Governance of Emergency Response in Scotland, Resilience Management, and Adaptation to Increasing Climatic Variability

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Introduction - Problem definition

This research takes a systems ecology approach to the 'wicked problem' of managing under conditions of uncertainty. Specifically, it addresses the challenge of responding to increasing climatic variability in Scotland.

The management of emergencies associated with climatic change has the characteristics of a 'wicked problem'. It requires the management of uncertainty (surrounding increased climatic variability) in complex, linked, social-ecological systems.

Whether or not these emergencies become 'disasters' is dependent on the effectiveness of the emergency response.

Emergency response in Scotland occurs as part of the 'Emergency Management Cycle', iteratively comprising activities associated with Assessment, Prevention, Preparation, Response, and Recovery (Scottish Executive 2006).

The organisations and institutions associated with Emergency Management in Scotland function as a cross-sectoral network collaborating to achieve a common goal, referred to henceforth as the Scottish Emergency Management system [SEMS]. The form of collaboration and the goal are prescribed by policy that is centrally administered from central UK Government, and adapted by the devolved Scottish administration, the Scottish Government. Currently, the SEMS is organised following principles established by the Civil Contingencies Act 2004 [henceforth the 'CCA'], adapted to Scotland in the document 'Preparing Scotland' (Scottish Executive 2006). This policy sets out the statutory duties of organisations operating within the system, grouped into 'Category 1' and 'Category 2' responders by types of duty.

The CCA is a policy designed around the principle of 'resilience'. This entails specific duties and consequent relations between organisational and institutional actors within the system. In a change to the traditional 'civil defence' drivers of Emergency Management, the system since 2004 is additionally charged with the task of resilience management.

As such, it is one of the first implementations of resilience management outside of its usual context of natural resource/ecosystem management, with lessons for the future

redesign of organisations and institutions for greater adaptability in the face of change.
Further, the management of crisis additionally provides scope for rapid policy change as a result of the iterative learning and evaluation process that has been traditionally associated with Emergency Management systems. Thus it is possible to examine the direct effects of events related to increasing climate variability, and what policy changes are made to enhance adaptation.
System actors are highly engaged in the effectiveness of both policy and implementation due to the social, cultural, and moral associations ('imperatives') of their profession, which provide a strong basis for incentivisation. Emergency Management could be read as a 'high stakes' strategy game - gaps in capacity or policy implementation equate to loss of life or damage to social resilience. Disaster scholars call emergency/disaster management 'the quintessential function of government' (Comfort 2002).

This paper introduces an original empirical Pilot Study investigating the research question 'Is There a Role for the Scottish Third Sector in the Provision of Disaster Response in Scotland?'. The findings are presented as part of the discussion of a provisional conceptual framework developed to analyse the results and build the basis for a doctoral thesis that expands the research question from the original pilot to consider resilience and adaptation processes in the SEMS.
The Pilot Study had several key findings that indicated local implementation networks for national disaster response policies impacted on inter-organisational collaboration in the event of an emergency.

Background

What does resilience mean in this context?

Systems Ecology is the discipline where the concepts of resilience, adaptation, and transformation originated. This 'new ecology' arose from the recognition that ecosystems did not operate as the stable equilibriums they had been assumed to be, and in fact displayed the properties of complex adaptive systems. Complex adaptive systems [CAS] are systems that self-organise through sets of non-linear processes, existing in dynamic equilibrium states around sets of 'attractors' within certain 'thresholds' or limits, beyond which they enter disequilibrium and either collapse into chaotic releases of energy, return to the previous dynamic equilibrium, or reorganize into new 'system regimes' around new sets of attractors.
Systems Ecology is separate from other ecological disciplines in that, having defined these processes, it allows for their application to any suitable context. There are a number of key authors in the discipline who have published prolifically and significantly extended the theoretical base of the discipline (see Armitage et al. 2007a:6). Much of this work concerns natural resource management [NRM], and the emergent paradigms of 'adaptive management', 'adaptive co-management' (Armitage et al. 2007b), and 'adaptive governance' (Folke et al. 2005).
Walker et al. state that there has been 'considerable evolution' of the resilience concept since Holling's original (1973) 'seminal paper' (2004:5). Confusion arises because "different groups adopt different meanings to fit their understanding and purpose" (2004:5). The original definition of the concept is "the capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain

