Resilience Planning: Forging a New Planning Paradigm

By

Peter Newman, Curtin University

And

Tim Beatley, University of Virginia

Abstract

The environment has been a significant focus for planning education since the 1960's. This paper traces the transition of environmental planning through the sustainability era to the emergence of a new and more accelerated transition that increasingly is termed resilience. It outlines the emerging characteristics of resilience and suggests they need to become part of a new paradigm in planning education – resilience planning.

Keywords: resilience, planning, sustainability, planning education

The Environmental Policy Era

Environmental limits at local levels due to overcutting, overgrazing, overuse of groundwater and in general over exploitation of natural resources, has been part of human history for thousands of years (Marsh, 1864). By the 1960's awareness of these local limits had begun to reach global awareness as the last easy arable land had been opened up and the first hints of global limits to the forests, oceans and atmosphere began to be understood. At this time planning degrees began to incorporate more and more environmental planning into their curricula.

Silent Spring alerted us to a new and more global environmental threat in the 1960's and since then there has been an accelerating awareness of the limits on unrestrained economic activity. There was always a market for chlorinated hydrocarbons but its impact on mammalian biochemistry due to its long term storage in fatty tissues led to the need for regulations to prevent their use. The sense of global environmental limits combined with the sense of global chemical contamination to form the basis of deep environmental concern and the need for environmental policy. This global issue, which spread across every national and geographical border, led to the global environmental policy movement, described by one commentator as 'one of the largest mass movements in history' (McCormick, 1991).

The environmental policy movement was given huge momentum across the world after the 1972 Stockholm World Conference on the Human Environment. National, state and local government everywhere began to set up environmental regulations, create environmental departments and legislate for environmental assessment. Planning included environmental issues in an increasing focus but the major priority was on the development of the new disciplines in environmental engineering and environmental science.

For nearly 20 years public policy created innovative processes for managing the environment mostly through technical change induced by regulation. But it wasn't enough.

The Sustainability Policy Era

Awareness of the deeper causes of environmental degradation has always been part of the environmental debate. The need to minimise the overall footprint from natural and physical resource consumption was recognised as the fundamental metabolism of impact in the 1960's and 1970's (Ehrlich, Ehrlich and Holdren, 1970). However the environmental profession focussed on technically achievable outcomes through product regulation, waste regulation and impact assessment. The environmental movement (and planning education) however was driven to express the need for more fundamental change to cultural attitudes and to the economic system. Thus environmental policy debates began to include questions that sought more fundamental reform.

Immediately the threat of large-scale non-technical change was imputed as being necessary there were significant political repercussions. Adding new technologies to control environmental problems is fine but suggesting economic and social change is not so easy.

At the same time that deeper social and economic change was seen as necessary, Third world growth and progress were being seen as seriously flawed and the planet just not big enough to allow the 3rd world to take the same economic route. The environmental movement thus began to have an anti-development thrust that had potentially global repercussions. Development-oriented politicians and indeed 1st world global equity protagonists began to see that there were large implications if economic growth was hampered due to the new sense of environmental limits.

Mme Brundtland and the UN World Commission on Environment and Development were called into resolve this impasse (WCED, 1987). Thus the sustainability policy era was invented as a way to try and integrate the goals of environmental protection, social advancement and economic prosperity.

Sustainability policy became a major focus of public policy at all levels of government from the 1990's to the present. The need for integration and long-term synergistic solutions to the fundamental causes of environmental degradation began to be worked through. In Australia the Federal Government ESD process, the Western Australian State Sustainability Strategy and the NSW Sustainability Commissioner's role were part of one author's (PN) experience of sustainability policy; there were some creative solutions found through this new policy process (Newman, 2006; Beatley with Newman 2009). Similar experiences of developing sustainability policy were developed across the world in national, state and local government as well as in major corporations. However next steps and demonstrations tested every fibre of government and business. Synergies from integrated sustainability policy can be found but it is still easier for governments and corporations to do nothing about the deeper, long-term issues.

