience-based approach'' to DRM (COAG, 2011: ii). DRM policy in Australia, and elsewhere (e.g., the US), however, still gives relatively little attention to adaptation based approaches.[1] This neglect of adaptation informed DRM strategies, we argue, stems from the continued reliance by governments on a linear, 'predict then act' DRM policy model (Beck, 2011) which requires knowledge that is often unavailable while also promoting unrealistic public expectations for the prevention or containment of natural events like flooding and bushfires by authorities.

In this paper we further argue that existing policy approaches to DRM, in particular the *prevent*, *prepare*, *respond*, *recover* (PPRR) model first conceived in the US and subsequently adopted by the Australian federal government in 1989 (Crondstedt, 2002; Emergency Management Australia, 2004), can be significantly improved by prioritising resilience building strategies that allow for localised 'bottom up' measures to be implemented within a more flexible national framework. Reconceptualising DRM in this way not only gives opportunity to more robust, low regrets policy making (Wilby and Dessai, 2010), and increased community resilience over time (Productivity Commission, 2012), but also effectively 'mainstreams' climate change adaptation by legitimising community resilience and vulnerability DRM measures on the basis of currently known risks and threats that, unlike climate change and its future impacts, are not politically contested. Doing so we contend generates broader political support for adaptation initiatives by linking their rationale to known, local conditions rather than future, unknown consequences (Productivity Commission, 2012: 10-11). Aiming for achievable short to medium term risk management outcomes based on ongoing, incremental adaptation is we believe more helpful in building resilience over time than the pursuit of often politically unachievable, and potentially mistaken, optimal policy outcomes that require large changes and high levels of investment.

Using institutional and social learning concepts, existing critiques of rationalist policy models, and evidence drawn from a recent research project involving interviews and workshops with DRM personnel across Australia (See Howes et al., 2013), we propose that existing PPRR policy approaches to DRM be reconfigured to allow adaptation to become the overarching conceptual framework within which DRM strategies are developed and pursued. Our argument proceeds in three stages. We first explain why the linear, 'predict then act' model of policy making informing the PPRR model is ill suited to *building* community resilience to natural events over time. Secondly, we draw on evidence from flooding in South East Queensland over the last four decades, and interviews with DRM personnel to illustrate several important problems and limitations associated with applying linear, 'good science equals good policy' approaches – as reflected by the PPRR concept – that are relevant to DRM's application across a range of issue areas.

Thirdly, we argue that an adaptation-based approach is more appropriate for the political constraints and institutional structures that liberal democratic governments operate within, and as a result will more effectively reduce both the exposure and vulnerability of communities to natural events, and build effective community resilience in the face of irreducible uncertainties.

2. Policy and decision making under uncertainty: a story of great expectations?

Government policy and decision making in Australia, as well as in many other liberal democracies, follows a linear, 'rationalist' model (NEMC, 2010; Head, 2008; Marston and Watts, 2003; Sanderson, 2002). As in other policy areas, a rationalist, knowledge-based policy approach to DRM assumes that policy objectives are clearly and unambiguously defined, that risks can be adequately understood and events reliably predicted, and that government responses can be objectively evaluated using accurate assessments of costs and benefits. However, in practice, policy objectives are often ambiguous due to competing demands on resources and conflicting or incomplete knowledge of hazards, risks, and the costs and benefits of policy intervention.

DRM guidelines and operational procedures developed under linear policy models, such as PPRR,[2] rely on precise technical data and high confidence assessments that are expected to 'rationalise', and therefore legitimise, policy choices and decision making. In contrast to the controlled environments and testing that characterise the practice of normal science, the sheer scale and complexity of climate and weather related events mean that falsification (or verification) of predicted impacts – such as rainfall or flood level predictions – is limited to waiting to see whether or not they actually materialise within a given period of time. But even the occurrence of a predicted outcome may not resolve uncertainties over the methods and arguments used to predict it while alternative causal explanations remain possible. Thus, the information needed to effectively ''prevent'' and ''prepare'' in the ways expected by communities is often lacking or cannot be provided with the degree of certainty or timeliness expected by policy makers, making optimal policy responses extremely difficult to design and even more difficult to realise.