essentially the same function, structure, identity, and feedbacks" (Holling 1973; Gunderson and Holling 2002).
In Scottish Emergency Management, the CCA defines resilience as "the ability "at every relevant level to detect, prevent and, if necessary, to handle and recover from disruptive challenges" (Scottish Executive 2006:1, citing CCA 2004).
The processes underpinning resilience are the elements of civil protection or civil contingency planning: "the application of knowledge, measures and practices to anticipate, guard against, prevent, reduce or overcome any risk, harm or loss that may be associated with natural, technological or man-made crises and disasters in peacetime" (Scottish Executive 2006:1).
Enhancing resilience is often linked to the social construction of increasing societal risk, e.g. "In recent years, the range of challenges that society faces has broadened as networks have become more complex" (Scottish Executive 2006:1).
Crucially, the Pilot Study below revealed that the CCA guidance is often interpreted in Emergency Management policy implementation processes, both documented and relationally enacted, as the ability to return 'back to normal' (see O'Brien and Read 2005; O'Brien 2006 for context).

What is the relationship between resilience and adaptation?
Systems Ecology uses the term 'social-ecological system' [SES] (Berkes and Folke, 1998) to capture the inextricable linkage between human and environmental systems. According to Walker et al. "resilience has four components – latitude, resistance, precariousness, and panarchy – most readily portrayed using the metaphor of a stability landscape" (2004:5). Undesirable systems can be resilient, too. The definition of what constitutes a 'desirable' system configuration is essentially political, with those actors most invested in the current SES relations and institutions most likely to conceive of resilience as 'good' (Nadasdy 2007:215).
Adaptability is defined here as "the capacity of actors in a system to influence resilience. In a SES this amounts to the capacity of humans in a system to manage resilience." (2004:7). Resilience management then is the process by which resilience is either maintained (avoidance of crossing threshold into an undesirable regime), or shifted to a more desirable state. In SESs it is human action that dominates, thus "adaptability of the system is mainly a function of the social component –the individuals and groups acting to manage the system" (2004:7).
Adaptation can be read as successful resilience management. Adaptation occurs in cycles, and these cycles occur at a number of scales - SESs exist as 'panarchies' – adaptive cycles interacting across multiple scales, "these cross-scale dynamics are of great significance in the dynamics of SESs" (Walker et al. 2004:7).
Adaptive capacity is related to vulnerability, and concerns the possibility of mobilising resources for adaptation, or "the capability of a system to adapt to change and respond to disturbance yet still retain essential self-organising structure function, and feedback mechanisms" (Berkes et al. 2003; see Armitage 2007:67 for further definitions).

The above concepts are linked to science and policy for sustainability, in that assessing and actively managing resilience …'will require new forms of human behaviour with a shift in perspective from the aspiration to control change in systems, assumed to be stable, to sustain and generate desirable pathways for societal development in the face of increased frequency of abrupt change" (Folke et al. 2005:443).

What are the features of the task of resilience management?
The Civil Contingencies Act [CCA] (2004) was enacted by the UK Cabinet Office and effectively marked the redesign of UK Emergency Management and Civil Contingencies policy around the principles of resilience management and away from civil defence. 'Preparing Scotland' describes the key activities around which resilience is built:
"First, risks of disruptive challenge must, where possible, be identified, either by considering internal weaknesses or scanning the horizon for external threats. Risk assessment allows choices to be made. In some circumstances it is possible to prevent disruptive challenges occurring by taking action at an early stage. In other cases, planning has to take place to prepare to deal with a disruptive challenge. If the disruption does occur it becomes necessary to respond and, once the situation is brought under control, to focus on recovery. This cycle – assessment, prevention, preparation, response and recovery – is at the heart of resilience. It is complemented by review of plans and arrangements based on experience of emergencies and exercises" (Scottish Executive 2006:2).

Institutional and organisational forms in crisis response [in Scotland]
The governance structures that facilitate resilience management are discussed as part of the findings of the Pilot Study.
The SEMS has unique historically-situated social and cultural characteristics.
The system is characterised by cross-sectoral collaboration organised around the common goal of Emergency Management. There is a hierarchy that operates as a 'chain of command', with functional separation to achieve a cohesive management system, designed on the principle of subsidiarity from local to national (Scottish Executive 2006), crossing multi-level governance systems.
Within Public Administration, Moynihan's (2007) work on emergency response conceptualises a form of Emergency Management, the Incident Command System [ICS], as a 'hierarchical network'. Here, the network functions between events, and the hierarchy is enacted in response to events. This combination of organisational arrangements is consistent with empirical findings from Disaster Scholarship (e.g. Tierney and Trainor 2004). While this theory and data originate from the US, both the US and the UK practice Integrated Emergency Management, an all-hazards approach that allows parallels to be drawn between the two systems. From this we can hypothesise that in the SEMS it is the network that enables the hierarchy functions of the emergency management system. Based on network values and relational capital leading to inter-agency collaboration (Moynihan 2007), it thus appears that effective network management is crucial to the maintenance of a functioning response hierarchy. However, this process is obscured by the formally mandated 'training and exercising' procedures that maintain the rational hierarchy. The interplay between network and hierarchy has not yet been investigated in the SEMS.