Planning and sustainability were natural allies. Planning always had a goal of being integrative and long-term in its perspective, however the need to reduce the footprint of settlements was a new idea and needed a lot of work to recognise how it could be brought into settlement planning. Today there is hardly a single university that would not use the concept of sustainability as a fundamental part of their curricula and indeed it is a major part of all Planning Schools.

Sustainability has seeped through into every part of government across the world and heroic stories and case studies abound (Newman & Jennings, 2008). However there is a growing disconnect between the aspirations of sustainability (to reduce the overall footprint whilst improving liveability) and the realities of the political and economic system.

As each year of minimal change occurs the veracity and viability of sustainability policy becomes more deeply questioned. The highpoint of aspiration over climate change policy was in 2007 with the UN's Intergovernmental Panel on Climate Change (IPCC) and Al Gore receiving the Nobel Peace Prize and Nicholas Stern and Ross Garnaut showing the economic case for deep carbon cuts. However the Global Financial Crash of 2008 undermined most of these aspirations, at least the sense that the transition would be easy once a global treaty was established.

The importance of sustainability policy remains. The fiasco over the Murray Darling Plan in Australia is a good example. Having independent environmental science as the legal basis of the Murray Darling Commission findings it was inevitable that an environmental focus would be the outcome of the proposed Plan. Yet the social and economic change it implied was not pursued in anything like the same degree leading to an obvious set of trade-offs rather than synergies. Similar case studies can be found across the world. Without an integrated sustainability approach it is hard to achieve any necessary changes, including the obvious environmental changes. Environmental fundamentalism is not good policy.

At the same time economic fundamentalism remains bad policy but continues to be a feature of modern government. For example, the endless supply of reports from economic institutions such as the Australian Productivity Commission that focus almost entirely on economic issues without considering environmental and social factors equally remains an obvious reminder of the need for sustainability to be part of public policy.

However the deeper issue over the extent of change achievable through sustainability policy remains. Is it sustainable just to ensure integration has occurred? How much social and political change is really needed to ensure the environmental fundamentals are not just slowly getting worse? Increasingly, planning professionals as well as engineers and academics are asking whether sustainability is enough. Something more seems to be needed.

There is a consensus, for example, amongst global scientists that the challenge of climate change is not being adequately addressed and that each year action is postponed means there is a greater need for harsher measures (IPCC, 2009). The problem of peak oil is the other recent issue to question our ability as a world to deal with excessive resource consumption (Deffeyes, 2005). Similar sentiments are expressed about biodiversity and even water at a global level (Brown, 2006).

So what could be the next phase of public policy that can begin to address in a more transformative way the underlying combinations of technology, social change and economic reform that are needed to enable the environmental policy transition?

The Resilience Policy Era

Resilience has become the term in recent times to express the need for systemic approaches to our environmental problems (Folke, 2002). It has come from an awareness of the need for deeper

changes if environmental issues are to be seriously addressed, combined with the insights from systems theory, especially complex adaptive systems (Holland, 1999).

Australians have played an important role in this emerging area of public policy through the work of Walker, Salt and Reid (2006) and Wallington, Hobbes and Moore (2005) on resilience thinking that built on the more theoretical work of the Canadian Holling (2002). They applied resilience to the complex social-economic ecological systems in rural areas like coral reefs and river catchment systems. In Newman, Beatley and Boyer (2009) we have tried to apply this approach to cities.

Resilience tries to enable a system to adapt to an outside influence that is threatening its ability to survive or thrive. Like complex adaptive systems approaches, resilience tries to find those key points of change that can lead to a transformation of the system. It is not just trying to do what you can, even if its integrated and long term. It seeks to do much more. It is constantly seeking a tipping point (Gladwell, 2000).

Resilience builds on the previous parts of the environmental transition, it takes the technical work of environmental policy and the integrative work of sustainability policy, and adds to it a transformative element. It is sustainability on steroids.

Resilience policy in our view provides a framework for cities and regions to:

- **Enhance their ecological regeneration – not just minimise impact;**
- **Dramatically reduce their resource consumption – especially fossil fuels and water;**
- **Provide increased economic opportunities – not reduced opportunity as suggested by many in the 'degrowth' movement; and**
- **Make more liveable and equitable settlements.**

All this needs to occur at the same time.