Despite these limitations, the rational policy model – characterised by its linear, problem solving process and

[1] See, for example, Australia's National Emergency Risk Assessment Guidelines (NEMC, 2010), which are explicitly built on expectations for uncertainty reduction and technical solutions to DRM.

[2] As Crondstedt (2002: 12) argues, PPRR creates artificial barriers between its four elements under the assumption that clear delineations exist between them, and that they will be implemented sequentially. PPRR thus reflects rationalist policy assumptions concerning both the ability to clearly define and separate policy goals and priorities, and the knowledge required to do so.

positivist epistemology – still dominates perceptions of how policy making is and should be made despite strong criticism of its straightforward and commonsensical depiction of the policy process (Lindblom, 1959, 1979; Jasanoff, 1990; Pielke Jr., 2007; Stone, 2002). The continued mainstream embrace of this model is illustrated not only by the contemporary appeal of 'evidence-based' policy making in government, and the ongoing imperative that policy must appear 'rational' in order to be legitimate, but also by the way in which policy makers continue to explain policy failure and bad decision making as the product of poor information or inadequate resources (Burton, 2006; Hulme, 2009, Heazle, 2010). Alternatively, policy makers often point to imperfect knowledge and uncertainty as justification for policy inaction, as is currently the case with climate change. Meanwhile, the values and ideas actually driving policy choices under uncertainty and the debates that surround them remain hidden by both the public's disdain for policy that cannot be rationally justified on the basis of what we know and the recognition of this fact by politicians whose main task is to ensure their decisions always appear to be 'rational' rather than 'political'.

Rationalist assumptions about the nature of problems (discrete, objective), policy actors (rational, self-interested, unitary) and the knowledge they use (available, obtainable, verifiable) are shared by a broad range of policy and decision making theories because they allow for the creation of a simple heuristic for describing, explaining, and judging policy behaviour or choices at either the domestic or international level. More importantly though, rationalist approaches are also informed by a fundamental normative assumption that identifies politics as a form of contagion afflicting the policy process. Politics, according to the rationalists, needs to be minimised so that it does not 'vulgarise decision making' (Nieman and Stambough, 1998: 450.).

However, there is nothing 'rational' about denying the quite obvious competition that occurs between differing values and interests when big decisions need to be made, particularly for no better reason than the desire to craft uncomplicated, 'user friendly' explanations of how policy and decision making works. Indeed, ignoring the existence and influence of competing values and interests – that is, politics – is to deny what sets democratic societies, in particular *liberal* democracies, apart from other forms of government and social organisation (Crick, 2000).

Moreover, rationalist perceptions and expectations of policy also allow decision makers at the elite level to selectively dodge responsibility for the policies they adopt and the outcomes produced. If a policy is broadly seen as a success, responsibility for its formulation and implementation is unequivocally accepted, indeed enthusiastically embraced, by policy elites. But when things go wrong, responsibility becomes far more diffused and usually is distanced from the executive; the sources of policy failure are instead most often attributed to organisational and structural shortcomings.[3]

[3] Heazle (2010), for example, demonstrates how rationalist policy expectations allowed US, UK, and Australian executives to deflect responsibility for the decision to invade Iraq by arguing that the intelligence they received was flawed.