The Pilot Study: The Role of the Third Sector in the SEMS (2008)

This research was conducted over 6 months in 2008. It was a qualitative survey of the SEMS, using selective sampling to identify 11 key stakeholders. These stakeholders included representatives from statutory response agencies, Third Sector organisations within and without the system, Scottish Government policymakers, and policy

lobbyists. This small sample did not include Scottish Government Emergency Planners, or any representatives of the Emergency Services, due to the focus on the strategic coordination process and the preservation of data sources for future research. These respondents were identified through snowballing, beginning with a contact in ScoRDS, the Scottish Resilience Development Service, who was identified by a Scottish Government knowledge transfer broker. The survey was preceded by document analysis of 'Preparing Scotland', the Scottish implementation document for the CCA (2004), and supported by a range of other contextual documents. It was thus a top-down study, appropriate to the investigation of system design features and the identification of strategic adaptations. What began as a deductive research design was quickly modified to an inductive process, as it became clear that predictions from existing Public Management theory were not adequate to capture the complexity and uniqueness of empirical material needed to answer the research question. Subsequent research has synthesized multi-disciplinary literature in an attempt to unpick the relations that were uncovered by this inductive data collection (further discussion of which can be found in 'Future Research').

Policy Design, Organisation, and Existing Relationships with the Third Sector

The design of the CCA legislation (2004) has evolved from UK Emergency Management's historical focus on evaluation, learning, and improvement (O'Brien and Read 2005). This process of policy as 'experiment', to be iteratively tested and modified, is reminiscent of the adaptive management process that has been applied in natural resource management as a way of addressing uncertainty in the environment. The adaptive management concept evolved from the 'New Ecology' – the recognition that ecosystems are dynamic equilibriums whose processes are non-linear – challenging the basis of 'stable–state' management techniques. Across other disciplines, including Management studies and Disaster Management, it is this process of 'double-loop', feedback', or 'social' learning that has been isolated as a key response to the challenges of managing uncertainty, complexity, and non-linear dynamic equilibriums.

This learning is embedded in the policy design for the CCA (2004) legislation, reflecting the social, economic, and political necessity of delivering effective Emergency Management. The CCA is designed to facilitate knowledge sharing between localities, enabled by the provision of an online resource, UK Resilience (2009), an extensive open-access website with additional statutory and event-specific guidance, and design of 'Preparing Scotland', the regional implementation framework, as a 'live' document, with periodic updating (centrally administered). Document analysis of the CCA showed that the SEMS has working relationships on a functional basis with a number of what they call 'voluntary organisations' (referred to in this study as Third Sector organisations [TSOs]). These are established relationships and are delineated by the utility of either support or expertise functions to the operation of the overall system (Scottish Executive 2006:185[4.175]).

These Third Sector organisations may be involved in the local planning mechanisms that implement the CCA, called 'Strategic Coordinating Groups' (SCGs). Each SCG has a 'Voluntary Sector' sub-group that meets periodically and feeds into the main SCG process. Evidence from representatives of the TSOs that operate within the SEMS suggested that organisation of these sub-groups was subject to significant local variation.

The activity of the 'Voluntary Sector' sub-group, as well as representation 'around the table' of the main SCG meetings, is at the discretion of gatekeepers. The SCGs are the