The task may seem to be impossible because after 50 years of environmental policy, the results are not dramatic. The achievements of the environmental movement are also not 'nothing' and people like David Susuki can look at the changes they observe with some hope (Susuki and Dressell, 2002). Perhaps the growing awareness that there is 'too little, too late' going on to address the big problems, means that these early stages were needed – but were indeed not enough. Perhaps it is time for professions (including planning) to take on this new paradigm for their practice?

The early days of environmental policy were very uncertain as public officials and industry grappled with how to tackle the issues. The reductions in chlorinated hydrocarbons, the tackling of ozone depleting chemicals and the reduction of automobile pollutants were all examples of environmental policy success. Environmental assessment continues to be an important ongoing part of public policy that despite review and reforms in most governance systems is usually maintained or strengthened.

In the same way sustainability policy had a very uncertain start. Despite the appeal of the concept there were no manuals on what to do. The successes of sustainability policy can be seen in the assessment of urban development applications, green building ratings, and areas such as natural resource management and water supply management as well as the growing use of sustainability

appraisal or sustainability assessment in large complex projects and plans. This should encourage us to continue to apply the concept.

Thus the obvious reaction that resilience policy (as outlined above with its dramatic reductions in resource consumption) may be too hard, should not prevent us from beginning to try and see how it could possibly be made to work. Is it possible to begin applying the notion of resilience as the basis of strategic planning?

Resilience is a better word at encapsulating the driving need to adapt urban and regional systems to climate change and peak oil (the main focus of our book). The decarbonising agenda has powerful environmental and economic motivations but cities do not appear to have the tools to enable them to take up this agenda. So the market is forcing changes anyway. The peak price of oil in 2008 of $140 a barrel was a large cause of the GFC as so many vulnerable parts of US cities could not pay mortgages as gasoline prices tripled. The shift to building public transport and not building scattered car dependent suburbs has proceeded rapidly since 2008 – 82 Chinese cities are building metros as are 14 Indian cities and even the large oil-rich cities of the Middle East are now building rail. Now we are seeing 'peak car use' setting in amongst the industrial cities of the world (Newman and Kenworthy, 2011). The best way to describe this trend is to say it is forcing cities to become more resilient though it is clearly not yet enough. Now it will be necessary to find tools that can enable the major reductions in resource use to continue whilst enabling the economy and quality of life to be improved across the world's cities.

The best assessment tools we have developed in environmental and sustainability policy have not yet been applied seriously to address the issue of carbon independence in general and oil vulnerability in particular. Strategic Environmental Assessment and Sustainability Assessment have been the main new tools of environmental and sustainable policy (Pope, Annandale and Morrison-Saunders, 2004) along with Strategic Planning to address long-term settlement issues. The older tool of Strategic Planning is still fundamental to the planning profession but perhaps it needs to be given a make-over in its focus and application. And the tools of Statutory Planning are also needing a make-over to enable the resilience of cities to be part of any urban and regional planning assessment for resilience. If cities and regions had the political will to address carbon and oil then they would add them into this new mix of tools. However few have done this and so few governments are ready for this agenda of resource depletion and energy vulnerability.

Perhaps Resilience Planning is the new tool we need to adequately address the adaptations required to cope with the new resource depletion shocks. This would focus on oil and carbon in general, with water as well, particularly in places like Australia. Resource consumption needs to be linked into planning for housing, accessibility, community services and economic productivity – it can no longer be left to the market as it is now shaping our cities and could undermine most of the hard won gains for planning in terms of environmental and equity gains.

Resilience can also have a much more positive element to its contribution. If a city or region can easily bounce back from shocks like climate change, oil depletion price hikes or deep droughts (even earthquakes), then it also has a strong economy and strong community. It has a much deeper belief in itself. It has a lease for its long term future and this is what drives cities to be confident, to be innovative and to be creative. It is a fundamental of good governance. Hope is the basis of a resilient city.

