



# Newcastle University ePrints

Davoudi S.

[Resilience: a bridging concept or a dead end?](#)

*Planning Theory and Practice* 2012, 13(2), 299-307.

**Copyright:**

This is an Accepted Manuscript of an article published by Taylor & Francis Group in *Planning Theory and Practice* on 24/05/2012, available online: <http://dx.doi.org/10.1080/14649357.2012.677124>

**Date deposited:** 31<sup>st</sup> October 2014



This work is licensed under a

[Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License](#)

ePrints – Newcastle University ePrints

<http://eprint.ncl.ac.uk>

## Resilience: a bridging concept or a dead end

Simin Davoudi<sup>1</sup>

### Introduction

The world breaks everyone and afterward many are strong at the broken places.

Ernest Hemingway, *A farewell to Arms* (1929)

We live in challenging times with a heightened sense of uncertainty and constant reminders of the unpredictability of what might be lurking around the corner; be it catastrophic climate events, terrorist attacks, credit crunch, youth riots, or mass redundancies. For planners in the UK, this wider sense of unease is exacerbated by a decade of constant change and perennial attacks on the value of their professional contributions to society. Among the prescribed remedies for dealing with such a state of flux, the one that is rapidly gaining currency is 'resilience'. It appears that resilience is replacing sustainability in everyday discourses in much the same way as the environment has been subsumed in the hegemonic imperatives of climate change (Davoudi, 2012b). Yet, it is not quite clear what resilience means, beyond the simple assumption that it is good to be resilient. Despite this lack of clarity, there is a growing number of governmental and non-governmental reports which aim to develop ready-made, off-the-shelf toolkits for resilience-building (see for example: Edwards, 2009; The Young Foundation, 2010; Cabinet Office 2011). One such report, supported by the Department of Business and Innovation and Skills (BIS) considers 'cross-dressing' as a way of building community resilience (Risk & Regulation Advisory Council, 2009:10).

These beg the questions: is resilience in danger of becoming just another buzzword? Does its malleability mean that many divergent measures, including those that might otherwise appear indefensible, can be justified in the name of resilience? Or, is it a promising concept for planning theory and practice? And if so, what are the opportunities and limitations of translating resilience from the field of ecology into planning? As the opening essay for this *Interface*, this paper aims to shed light on these questions in order to stimulate debate on this slippery concept and its utility. The paper will: firstly, trace the origin of resilience and unpack its three fundamentally different

---

<sup>1</sup> Simin Davoudi is Professor of Environmental Policy and Planning at the School of Architecture, Planning and Landscape and Associate Director of the Institute for Sustainability Newcastle University, United Kingdom.  
[Simin.davoudi@ncl.ac.uk](mailto:Simin.davoudi@ncl.ac.uk)

meanings; secondly, present a number of emerging parallels between resilience thinking and what I call the interpretive approach to planning (Davoudi, 2011); thirdly, raise some critical issues to be considered when translating resilience from the natural to the social world, and finally, outline some concluding remarks.

### **What is resilience?**

Although resilience is a recent addition to planners' discursive repertoire, it is by no means a new concept. Coming from the Latin root *resi-lire*, meaning to spring back, resilience was first used by physical scientists to denote the characteristics of a spring and describe the stability of materials and their resistance to external shocks. In the 1960s, along with the rise of systems thinking, resilience entered the field of ecology where multiple meanings of the concept have since emerged, with each being rooted in different worldviews and scientific traditions. What set this development in motion was a seminal article published in 1973 by a Canadian theoretical ecologist, Crawford Stanley Holling. In that article, he made a distinction between engineering and ecological resilience.

#### *Engineering resilience*

Holling defined engineering resilience as the ability of a system to return to an equilibrium or steady-state after a disturbance (Holling 1973, 1986), which could be either a natural disaster, such as flooding or earthquakes, or a social upheaval, such as banking crises, wars or revolutions. In this perspective, the *resistance* to disturbance and *the speed* by which the system returns to equilibrium is the measure of resilience. The faster the system *bounces back*, the more resilient it is. The emphasis is on return time, "efficiency, constancy and predictability", all of which are sought after qualities for "a fail-safe" engineering design (Holling, 1996:31).