local nexus of the SEMS, and are organised by police regions but governed by the local [municipal/district] authority. It is the local authority Emergency Planning officers or their staff that oversee the local coordination process.
Interviews conducted with key stakeholders in 2008 suggested that, at this level, we find the typical features of relationships between public organisations and the Third Sector, but in the context of a system whose long relationship with the sector is based on a very clear power asymmetry. The closest relationships are with those organisations that have an historical association with the system, and have grown up synergistically around it to provide support – such as the WRVS, St Johns Ambulance, and The Red Cross. These TSOs are usually large, national organisations with a number of other functions, and local representation.
Several respondents suggested that the high demands of the job faced by Emergency Planning officers in local authorities (who may also perform another, 'official' role within the organisation), as well as the cultural legacy of the 'civil defence' approach to Emergency Management, meant that these gatekeepers were unlikely to (a) perceive TSOs as 'equal partners' in the Emergency Management process, or (b) proactively engage with other TSOs outside the established system of relationships.
Respondents to the 2008 survey indicated that actors and strategic mechanisms within the SEMS are caught in the double-bind of unfamiliarity – both an overestimation of the capacity (resources and organisation) of TSOs to meet SEMS needs (gaps in their own capacity – either anticipatory or responsive) and an underestimation of the energy inputs required to build these collaborative relationships and increase TSO capacity to meet needs.
It is important to note here that qualitative evidence from the 2008 study indicated that the SCGs, and the SEMS as a whole, operates as a social network as well as a functional hierarchy. As a relatively 'closed' system, where trust and expertise are the predominant values, many members will share a professional background in the military or emergency services. Due to the SEMS's small size, actors are likely to change roles but stay within the system, so will have worked with or alongside many other actors. This high degree of familiarity, the homogeneity of professional norms, and consensus about the value, importance, and confidentiality of the work of Emergency Management professionals, create a strong network that is difficult to penetrate by 'outsiders' This strong social network, in effect, creates an additional 'layer' to the formal coordination mechanisms (or 'shadow system').
The 2008 survey respondents perceived that part of the system redesign under the resilience paradigm is designed to adjust professional practice and 'open up' these networks.

System Change within the SEMS
Respondents from the 2008 survey felt that there were several processes of change occurring within the SEMS. The perception of SEMS respondents was that increased system actor diversity was a strategy to meet increased pressure to adapt to changing conditions in the internal [organisational] and external environment.
As a result of this perception, these change processes could be read as factors likely to provide impetus to the development of relationships between extant and new system actors. These new system actors could be private, public, or Third Sector organisations. Related to the research question, these are thus factors that provide an opportunity for an increased role for the Third Sector in the SEMS (Table 1).

Table 1 'Change processes within the Scottish Emergency Management system that

provide opportunities for an increased role for the Third Sector'.				
Type of Process	**Environment**	**Type of Change**	**Stimulus**	**Example of Causal Factor**
Professional/ Cultural	Internal to system	professionalisation	*sector maturity*	Accreditation; Diversification
		greater scrutiny	*event-related evaluation*	Pitt Report (2007 floods)
		organisational development & knowledge transfer	*System redesign following policy implementation of CCA (2004)*	Required to operationalise Resilience Management
Resource Transfer	External to system	Increasing resource needs	*planning for specific events*	Commonwealth Games (2014)
			planning for change	Perception increasing magnitude/ frequency
			responses to previous events	Indicating gaps in SEMS capacity

Returning to the Systems Ecology perspective discussed earlier, we can conceptualise the SEMS as a self-organising system whose dynamic equilibrium is retained around a set of desirable attractors. This allows us to separate these internal and external environmental factors further (Table 2):

Table 2 'A Systems Ecology Perspective to Conceptualise Change in the Scottish Emergency Management system [2008]'.

Change	**Process**	**Action**	**Type**	**Policy Term**	**Purpose**
Cultural/ Professional	System organisation ('steering')	movement to new 'attractors'	around set of desirable values	'partnership', 'modernisation', 'transparency'	desirable form resilience
Resource-Transfer	System redesign (rational; planning)		anticipatory	'innovation'	meet emergent need
			responsive	'failure'	result of unmet need

These structural features are the governance imperatives that drive changes to the organisation of the SEMS, in addition to values already embedded into the system around service provision, trust, and expertise.

Future Research

This section charts how the empirical data generated inductively by the Pilot Study have been theorised during Year 1 of the associated doctoral research.
As indicated previously, the Pilot Study had to be reflexively redesigned from a deductive to an inductive approach as predictions made from existing theory surrounding Government – Third Sector relationships were found to be inadequate to understand, explain, or predict the relations found within the SEMS once data collection began.
Preliminary analysis of the results obtained indicated that a much more complex level of insight was required to map the organisational forms, processes, and outcomes occurring.
Since then, the research brief has expanded considerably in response to the empirical data to include the notions of resilience and its relationship to adaptation.
As such, three research disciplines have been synthesised as an experimental research strategy to attain sufficient insight: Disaster Scholarship (Sociology, Management, Risk Reduction); Systems Ecology (Resilience, Adaptation [Adaptive Capacity; Adaptive Governance and Management], Transformation) and Emergency Management [practitioner].
These have been combined with emergent theory regarding sustainability, climate change, and complexity in Public Management and Administration (e.g. Public Administration And Development 2008; Public Management Review 2008; Public Money & Management 2008).
Below is an overview of the rationale for this synthesis. The preliminary conceptual framework developed is available from the author on request.
The doctoral research is an ecological study, in that it focuses on the relations between the organisations that act to achieve shared goals within a defined system. It uses the frame of Complexity Theory to understand these relations and the system itself, using the 'Complex Adaptive Systems' perspective.