3. The 2011 Brisbane flood: great expectations betrayed

In December 2010 and January 2011, an unusually strong La Nina event and prolonged intense monsoonal rainfall caused extreme flooding in the Brisbane River catchment. Lockyer Valley, and surrounding areas of Southeast Queensland, Australia. The flooding resulted in the deaths of 35 people and an estimated (Aus) 5 billion dollars worth of damage (Queensland Police, 2011; QFCI, 2011: 20). The La Nina event in question and its associated rainfall were forecast by the Australian Bureau of Meteorology, which briefed the Queensland Government of the *potential* for heavy rainfall in advance of the floods. The Brisbane area has a long history of extreme flooding, and the 2011 floods were preceded by a prolonged drought in the State of Queensland between 2001 and 2009. In the aftermath of the floods, the Queensland Government established an independent Commission of Inquiry into State and Local Governments' DRM provisions. This examined the procedures followed by local dam managers in great detail while avoiding, in its final report, questions relating to the broader policy context the managers and other DRM actors were required to operate in. Indeed, the nature of the inquiry, and in particular its focus on why flooding was not more effectively mitigated, contains lessons with relevance beyond the Brisbane floods on not only the extent to which rationalist, 'predict then act' type policy expectations influence perceptions of DRM and what it *should* do, but also how such expectations can lead to unrealistic demands on both managerial-level decision makers and the infrastructure they operate (QFCI, 2011, 2012).

3.1. *Policy and decision-making ambiguity*

> The drought brought home the value of water; the flood showed its capacity for destruction. These events demonstrated that Wivenhoe Dam is at once the most valuable and dangerous piece of public infrastructure in Queensland. (QFCI, 2011: 52)

Both flood mitigation *and* water supply in the Brisbane area are managed via two major dams on the Brisbane River, the Wivenhoe and Somerset dams, which, therefore, are required by policy makers to fulfil dual and often conflicting roles in the face of different weather events. Flood mitigation capacity is restricted to facilitate water storage for supply, or vice versa, which effectively reduces dam management to a zero-sum game between water security and flood mitigation. In the event of anticipated flooding, pre-emptive reductions in water levels below the dams' 'full supply level' – to allow space for storing flood waters and thus mitigate extreme flooding – increases vulnerability to water shortages during drought by reducing supply. Decisions made about the appropriate use of the dams during extreme events necessarily involve, therefore, political decisions about which hazard presents a greater threat, particularly in the absence of the data needed to reliably forecast the risk of flooding versus drought. Yet, the Commission revealed how the Wivenhoe dam was operated in a way that avoided recognition of these conflicting priorities,

with policy makers instead relying on expert advice to drive decisions on when the dam should play one role or the other. What resulted was a loss of flood mitigation capacity in advance of the floods, unrealistic expectations by the public about the capacity of the dams to reduce exposure to flooding extremes, and an investigation by Queensland's Crime and Misconduct Commission into how Wivenhoe dam's flood engineers managed the dam prior to and during the flooding.

The Commission of Inquiry gave considerable attention to the operation of Wivenhoe dam and its investigation revealed that there was no explicit government policy position in relation to Wivenhoe's conflicting priorities, nor any decision made by the government regarding dam use in advance of the expected floods. In fact, the Commission's investigations reveal an apparent avoidance of decision making by political elites over the question of whether dam water levels needed to be reduced in advance of the floods (QFCI, 2011: 46).[4] This, we suggest, was the result of uncertainties relating to the dam's flood mitigation capacity and expected rainfall, conflicting advice on the benefits of a pre-emptive release of water, and fears of the region returning to another extended period of drought. Faced with these considerable uncertainties, the Queensland Minister for Energy and Water Utilities Stephen Robertson deferred the decision on a pre-emptive release of water to the South East Queensland Water Grid Board, which told the Minister in December, 2010 that while it did not object in principle to a five percent reduction of the dam's water supply, the view of the board and the Water Grid Manager (WGM) was that such a small release would not be effective, and was not recommended given the potential water security impacts the reduction may have (QFCI, 2011: 47). Mr Robertson stated that at the time he did not believe a 5 percent reduction would be effective, and 'parked' the reduction proposal without seeking further advice from either the WGM or other agencies (QFCI, 2011: 45–47).

The decision making process concerning the proposal to reduce Wivenhoe's full supply level remains unclear, and the QFCI Interim Report (2011) notes the confusion over responsibility for the dam's FSL and the Minister's failure to intervene. However, also contributing to the ambiguity over to whom the responsibility for a decision fell was a normative prioritisation by the actors involved of the water security impacts of a release over the potential flood mitigation benefits even though '*the nature of the prospective 'benefits' seems to have been the subject of limited exploration*' (QFCI, 2011: 47). In the aftermath, a further set of modelling based on the characteristics of the floods in question justified a reduction in dam water levels of 25% in order to reduce the risk of any further flooding, even though approximately half of the flood waters affecting Brisbane had entered the Brisbane River downstream from the two dams (QFCI, 2011: 48; QFCI, 2012: 524).