#### *Ecological resilience*

Ecological resilience, however, was defined as "the *magnitude* of the disturbance that can be absorbed before the system changes its structure" (Holling, 1996:33). Here, resilience is defined not just according to *how long* it takes for the system to bounce back after a shock, but also *how much* disturbance it can take and remain within critical thresholds. Ecological resilience focuses on "the ability to persist and the ability to adapt" (Adger, 2003:1). The main difference between the two types is that ecological resilience rejects the existence of *a single*, stable equilibrium, and instead acknowledges the existence of *multiple* equilibria, and the possibility of systems to flip into alternative stability domains. Despite this difference and the fact that they are rooted in different disciplinary traditions, what underpins both perspectives is the belief in the existence of *equilibrium*

in systems, be it a pre-existing one to which a resilient system *bounces back* (engineering) or a new one to which it *bounces forth* (ecological).

Similar ideas about the existence of some illusive systems' equilibrium underpin mainstream economics and its holy grail of achieving *Pareto* efficiency<sup>2</sup>. In planning, too, the quest for spatial equilibrium has a long and enduring legacy going back to the modernist visions of a 'good city'. A classic example of this is the Charter of Athens which portrayed a good city as one which was in "a state of equilibrium among all its respective functions" (CIAM, 1933, n.p). It then advocated that such a steady state was to be achieved by the power of plan. The equilibrium-based resilience is rooted in a Newtonian world-view which considers the universe as an orderly mechanical device; a giant clock whose behaviour could be explained and predicted by mathematical rules and monitored by command and control systems. These assumptions are not dissimilar to the positivist approach to planning and its quest to order space and time (Davoudi, 2012a). In this clockwork universe, a resilient system is one which may undergo significant fluctuation but still return to either the old or a new stable state.

#### *The discourse of bounce-back-ability*

The equilibristic view of resilience has been highly influential in a range of social science disciplines such as: psychology, disaster studies, economic geography and environmental planning. For example, economic geographers often draw on these interpretations of resilience to explain the trajectory of regional economic change as "a process of punctuated equilibrium" in which outmoded institutional structures are seen as creating 'path-dependent lock-in' and preventing economic resilience (for a critique of this approach, see Simmie and Martin, 2010). Similarly, in disaster studies, urban resilience is often defined as "the capacity of a city to rebound from destruction" (Vale and Campanella, 2005), with the focus often being on whether the city has recovered, in quantitative terms, its economy, population or built form. In psychology, where resilience thinking has made major inroads, the equilibrium model of resilience to trauma is defined as "the ability of adults... who are exposed to an isolated and potentially highly disruptive event ... to maintain relatively stable, healthy level of psychological and physical functioning" (Bonanno, 2004: 20). Analyses of climate change adaptation plans in England have also shown that their interpretation of

---

<sup>2</sup> This is named after Vilfredo Pareto, an Italian economist, who used the concept in his studies of economic efficiency and income distribution. It refers to situations in which any change to make any person better off would be impossible without making someone else worse off.

resilience is at best ecological and at worst engineering (Fünfgeld and McEvoy, this issue; Davoudi *et al.*, 2013).

Furthermore, many of the references in governmental statements or everyday discourses are also implicitly, or explicitly, based on the engineering view of resilience, with an emphasis on bounce-back-ability. For example, in a 2005 article, the former government's first Intelligence and Security Coordinator described resilience as the "capacity to absorb shocks and to *bounce back* into functioning shape, or at the least, sufficient resilience to prevent [...] system collapse" (D. Omand, quoted in Edwards, 2009:18 emphasis added). Similarly, when launching Scottish Resilience, the former Cabinet Secretary suggested that the reorganisation was to "take all practicable steps to [...] respond and cope with major shocks so we can *bounce back* quickly" (J. K. MacAskill, quoted in Edwards, 2009:18 emphasis added). In his review of the 2007 UK floods, Sir Michael Pitt defined resilience as: "The ability of a system or organisation to withstand and recover from adversity" (quoted in Cabinet Office, 2011:10). What all these have in common is an understanding of resilience "as a buffer capacity for *preserving* what we have and *recovering* to where we were" (Folke *et al.*, 2010:20). The emphasis is on the return to 'normal' without questioning what normality entails (Pendall *et al.*, 2010). A striking example of the potential undesirability of the 'normal' is the 2005 Hurricane Katrina. It not only destroyed the physical fabric of New Orleans, but also revealed social processes which many people did not find as the acceptable, pre-disaster normal to which they wanted to return. On the contrary, what was aspired to was a 'new normal' in social, economic and political terms (Pendall *et al.*, 2010).