In our 2009 Resilient Cities book we have set out what we believe are the seven characteristics of a Resilient City and how the first examples of this can now be seen. There is no city however that has begun to show all seven characteristics. They do however provide the basis for beginning to think about how resilience planning could be formulated to ensure the next era of the environmental policy agenda is facilitated and implemented.

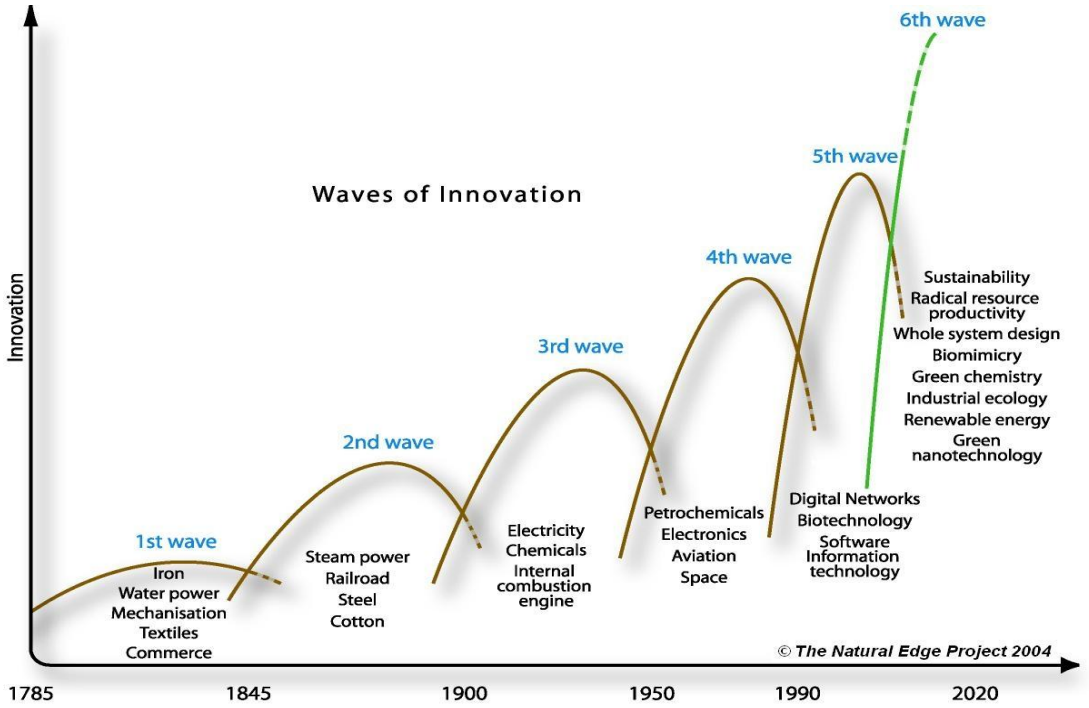
Characteristics of resilient planning cities and regions

Globally, there are seven features of resilient cities and regions that are emerging. These are described as seven archetypal cities:

- the renewable energy city
- the carbon-neutral city
- the distributed city
- the biophillic city
- the eco-efficient city
- the place-based city
- the sustainable transport city.

These city types are overlapping in their approaches and outcomes. The challenge for urban professionals is to apply all of these approaches together, to generate a transformational sense of purpose through a combination of new technology, city design and community-based innovation. They each have an environmental dimension and indeed a sustainability dimension but they give an extra dimension that includes radical resource efficiencies and resilience. They are therefore part of the transition in environmental policy that is necessary to address before the wicked problems that we now face can begin to be properly addressed.

The resilience agenda can also be seen in the theory of economic waves and innovation cycles summarised by Hargroves and Smith (2004) where the 4th wave based around cheap oil is being replaced by a digital wave and a sustainability wave. The key element of this new wave is 'radical resource productivity' and it is the key to the newly emerging green economy. The combination of smart and sustainable technologies and practices listed by Hargroves and Smith, are at the heart of the new resilience policy era.