[4] The Commission's Interim Report states: 'On the basis of the information received... Mr. Robertson [also Minister for Environment and Resource Management, Queensland] said, he made the decision not to proceed with the proposal for a temporary reduction of the full supply levels. The process was 'parked'. There is no record of the Minister's having made this decision or telling anyone about it – then or at any time... His Director-General, ...could not confirm that the Minister made this decision on that day, or at all.

Thus, different sets of expert knowledge were used to justify conflicting uses of the dam before and after the flooding events. The apparent failure of the government to address the decision about a pre-emptive release of water was followed by further ambiguity over decision making responsibility in the aftermath of the floods. Both the Minister's department and the technical operators responsible for dam operations denied holding ultimate responsibility for flood mitigation policy decisions relating to the dam (QFCI, 2011: 46–50). The Commission concluded its investigation by stating:

> It appears that no Queensland Government agency has wide ranging responsibility for flood mitigation... The fact that no single agency has overarching responsibility is likely to lead to inconsistency and gaps in policy. (QFCI, 2012: 604)

3.2. *Unrealistic expectations of technical expertise*

During the Brisbane floods, the technical operation of the Wivenhoe dam was dictated by the terms of an operational manual devised on the rationalist assumption that the relevant decision making data needed to operate the dam would be available. But when confronted with unresolvable uncertainty over current and future weather events in the lead up to the 2011 floods, dam managers were unable to apply the type of decision making advocated by the manual to the circumstances they faced. As a result, the dam operators breached the terms of the manual while attempting to optimise water releases from the dam, and as a result have been subject to investigation for suspected negligence.

> The Commission has found non-compliance with the manual under which the dam was to be operated. What should not be overlooked is that the manual itself was ambiguous, unclear and difficult to use. (QFCI, 2012: 1)

The Wivenhoe manual relies on a series of strategies for incremental water release, initiated on the basis of actual or expected water levels in the dam. Modelling and meteorological data are permitted by the manual to establish the likelihood of exceeding specified levels behind the dam or a maximum flow limit at a specific point downstream, but are not used within the terms of the manual to consider the impact of downstream flooding more generally. Nor does the manual allow dam operators discretion about when to release water based on the broader characteristics and potential impacts of any particular flood.

Moreover, while the Commission concluded that the dam operators were in breach of the terms of the operational manual for Wivenhoe dam, the Commission's expert hydrologist testified that the operators had made the most optimal decisions available to them given the information they possessed at the time (QFCI, 2012: 524).

The tendency for decision makers to depend almost exclusively on expert knowledge to legitimise their decisions to act or do nothing under uncertainty results in unrealistic expectations on technical expertise, which leads experts and managers to be held exclusively accountable if the decisions they make prove to be incorrect. In the case of the Brisbane floods, engineers and expert government employees were

given decision making responsibilities before and during the floods under the assumption that they could make correct, evidence-based, decisions. Yet the uncertainties in their knowledge, and the restrictions imposed on them for the purposes of accountability meant that they could not make the kinds of optimal decisions expected by policy elites and the public.