The emphasis on bouncing back to where we were raises a number of normative issues which I will discuss later in the paper. Meanwhile, it is worth mentioning that such an emphasis also shapes the type of responses that are planned by the relevant institutions. That is why much of the resilience building literature is dominated by post-disaster *emergency* planning, where the focus is on sudden, large and turbulent events, at the expense of gradual, small and cumulative changes. For example, the London climate adaptation strategy makes it clear that it uses a "prevent, prepare, response and recover' framework which is developed by *emergency* planners" (GLA, 2010:19, emphasis added). The UK Cabinet Office also focuses on emergency in defining resilient communities as: "Communities and individuals harnessing local resources and expertise to help themselves in an *emergency*, in a way that complements the response of the *emergency services*" (Cabinet Office, 2011:11, emphasis added). Resilience is, therefore, often reduced to emergency responses and measured by indicators such as the length of time needed for the ambulance service to reach a given incident. A key feature of emergency responses is the emphasis on short term damage reduction

which although is necessary it is not a substitute for long term adaptive capacity building. The latter is at the heart of the third conception of resilience, to which I turn.

### *Evolutionary resilience*

Evolutionary resilience challenges the whole idea of equilibrium and advocates that the very nature of systems may change over time with or without an external disturbance (Scheffer, 2009). Some commentators call this socio-ecological resilience (Folke et al, 2010). Others highlight the similarities between this view of resilience and the evolutionary perspective (Simmie and Martin, 2010). I concur with the latter view and call it evolutionary resilience. In this perspective, resilience is not conceived of as a return to normality, but rather as the ability of complex socio-ecological systems to change, adapt, and crucially, transform in response to stresses and strains (Carpenter et al, 2005). Systems are conceived as “complex, non-linear, and self-organising, permeated by uncertainty and discontinuities” (Berkes and Folke, 1998:12).

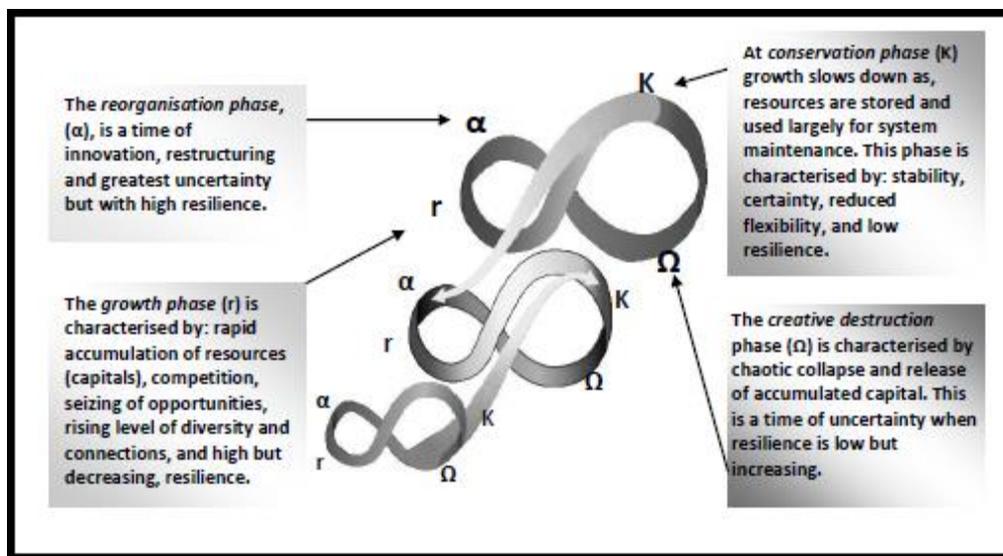
This view of resilience reflects a paradigm shift in how scientists think about the world. Rather than seeing the world as orderly, mechanical and reasonably predictable, they see it as chaotic, complex, uncertain, and unpredictable. Evolutionary resilience is embedded in the recognition that the seemingly stable state that we see around us in nature or in society can suddenly change and becomes something radically new, with characteristics that are profoundly different from those of the original (Kinzig et al, 2006). It suggests that faced with adversities, we hardly ever return to where we were. This in itself is not such a ground breaking idea. What *is* new is the acknowledgment that such regime shifts are not necessarily the outcome of an *external* disturbance and its linear and proportional cause and effects. That, change can happen because of *internal* stresses with no proportional or linear relationship between the cause and the effects. This means that small scale changes in systems can amplify and cascade into major shifts (reflecting Edward Lorenz’s idea of ‘the butterfly effect’<sup>3</sup>) while large interventions may have little or no effects. It means that “past behaviour of the system is no longer a reliable predictor of future behaviour even when circumstances are similar” (Duit et al, 2010:367). This perspective challenges the adequacy of planners’ conventional ‘toolkits’ such as extrapolation of past trends in forecasting and for reducing uncertainties. Does this mean that in a world defined by constant change and uncertainty “planning is condemned to solve yesterday’s problems” (Taylor, 2005:157)?