1. The renewable energy city

There are now a number of urban areas that are partly powered by renewable energy technologies, from the region to the building level. Renewable energy enables a city to reduce its ecological footprint, and if using biological fuels, can be part of a city's enhanced ecological functions. Renewable energy production can and should occur within cities, integrated into their land use and built form, and comprising a significant and important element of the urban economy. Cities are not simply consumers of energy, but catalysts for more sustainable energy paths, and can increasingly become a part of the earth's solar cycle (Droege, 2006).

New model cities that are 100% renewable are needed (see Masdar City in the United Arab Emirates), but retrofitting existing cities is just as important. In Europe, Freiburg and Hannover have become demonstrations on how to bring renewable energy into city planning (City of Hannover, 1998; Scheurer and Newman, 2008). Along with planning strategies and incentives (financial and density bonuses), renewable cities recognize the need to set minimum regulatory standards (see Barcelona solar ordinance).

Every city needs to have a goal of major increases in renewable energy but, by itself, this will not be enough to ensure resilient urban development that can meet the 80% less CO2 goal by 2050. However cities will need to assess policies for economically introducing renewables and to assess

each new development in a city to show how its renewable energy components can be contributing to the city. This should be a key part of resilience planning.

2. The carbon-neutral city

Many businesses, universities, local governments and households are now committed to minimizing their carbon footprint by becoming carbon neutral. This process is governed by an assessment process through the Carbon Trust in Australia and represents another potential element of resilience assessment: whole system carbon analysis. By assessing the level of carbon used, the way it is reduced by renewables and offset by carbon sequestration, a new element of assessment has been introduced into government. The power of this assessment has not yet been fully seen as it has not yet been applied to the built environment and its assessment processes.

The next phase of urban development however is moving towards a greater awareness of carbon if not yet moving to 'post-carbon cities' (Lerch, 2007). The United Kingdom government has decided that all urban development will be carbon neutral by 2016, and phasing in began in 2009. The Beddington Zero Energy Development initiative is the first carbon-neutral community in the United Kingdom. It has extended the concept to include building materials and, as it is a social housing development, it has shown how to integrate the carbon neutral agenda with other sustainability goals, making it a more resilient demonstration. Transport is not included in the assessment.

Cities using carbon neutral as their planning strategy include Malmö and Växjö in Sweden, Newcastle (UK), Adelaide, Sydney and Fremantle in Australia. Vancouver's Winter Olympic Village was built as a model North American demonstration in carbon neutral urban development.

The link to the green agenda of a city is very direct with respect to the carbon neutral approach of bioregional tree planting schemes. By committing to be carbon neutral, cities can focus their offsets into bioregional tree planting, as part of the biodiversity agenda as well as to address climate change. Although there are many good tree-planting programs (see Australia's Green Fleet and Gondwana Links), none are committed yet to a comprehensive city-wide carbon-neutral approach that can link tree planting to a broader biodiversity cause. If this is done, cities can raise urban and regional reforestation to a new level and contribute to reducing the impact of climate change, simultaneously addressing local and regional environmental issues.

3. The distributed city

The development of distributed power, water and waste systems is the most obvious expression of the new 5th and 6th wave technologies. They are small scale neighbourhood-based systems and yet appear to be more cost effective than large centralized systems characteristic of cities built in the 4th wave. The distributed use of power and water can enable a city to reduce its ecological footprint, because power and water can be more efficiently provided using the benefits of local distribution, electronic control systems and community-oriented utility governance (Benedict and McMahon, 2006).

A number of large cities including New York, London and Sydney are moving to distributed energy generation through co-generation and tri-generation from natural gas as well as local solar and wind. This distributed generation offers a number of benefits, including energy savings, given the ability to provide power without long distribution lines, better control of power production to meet demand, lower vulnerability and greater resilience in the face of natural and human-made disaster (including terrorist attacks and earthquakes). Clever integration of this small scale infrastructure into a grid can be achieved with new technology control systems that balance the whole system in its demand and supply from a range of sources as they rise and fall and link it to storage, especially vehicle batteries through vehicle-to-grid, or 'V2G', technology (Went, James and Newman, 2008). A number of such small-scale energy systems are being developed to make cities more resilient in the future (Sawin and Hughes, 2007).