3.3. *Over-reliance on engineering based solutions*

Another outcome of rational policy approaches is over-confidence in engineering based solutions to DRM. In addition to placing unrealistic demands on technical expertise, rationalist models also encourage unrealistic expectations among governments and the public that infrastructure such as dams and levees can eliminate or substantially reduce exposure to extreme events. One Queensland government official suggested such expectations are encouraged by the democratic political process:

> From a political perspective, we drive these expectations through the ceiling all the time… the state [government] says, don't worry, we'll look after you. The [local government] council says, our job is to take care of our people, so we will look after you. (Queensland Government Official 4, 2012)

Indeed, the disaster mitigation capacity of Wivenhoe Dam in the event of extreme flooding is far more limited than is commonly understood. This is as a consequence of the parallel priority given to water supply and the fact that a large proportion of flooding in the Brisbane River catchment – approximately 50% during the floods of 2011 (QFCI, 2012: 524) – can occur from rainfall entering the Brisbane River downstream of the Wivenhoe and Somerset dams. Key public service personnel interviewed for this study believed that there is a fundamental mismatch between public understanding of disaster risk and DRM provision, and the true nature of that risk and the actual effectiveness of DRM as currently practised (Queensland Government Officials 1,2,4, 2012; Victorian Government Officials 5, 6, 2012).

The problem of unrealistic public expectations being actively encouraged by governments is further illustrated by the widespread misinterpretation of local government planning schemes using Annual Exceedance Probabilities (AEP) of flooding as a determining factor in the application of building regulations. Interviews with local government staff revealed that these technical assessments of flood risk exposure are commonly misunderstood by the public as a virtual guarantee that, once followed, damage to private property from flooding events becomes very unlikely. Such objective indicators of exposure, however, fail to advise the public about either the dynamics of flood events (i.e., the speed and trajectory of flood waters), or the probable range of flooding extremes at any given location.

3.4. *Overcoming a reactive approach to DRM*

An additional outcome of underestimating the limits of infrastructure-based exposure reduction measures is that doing so encourages a reactive approach to DRM planning and thinking. DRM staff agreed that public priorities include not only engineering solutions to prevent natural disasters, but also an expectation, particularly in urban areas, of timely and effective emergency response from government in the event of a disaster (Queensland Government Officials 2, 4, 5, 2012). Conversely, those interviewed also suggested that there is a lack of institutional learning and community engagement by DRM organisations aimed at fostering preparation-based approaches to building resilience (Victorian Government Official 4, 6, 2012).

However, given the fickle nature of political priorities, and the assumption that uncertainty reduction and engineering responses are the main elements of disaster management, recovery steps often fail to incorporate the policy alternatives offered by an adaptation focused approach. What occurs instead is a reliance on exposure reduction strategies (e.g., flood mitigation infrastructure), driven by assumptions that better information and more resources can ensure more effective defences, leading to unmet DRM expectations on both counts and a broader failure to adequately consider adaptation-based alternatives targeting both exposure *and* vulnerability reduction strategies.

4. Increasing resilience: adaptation and social learning

DRM can be achieved by a variety of means, categorised for the purposes of our argument according to their relative effect on the public's *exposure*, *vulnerability* and *resilience* to climate events. Although defined by the Intergovernmental Panel on Climate Change (IPCC, 2007), as well as for DRM practitioners (NEMC, 2010), these terms have been subject to considerable debate and ambiguity in definition, particularly in the climate change literature (Gallopín, 2006; Brooks, 2003). While we accept the core definitions provided by the IPCC, we present the following characterisations of exposure, vulnerability, resilience, and adaptation to locate them more clearly within a policy context and make the political dimensions of the social learning components involved more explicit:

1) *Exposure* reduction: measures that seek to reduce the exposure of a community or location to natural events in order to reduce their vulnerability (e.g., dams and levees; changed human settlement patterns).
2) *Vulnerability* reduction: measures that seek to reduce the vulnerability of a community exposed to natural events in order to reduce risk (e.g., altering the usage of exposed locations; modifying existing buildings and infrastructure).
3) *Resilience*: while still a contested term, the results of our research suggest resilience is enhanced through both the reduction of exposure and vulnerability and also the enhancement of community 'spirit' and connectedness, effective communication between government and the public, and a better understanding of disaster risks.
4) *Adaptation*: we suggest that adaptation should be understood as a process of adjustment by a society aimed at more effectively coping with exposure *and* vulnerability to a given threat. The key goal of adaptation strategies is greater *resilience* brought about by a combination of decreased

exposure and vulnerability to one or more kinds of threat. Adaptation, therefore, should be thought of as a *process* aimed at achieving higher levels of resilience to external shocks, whereas resilience is a *measure* or outcome of a society's ability to resist alterations and impediments to its core structure and functions caused by external shocks (Nelson et al., 2007).