---

<sup>3</sup> This suggest that the flap of butterfly wings in Brazil can set off a tornado in Texas

## The panarchy model of adaptive cycle

The evolutionary understanding of resilience has been best articulated by the metaphor of the 'adaptive cycle' and its graphical representation in Holling's famous model (see Figure 1). This refers to four distinct phases of change in the structures and function of a system: growth or exploitation, conservation, release or creative destruction, and reorganisation (Gunderson and Holling, 2002). The first loop of the cycle relates to emergence, development and stabilisation of systems' structure and functions, while the second loop relates to their eventual rigidification and decline, and at the same time the opening up of new and unpredictable possibilities (Simmie and Martin, 2010). It implies that as systems mature, their resilience reduces and they become 'an accident waiting to happen' (Holling, 1986), and when systems collapse, 'a window of opportunity' (Olsen et al, 2006) opens up for alternative systems configuration. Holling uses the 'omega' symbol for the creative destruction phase to denote the end phase, but one which is rapidly followed by an alpha phase of reorganisation and renewal. The omega phase is, therefore, the time of greatest uncertainty yet high resilience; a time for innovation and transformation; a time when a crisis can be turned into an opportunity (Gunderson and Holling, 2002).



**Figure 1: The Panarchy model of adaptive cycle**

Source: Adapted from Holling and Gunderson (2002:34-41) and Pendall et al (2010:76)

Turning a crisis into an opportunity requires a great deal of preparedness which in turn depends on the capacity to imagine alternative futures: it is just such a capacity which does, or ought to, define

planning in broad terms. Planning is, thus, about being prepared for innovative transformation at times of change and in the face of inherent uncertainties. I will come back to the parallels between evolutionary resilience and planning later in the paper.

The adaptive cycle presents a number of paradoxes, such as: persistence versus change, flexible versus efficient, resilient versus transformational, and connected versus adaptable (Gunderson, 2000). To resolve these contradictions, Gunderson and Holling (2002) have developed the idea of 'panarchy', as opposed to hierarchy, which suggests that: firstly, the phases are not necessarily sequential or fixed; and secondly, systems function not in a single cycle, but rather in a series of nested adaptive cycles that operate and interact. They do so at multiple scales from small to large; at different speeds from slow to fast; and, in various timeframes from short to long. This allows systems to be both efficient and innovative: they are highly connected yet also free to experiment because these properties manifest themselves at different times and scales. It is this panarchy model of adaptive cycle that underpins the evolutionary meaning of resilience. Resilience in this perspective is understood not as a fixed asset, but as a continually changing process; not as a *being* but as a *becoming*. Furthermore, resilience is performed when systems are confronted with disturbance and stress. This means that, for example, people might become resilient not in spite of adversities but because of them. Disturbance can be understood not just as acute shocks, but also as chronic slow burns. The evolutionary perspective broadens the engineering and ecological description of resilience to incorporate the dynamic interplay of persistence, adaptability and transformability across multiple scales and timeframes (Holling and Gunderson, 2002; Walker et al, 2004; Folke et al, 2010). This has brought the role of institutions, leadership, social capital and social learning into the scope of resilience (Olsson et al, 2006).