This study makes an original theoretical contribution by bringing in insights from the Emergency Management [practitioner], Disaster, and Systems Ecology literatures to locate the process of Resilience Management within the latest Public Management literature.
The research synthesises material from these literatures that is relevant to the context of emergency management in Scotland (a developed country, with a lack of natural hazards, now adapting to increased resource demands arising from managing increased climatic variability) to add depth to the conception of both the SEMS and the process of resilience management.
With theory-practice insights generated over decades, the Systems Ecology discipline (incorporating 'resilience' and 'adaptation' literature) brings a depth of theoretical insight related to processes around knowledge, information, and learning; social and institutional change to increase adaptive capacity; and operationalising new governance regimes through management processes.
The 'emergency' and 'disaster' literatures bring empirical data regarding responses to events, collaboration processes, and specific forms of organising for effective adaptation to, and management of, crisis.
The complementarity of these literatures to the Public Management discipline is demonstrated by Moynihan's recent scholarship, such as his application of Koppenjan and Klijn's (2004) network management of uncertainty to learning in an emergency management network (2005).

Synthesis is further enhanced in this case, as all the above disciplines now draw heavily on structural insights generated by Complexity Theory, allowing linking of different disciplinary and cross-disciplinary concepts. The conceptual framework for this study is structured by this common theoretical basis, utilising applications of Complexity Theory to Public Management (e.g. Klijn 2008; Rhodes 2008), Disaster Management (e.g. Comfort et al. 1999; 2001), and Emergency Management in the UK (O'Brien and O'Keefe 2008) to link these disciplines with the Systems Ecology perspective.
It is intended that generating theoretical insights in this area using the novel methodologies of Complexity Theory will also further the legitimacy and application of these methodologies within the discipline of Public Management.

The research will additionally make an empirical contribution to the Systems Ecology field by using Public Management theories around network management and governance to explore *how* these theories could be put into place, using the SEMS as the research site. What is lacking in the adaptation literature is in-depth knowledge of the process of managing multiple scales of governance and cross-sectoral collaboration. While there is an abundance of case study material for theory generation, what is lacking is the testing and application of these theories in a coupled social-ecological system outside of a natural resource management context. The findings of this research will be UK-focused, but are explicitly generated within the context of one of the UK's three devolved regions: Scotland. This makes a novel contribution to the Emergency Management and Disaster Risk Reduction literature in the UK, where much of the attention is on English processes that are assumed to be generic across the four regions.
Further, this topic is of immediate policy relevance to Scotland and other nations planning for adaptation to climate change. Policy learning will be greatly enhanced through its investigation within Public Management's policy-practice focus and cooperation from the Scottish Government through the researcher's association with a joint Economic and Social Research Council/Scottish Government PhD scheme.

The doctoral study will frame the problem of resilience management and adaptation to climate change in the SEMS from a governance perspective. This allows modelling of the management-governance dynamic across the system, utilising pertinent concepts suggested by the literature, such as network management, feedback learning, and social capital. A cross-sectional case study will focus on further exploration of the cultural and professional drivers for the change processes described above, working closely with statutory system actors to understand how the SEMS might increase the diversity of non-statutory actors (for instance by implementing new governance-style reforms). It will consider how the Scottish Third Sector might meet these increased resource needs, and on what basis that relationship could be negotiated, using the extensive Public Management/Voluntary Sector literature in this area. This will allow the research to explore the possibility of collaboration with the Third Sector as fostering emergence/innovation within the system, for example in implementing the emergent paradigm of community-led flood risk management.

References

Armitage, D., Berkes, F., Doubleday, N. (2007a) 'Introduction: Moving Beyond Co-Management' in Armitage, D., Berkes, F., Doubleday, N. [eds.] *Adaptive Co-Management: Collaboration, Learning, and Multi-Level Governance*. UBC Press: Vancouver, BC, Canada. pp.1-19.