Achieving greater resilience as a society or community, therefore, requires individuals, groups, and institutions to alter behaviours, that is 'learn', in ways that reduce exposure and vulnerability to threats without changing the fundamental structure and function of that society or community. Doing so, however, is fundamentally a political process, since many of the challenges and questions raised by adaptation measures cannot be resolved by scientific or technical expertise alone. The extent to which change is possible is dependent, therefore, on *both* the material resources of a society and the maturity and flexibility of its political system and institutions, as reflected by a society's ability to draw lessons from past and current experience and implement change (Hall, 1993). Thus, we argue that the realisation of an effective adaptation process (i.e., one that produces greater socio-economic resilience by reducing vulnerability and/or exposure) relies on the following key components of adaptive capacity:

1) The transparency and quality of political institutions and policy debate in order to determine what changes are required, at what cost, and to whom?
2) The quality and availability of technical expertise and resources (employed to inform and facilitate the policy outcomes produced by the political process above).
3) The ability of the policy process to distinguish between political versus technical issues and employ technical resources in the pursuit of broadly supported (i.e., politically inclusive and legitimate) policy goals.

4.1. *Institutional learning for DRM*

Institutional or social learning within the current 'predict then act' policy making process is curtailed and misdirected by the expectation that uncertainties can always be reduced and that reliable knowledge of how, when, where, and on what scale natural disasters are likely to occur is possible. The expectation that such knowledge can be acquired and used to provide 'evidence-based' policy, however, limits the scope for adaptive institutional learning, since it relies so heavily on the provision of hard, empirical data and engineering solutions, both of which make long term demands on institutions and limit flexibility. Moreover, expectations that uncertainty issues can be resolved, or reduced to a low order, also remove incentives to explore alternative approaches that seek to manage rather than reduce uncertainties (Birkmann and Teichman, 2010: 181).

Institutional learning capacity is also limited by the rationalist expectation that conflicting values and beliefs can be reconciled by expert knowledge claims. But expert authority alone is seldom able to overcome the kinds of entrenched values and preferences that inform political authority, particularly when as Ravetz (2004: 350) has argued, uncertainty is high, values in conflict, and decisions urgent. Attempting to remove politics from policy making by adopting ostensibly 'evidence-based' decisions causes policy debate to become 'scientised', which obscures the political dimensions of not only how people and governments understand resilience, but also the trade offs they are prepared to accept in order to better manage their exposure and vulnerability to hazardous events.

Rationalist informed DRM policies, as demonstrated during the 2011 Brisbane floods, also encourage unrealistic expectations concerning the government and its agencies ability to control natural events and mitigate their potential for becoming natural disasters, which limits perceptions of institutional and social learning to the pursuit of more and better scientific and technological solutions. In so doing, DRM continues under the illusion that *optimal* protection for communities is available through threat mitigation measures, thereby providing peace of mind for the public and political kudos for governments – that is, until mitigation measures fail to meet expectations. And, as the government and public reaction to the 2011 Brisbane floods demonstrated, the response to failure is inevitably investigations in to why managers and institutions got it wrong, followed by institutional reforms intended to provide better information and more effective engineering responses.

A greater focus on *managing* uncertainties by engaging communities on disaster risk and openly negotiating exposure and vulnerability reduction priorities is, we argue, dependent on iterative social learning since public and political priorities are, by their nature, in continuous review. Learning resulting in genuine policy change thus requires policy debate on DRM to be framed in ways that (i) explicitly recognise uncertainties; (ii) address questions about what we realistically can or do know about current and future hazards; and (iii) explore the available options for progressively enhancing resilience over the short to medium term. An adaptive approach, therefore, should seek to learn about priorities and vulnerabilities progressively with each new event in order to incrementally enhance resilience

5. Prepare, respond, review and inform: incremental policy and learning under uncertainty

The alternative DRM policy paradigm we are proposing seeks to manage uncertainties by focusing on ways in which vulnerability and exposure to current events can be improved on the basis of currently accepted knowledge and experience rather than highly uncertain, and politically volatile, claims about the impacts of future climate behaviour. Our alternative replaces the linear, rationalist based PPRR schema with an adaptive *spiral* intended to enhance resilience through iterative and incremental social learning and build broader political consensus and support for policy in order to reduce policy gridlock over politically sensitive issues.