Advances on this type of conceptualisation have been made largely by scholars working at the interface of social and ecological systems and their responses to change. As I mentioned earlier, resilience has also gained considerable prominence in social sciences. In the *Social Science Citation Index*, the annual references to resilience as a topic, although not necessarily the evolutionary perspective, increased by 400% between 1997 and 2007 (Swanstrom, 2008:4). Scholars have begun to focus on synergies between evolutionary resilience and similar approaches used in disciplines other than ecology, such as regional economic theories (Simmie and Martin, 2010) and socio-technical studies (Janssen et al, 2006).

## **Evolutionary resilience and interpretive planning**

In planning, although resilience is a relatively new concept it is rapidly gaining salience. Indeed, there are some promising parallels between evolutionary resilience and the interpretive approach to planning because both put the emphasis on “fluidity, reflexivity, contingency, connectivity, multiplicity and polyvocality” (Davoudi and Strange, 2009:37). Evolutionary resilience promotes the understanding of places not as units of analysis or neutral containers, but as complex, interconnected socio-spatial systems with extensive and unpredictable feedback processes which operate at multiple scales and timeframes. This resonates strongly with the relational understanding of spatiality which, according to Doreen Massey, is defined by “simultaneity of multiple trajectories” (Massey, 2005:61). Evolutionary resilience discourages fixity and rigidity in the same way as interpretive planning discourages the modernist ‘will to order’ (Davoudi, 2012a). Both recognise the ubiquity of change, inherent uncertainties, and the potential for novelty and surprise. Both advocate the exploration of the unknown and the search for transformation. In my view evolutionary resilience offers a useful framework which allows us to think in new ways about planning: ways that have a lot in common with interpretive planning and the relational understanding of space and time.

## **Translating resilience from the natural to the social world**

Notwithstanding these parallels, we need to tread carefully when translating resilience thinking from the natural to the social world. There are at least four critical issues which deserve particular attention. The first one relates to the *intentionality* of human actions. The adaptive cycle seems overly deterministic, not allowing for human intervention to break cycles through their ingenuity, technology and foresight. Ecologists recognise this limitation and have, hence, suggested that in the social context adaptive cycles and their outcomes should be considered as tendencies rather than inevitabilities. This means that interventions in processes can indeed diminish, sustain, or enhance resilience. Intervention, in turn, raises a number of normative and political questions. The first one relates to the idea of *self-organisation* which is inherent in resilience thinking. When this is translated into the social context, it becomes highly charged with ideological overtones as it refers to *self-reliance*. It is argued that the emphasis on self-reliance in resilience thinking is a quintessentially American idea, referring to the ability of people and places to “pull themselves up by their bootstraps and reinvent themselves in the face of external challenges” (Sawnstrom, 2008:10). A close look at the resilience-building literature in the UK shows that a subtle version of ‘self-reliance’ is repeatedly advocated. For example, the BIS-supported report on community resilience (mentioned above) argues that their “system dynamic diagram shows that if the Government takes greater responsibility for risks in the community, it may feel under pressure to take increasingly

more responsibility, thereby eroding community resilience” (Risk & Regulation Advisory Council, 2009:6). This seems to suggest that the government should retreat from its responsibilities; a favourable conclusion in the current neoliberal climate in the UK. Similarly, in their ‘Resilient Nation’ report, Demos advocate that, British society is increasingly ‘brittle’ but resilience is built not by government and the institutions of the state, but by individuals and communities (Edwards, 2009). While the existence of engaged social networks help foster adaptive capacity and enhance transformative resilience, it is not a substitute for responsive and accountable governance. Advocating the rolling back of the state’s support for vulnerable communities in the name of resilience is a misguided translation of self-organisation in ecological systems into self-reliance in social systems: it advocates a kind of social Darwinism.