Armitage, D., Berkes, F., Doubleday, N. [eds.] (2007b) *Adaptive Co-Management: Collaboration, Learning, and Multi-Level Governance*. UBC Press: Vancouver, BC, Canada.

Berkes, F., Folke, C., [eds.] (1998) *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge University Press: Cambridge, UK.

Civil Contingencies Act (2004) '(Contingency Planning) Regulations 2005'. *Cabinet Office*. HMSO: London, UK.

Comfort, L.K., Sungu, Y., Huber, M., Piatek, J., Dunn, M. and Johnson, D. (1999) 'Self-Organisation in Disaster Mitigation and Management – Increasing Community Capacity for Response' *TIIEMS Conference Paper* [online] www.iisis.pitt.edu/html/publications/html. Accessed 10/02/2009.

Comfort, L.K., Sungu, Y., Johnston, D., Dunn, M. (2001) 'Complex Systems in Crisis: Anticipation and Resilience in Dynamic Environments'. *Journal of Contingencies and Crisis Management*. 9(3)144-158.

Comfort, L.K. (2002) 'Managing Intergovernmental Responses to Terrorism and Other Extreme Events'. *Publius*. 32 (4).

Folke, C., Hahn, T., Olsson, P., Norberg, J., (2005) 'Adaptive Governance of Social-Ecological Systems'. *Annual Review of Environmental Resources*. 30:441-73.

Gunderson, L.H., Holling, C.S. [eds.] (2002) *Panarchy: Understanding Transformations in Human and Natural Systems*. Island Press: Washington, D.C., USA.

Holling, C.S., (1973) 'Resilience and Stability of Ecological Systems'. *Annual Review of Ecological Systems*. 4:1-23.

Klijn. E.H. (2008) 'Complexity Theory and Public Management: What's New?'. *Public Management Review*. 10(3)299-317.

Koppenjan, J. and Klijn, E.H. (2004) *Managing Uncertainties in Networks*. Routledge: London, UK.

Moynihan, D. P. (2005) 'Learning Under Uncertainty: Networks in Crisis Management', *La Follette School Working Paper No. 2005-028*. University of Wisconsin - Madison - Robert M. La Follette School of Public Affairs.

Moynihan, D. P. (2007) 'From Forest Fires to Hurricane Katrina: The Network Aspects of Incident Command Systems'. *Paper Presented At The Annual Meeting Of The International Research Society For Public Management, Potsdam, Germany, April 2-4, 2007.*

Nadasdy, P. (2007) 'Adaptive Co-Management and the Gospel of Resilience' in Armitage, D., Berkes, F., Doubleday, N. [eds.] *Adaptive Co-Management: Collaboration, Learning, and Multi-Level Governance*. UBC Press: Vancouver, BC, Canada. pp.208-227.

O'Brien, G., Read, P. (2005) 'Future UK Emergency Management: New Wine, Old Skin?' *Disaster Prevention and Management*. 14(3)353-361.

O'Brien, G. (2006) 'UK Emergency Preparedness – A step in the right direction?' *Journal of International Affairs*. 59(2)63 -85.

O'Brien, G. and O'Keefe, P. (2008) 'Resilient Responses to Climate Change and Variability: A Challenge for Public Policy' [in review].

Public Administration And Development (2008) 'Symposium On Climate Change, Governance And Environmental Services'. 28(5)327–404

Public Management Review (2008) 'Complexity Theory and Public Management'. 10(3).

Public Money & Management (2008) 'Sustainable Development and the Public Sector'. 28(6).

Rhodes, M.L. (2008) 'Complexity and Emergence in Public Management'. *Public Management Review*. 10(3)361-379.

Scottish Executive (2006) *Preparing Scotland: Scottish Guidance on Preparing for Emergencies*. Scottish Executive: Edinburgh, Scotland.

Tierney, K., Trainor, J. (2004) 'Networks and Resilience in the World Trade Center Disaster'. *Research Progress and Accomplishments: Multidisciplinary Center for Earthquake Engineering Research.* 6:158-172.

UK Resilience (2009) [online] at http://www.ukresilience.gov.uk/home accessed 01/09/08.

Walker, B., Holling, C.S., Carpenter, S.R., Kinzig, A. (2004) 'Resilience, Adaptability and Transformation in Social-ecological Systems'. *Ecology and Society*. 9 (2):5-13.