DRM's existing reliance on technical modelling, data, and operational procedures, we suggest, should become more balanced to include a much stronger emphasis on preparation for extreme events, accompanied by explicit policy position statements explaining how government priorities are balanced between resource management, land-use planning and

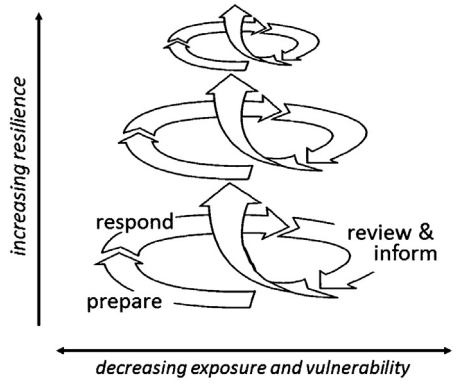

Fig. 1 – Prepare, respond, review and inform (PRRI) spiral.

disaster mitigation. In particular, management of disaster mitigation assets should be backed by political prioritisation of risks and their communication to the public (Lorenzoni et al., 2005) We argue that, in the case of Australian DRM, the existing government framework of Prevention, Preparation, Response and Recovery should be reconceived as a three stage spiral model that focuses on a Preparation, Response, Review & Inform (PRRI) dynamic driven by adaptation principles and planning (see Fig. 1).

Integral to this alternative model is a Bayesian-type feedback spiral between the three elements, which requires incremental improvement at each stage following a post-crisis review. This feedback mechanism is intended to ensure each of the three stages, in particular the preparation stage, 'learns' from experience in ways that will make society more resilient in the face of the next crisis than it otherwise would have been. Moreover, the increasing social resilience produced by this approach also means that the demands and risks faced by emergency service personnel should decrease over time.

Unlike existing 'predict then act' approaches to DRM policy, an incrementalist approach to adaptation does not require precise knowledge of future events. Instead they depend on developing a better understanding of how and why natural and other events become 'disasters' (e.g., where and how we live and socio-economic inequalities as major contributors to disaster scale and severity); on our ability to conduct and resolve political debates over normative priorities; and on our willingness to accept that uncertainty in DRM policy can be managed, but not removed.

Sarewitz's (2004) call for more 'incremental approaches to decision making' on the basis of consensus being achieved, not on scientific or knowledge disputes but on values and interests, invokes Charles Lindblom's (1959) ideas about the need to abandon the quest for 'synoptic' or complete knowledge as the basis of policy and instead to accept our inability to know very much at all about complex policy issues, or even to reach shared understandings of policy goals. Lindblom's famous description of policy making and analysis as 'the science of muddling through' (1959) represents what he later stated 'is and ought to be the usual method of policy making' (1979). The primary reason, for making only incremental policy changes in basically the same direction as before is that we are *relatively confident* about what works and what doesn't from past experience. An important part of Lindblom's incrementalist vision for policy was the open debate of conflicting values and ideas, what he called partisan analysis, which in Lindblom's view (1979: 524) should be 'improved rather than ... curbed, [so] that policy making can be made more intelligent.' Sarewitz (2004) makes a similar point when he argues for improving the conditions under which consensus on competing values and interests can be reached. For Sarewitz, the best way of doing so is by preventing the 'scientization' of political debates by ensuring they remain focused on the actual values and interests that drive them, which, according to Bernard Crick (2000: 18), is the very essence of 'politics'.