The second critical issue relates to the *outcome* or purpose of resilience: resilience to what ends? In ecological literature, the desirable outcome of resilience is sustainability which is often defined uncritically. In the social context, defining what is desirable is always tied to normative judgements. Quite often, particular outcomes are perceived as ‘natural’ or desirable while others are dismissed as a lack of resilience. For example, in psychology, a return to social conformity may be considered as a desirable outcome of individuals’ resilience in the face of adversity. If the outcomes depart from the perceived desirable, reaching an alternative outcome may not be seen as a sign of resilience.

The third issue is the question of defining a system’s *boundary*. In a particular ecosystem, the analysis of resilience has to determine the ‘resilience of what to what’. This means that analysts inevitably focus on some things and discount others. In the social context, a bounded approach soon leads to exclusionary practices.

The fourth challenge of translating resilience from ecology to society relates to *power and politics* and the conflict over questions such as what is a desired outcome and resilience for whom? In the ecological literature, resilience is almost power-blind and a-political, partly because ecologists often subscribe to the idea that: “There are in nature no rewards or punishments, just consequences” (Westley et al, 2012:103). This may be true, but in society there are always rewards and punishments: some people gain while others lose in the process of resilience-building. Resilience for some people or places may lead to the loss of resilience for others. Therefore, in the social context we cannot consider resilience without paying attention to issues of justice and fairness in terms of both the procedures for decision-making and the distribution of burdens and benefits.

## **Concluding remarks**

Pitfalls such as those mentioned above have led Swanstrom (2008:6) to argue that, “applying the framework of ecological resilience to human institutions and governance processes generates paths to greater understanding, as well as dead ends”. I am less pessimistic and believe that evolutionary resilience with its: rejection of equilibrium, emphasis on inherent uncertainty and discontinuities, and insight into the dynamic interplay of persistence, adaptability and transformability provides a useful framework for understanding how complex socio-ecological interdependencies work. I also believe that it has the potential to become a bridging concept between the natural and the social sciences and stimulate interdisciplinary dialogues and collaborations. As far as planning is concerned, I think it offers promising parallels with the interpretive approach to planning, which are worth exploring further. However, in applying an ecologically-rooted concept to the social setting, we need to tread carefully and ensure that in trying to understand society through the lens of ecology, we do not lose the insights from critical social science. In the social world, resilience has as much to do with shaping the challenges we face as responding to them.

## **Acknowledgement**

This paper is based on the author’s keynote speech presented at the annual UK/Ireland Planning Research Conference, 12-14 September 2011, Birmingham. A slightly different version of the paper is published as: Davoudi, S. (2012) Resilience: A Bridging Concept or a Dead End? *Planning Theory and Practice*, Volume 13, Issue 2, pages: 299-307

## **References**

Adger, W. N. (2003) ‘Building resilience to promote sustainability’ *IHDP Update 2*, 1-3.

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

Bonanno, G. A. (2004) ‘Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events?’ *American Psychologist*, 59(1):20–28.

Cabinet Office (2011) *Strategic National Framework on Community Resilience*, London: Cabinet Office.

CIAM (1933) *CIAM's The Athens Charter*, Available online from: <http://modernistarchitecture.wordpress.com/2010/11/03/ciam%E2%80%99s-%E2%80%9Cthe-athens-charter%E2%80%9D-1933/>, Accessed 18/04/2011.

Carpenter, S. R., Westley, F. and Turner G. (2005) 'Surrogates for resilience of social-ecological systems', *Ecosystems*, **8**(8): 941-944.

Davoudi, S. (2012a) 'The legacy of positivism and the emergence of interpretive tradition in spatial planning', *Regional Studies*, 2012, **46**(4): 429-441

Davoudi, S. (2012b) Climate risk and security: New meanings of 'the environment' in the English planning system, *European Planning Studies*, **20**(1) 49-69

Davoudi, S. and I. Strange (2009) 'Space and place in the twentieth century planning: An analytical framework and an historical review', in Davoudi, S. and I. Strange, (eds) *Conceptions of Space and Place in Strategic Spatial Planning*, London: Routledge.

Davoudi, S., Brooks, E and Mehmood, A., (2013) Evolutionary resilience and strategies for climate adaptation, *Planning Practice and Research*, **28**(3):307-322

Duit, A., V. Galaza, K. Eckerberga, J. Ebbesson, (2010) 'Governance, complexity, and resilience', *Global Environmental Change*, **20**(3): 363–368.

Edwards, C. (2009) *Resilient Nation*, London: Demos.

Folke, C., S. Carpenter, B. Walker, M. Scheffer, T. Chapin, and J. Rockstrom (2010) 'Resilience thinking: Integrating resilience, adaptability and transformability', *Ecology and Society*, **15**(4): 20-28.

GLA (Greater London Authority) (2010), 'The draft climate change adaptation strategy for London: Public Consultation Draft', London:Greater London Authority.

Gunderson, L. H. (2000) 'Ecological resilience - In theory and application', *Annual Review of Ecology and Systematics* **31**: 425-439.

Gunderson, L. H. and C.S. Holling (2002) *Panarchy: Understanding transformations in human and natural systems*, Washington, DC: Island Press.

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

Holling, C. S. (1986) 'The resilience of terrestrial ecosystems: local surprise and global change', in Clark W.C. and R.E. Munn (eds) *Sustainable Development of the Biosphere*, London:Cambridge University Press.

Holling, C.S. (1996) 'Engineering resilience versus ecological resilience', in Schulze, P.C. (ed) *Engineering within ecological constraints*, Washington, DC:National Academy Press.

Holling, C. S. and L.H. Gunderson (2002) 'Resilience and adaptive cycles', in Gunderson L.H. and C.S. Holling, *Panarchy: Understanding transformations in human and natural systems*, Washington, DC: Island Press.

Janssen M., M. Schoon, W. Ke, and K. Borner (2006) 'Scholarly networks on resilience, vulnerability and adaptation within the human dimensions of global environmental change' *Global Environmental Change*, 16(3): 240-252.

Kinzig, A. P., P. Ryan, M. Etienne, H. Allison, T. Elmqvist, and B. H. Walker (2006) 'Resilience and regime shifts: assessing cascading effects', *Ecology and Society* 11(1): 20. Available online at: <http://www.ecologyandsociety.org/vol11/iss1/art20/>, accessed 27 February 2012.

Massey, D. (2005) *For Space*, London: Sage.

Olsson, P., L. H. Gunderson, S. Carpenter, P. Ryan, L. Lebel, C. Folke and C.S. Holling (2006) 'Shooting the rapids: Navigating transitions to adaptive governance of social-ecological systems', *Ecology and Society* 11(1):18, available online at: <http://www.ecologyandsociety.org/vol11/iss1/art18/>, accessed 27 February 2012.

Pendall, R., K. A. Foster and M. Cowell (2010) 'Resilience and regions: Building understanding of the metaphor', *Cambridge Journal of Regions, Economy and Society* 3(1): 71-84.

Risk and Regulation Advisory Council (2009) *Building resilient communities, from ideas to sustainable action*, London: RRAC.

Scheffer, M. (2009) *Critical transitions in nature and society*. Princeton: Princeton University Press.

Simmie J. and R. Martin (2010) 'The economic resilience of regions: Towards an evolutionary approach', *Cambridge Journal of the Regions, Economy and Society*, 3(1):27-43.

Swanstrom, T. (2008) 'Regional resilience: a critical examination of the ecological framework', *IURD Working Paper Series*, Berkeley, CA: Institute of Urban and Regional Development, UC Berkeley.

Taylor, P. (2005) 'Time: from hegemonic change to everyday life', in Holloway, S., S. Rice and G. Valentine (eds), *Key concepts in Geography*, London: SAGE.

The Young Foundation (2010) *Building Resilient Communities*, London: The Young Foundation.

Vale, L. J., and T. J. Campanella (2005) (eds) *The Resilient City: How Modern Cities Recover from Disaster*, New York: Oxford University Press.

Walker, B., C. S. Holling, S. Carpenter, and A. Kinzig (2004) 'Resilience, adaptability and transformability in social-ecological systems', *Ecology and Society* 9(2):5, available online at: <http://www.ecologyandsociety.org/vol9/iss2/art5/>, accessed 27 February 2012.

Westley, F. et al. (2002) "Why systems of People and Nature are Not Just Social and Ecological Systems" in, L. H. Gunderson and C. S. Holling (eds) Panarchies: Understanding Transformations in Human and Natural Systems, Washington D.C.: Island Press: 103-119.