Partisan analysis, as an instrument of politics, therefore, should be about openly debating values and negotiating interests as a means of persuasion and facilitating compromise, thereby allowing incremental policy responses to be agreed upon and pursued with the size of the policy steps involved determined by the level of agreement reached. Such cooperation need not require precise agreement on a policy's ultimate goals, since different actors will often have a different understanding of the goals or benefits the policy is intended to achieve. The point, rather, is to achieve consensus on the action to be taken in the short term rather than requiring or expecting detailed agreement on the longer term outcomes to be expected.

Incrementalism, then, provides a pragmatic policy response to high uncertainty issues by shifting the focus to developing consensus on how to proceed, as opposed to holding out for consensus on possible futures, as the main criterion for legitimate policy action. Whereas Lindblom saw small incremental policy steps when faced with complexity and knowledge gaps as a source of insurance against getting things completely wrong, assuming that past or existing policies were or are to some degree effective, our proposed use of it is more about getting over the problem of competing values and the gridlock uncertainty can create when political debates become scientized.

In the case of the 2011 Queensland floods, the approach we advocate here would, at the very least, have encouraged public debate on the Wivenhoe Dam's conflicting purposes, and also much greater public awareness of the limits to the dam's ability to 'prevent' flooding. As a consequence, the need for local community resilience to be developed on the basis of more than only the provision of public infrastructure and misplaced expectations that flooding can be prevented would receive the attention we believe it deserves.

6. Conclusion

Post-positivist policy approaches such as the DRM model we have proposed here should not be seen as some radical theoretical enterprise. The questioning of what we can realistically know and use as the basis of policy instead should be seen as a logical progression in the way we think about knowledge and its role in justifying and legitimising our actions. Many of the problems the case-study presented here highlights are common to all policy areas where

rationalist based policy approaches are employed under conditions of high uncertainty, since doing so inevitably leads to the kinds of unrealistic expectations of technical expertise – both as the basis for policy and as a source of legitimacy for policy choices – illustrated by both the circumstances of the Brisbane flood and political reactions to how the threat of flooding was managed. As we have argued here, conditions of high complexity and uncertainty prevent policy debate from being negotiated and resolved on the basis of knowledge claims or the best available advice alone. Recourse to the rationalist model's vision of policy being objectively determined by the evidence is, as a consequence, blocked, leaving the legitimacy of policy decision making open to contest for those with an interest in questioning it. The politics actually driving debate and competition, meanwhile, under the rationalist schema, remain obscured or are misframed as issues requiring a scientific or technological solution.

Incrementalist approaches to policy, in contrast, are better suited to resolving political disputes over who gets what, why, and at what cost, because they (i) explicitly recognise the political character of policy debate and prioritise the need for political agreement on what is to be done *before* science has a role in saying what *can* be done; (ii) do not require long term commitment and expense; and, therefore, (iii) make policy more adaptable to unforseen circumstances arising, allowing us to hedge our bets under high uncertainty, particularly as climatic conditions around the world continue to change in ways we may not expect. Moreover, incremental policy making compliments adaptation-based DRM because it encourages the mainstreaming of climate change by promoting a focus on things we agree we know (Brisbane experiences major flooding on a regular basis); things we agree are important (the need to limit flood damage); and in particular the things we are confident we can change or control (where we live, or the kinds of houses we build) as opposed to things we realistically cannot control (intensity and frequency of flooding), regardless of what is causing them.

What we propose in order to reconcile political conflict and make some policy response possible is, put simply, to adapt to the problems we *know* we have now and factor in a margin for them becoming worse. Hedging against current and future unknowns in this way, however, is an inherently *political* process, one that will need to openly negotiate differing perceptions within society on what costs and levels of risk are acceptable, what risks are realistically avoidable, and how much people are willing to sacrifice in order to try and limit those that are neither.

Acknowledgements

This work was carried out with financial support from the Australian Government (Department of Climate Change and Energy Efficiency) and the National Climate Change Adaptation Research Facility. The views expressed herein are not necessarily the views of the Commonwealth, and the Commonwealth does not accept responsibility for any information or advice contained herein.

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