Each city requires a tool to enable it to assess the cost and carbon/water implications of any infrastructure, especially in urban developments that are planning to use the new green infrastructure of small scale, localised systems. We have examined the tools used in assessing carbon in urban development and found only two out of nearly 80 that used the smart systems of the web to enable carbon and cost calculations to be made on any urban design (. These tools will be part of resilience planning.

4. The biophilic city

Biophilic cities are using natural processes as part of infrastructure: green roofs, green walls and integrated open space management together with creative use of urban areas for food production (Beatley, 2010). One of the core reasons for cities moving down the Biophilic path is to air condition their city through the photosynthetic cooling effects of plants and water in the urban landscape as well as using less heat absorbing materials. Chicago and Toronto are requiring green roofs in commercial development and Singapore is moving to be Asia's first Biophilic City (Newman, 2010).

Progress in moving away from fossil fuels also requires serious localizing and local sourcing of food and building materials (Halweil and Nierenberg, 2007). This, in turn, provides new opportunities to build more biophilic economies. The value of emphasizing the local is many-fold with the primary benefit of dramatic reductions in the energy consumed in mass producing and delivering products and food (see BedZed example). A biophilic approach can produce local fibre which will mean an added reduction in fibre miles as well as potential to help re-grow local bioregions.

The new agenda of the biophilic city will be confronting every city as it seeks to cool the urban environment through landscaping of land and buildings. Cities are beginning to require biophilic design and the assessment criteria for this in terms of carbon implications, water and biodiversity, need to be part of resilience planning.

5. The eco-efficient city

The 5th and 6th wave will require industry to play its role in radical resource efficiency. This agenda is usually called eco-efficiency, where industry is moving from linear to circular or closed-loop systems, where substantial amounts of their energy and material needs are provided from waste streams. Eco-efficient cities reduce their ecological footprint by reducing wastes and resource requirements, especially in industrial parks through industrial ecology (waste exchanges). Good examples exist in Kalundborg, Germany, and Kwinana, Australia (Newman and Jennings, 2008). The eco-efficiency agenda also includes the 'cradle to cradle' concept for the design of all new products (McDonaugh and Braungart, 2002). The next wave of innovation has a lot of potential to create the kind of eco-efficiency gains that are required (Hawkens et al., 1999; Hargrove and Smith, 2006).

One extremely powerful example of how this eco-efficiency view can manifest in a new approach to urban design and building can be seen in the dense urban neighbourhood of Hammarby Sjöstad, Stockholm, which is connected to central Stockholm by a high-frequency light-rail system. Here, from the beginning of the planning of this new district, an effort was made to think holistically, to understand the inputs, outputs and resources that would be required and that would result. For instance, about 1,000 flats in Hammarby Sjöstad are equipped with stoves that use biogas extracted from wastewater generated in the community. Biogas also provides fuel for buses that serve the area. Organic waste from the community is returned to the neighborhood in the form of district heating and cooling. Industries in the area are similarly integrated in their resource and waste management (Newman, Beatley and Boyer, 2009).

Cities need a tool that can assess the eco-efficiency of developments including the way that products are designed to minimise their footprint and wastes are integrated into the overall carbon reduction goal of the city. Perhaps the eco-efficiency agenda can also be incorporated into resilience assessment and planning.

6. The place-based city

The more place-oriented and locally self sufficient a city's economy is, the more it will reduce its ecological footprint and the more it will ensure that its valuable ecological features are enhanced. Place-based city concepts will increasingly be the people-oriented motivation for the infrastructure and technological decisions that are made in each of the other city types. When people belong and have an identity in their town or city, they want to put down their roots and create local enterprise – to create a slow city.

Local economic development is a first priority for most cities. As part of this, many cities are placing increasing emphasis on local place identity, as social capital has been found to be one of the best ways to predict wealth in a community (Putnam, 1993). Thus, when communities relate strongly to the local environment, the city's heritage and its unique culture, they develop a strong social capital of networks and trust that forms the basis of a robust urban economy (Sirolli, 1999).

Sense of place in a city requires paying attention to people and community development in the process of change — a major part of the urban planning agenda for many decades. This localized approach will be critical to creating a resilient city. It creates the necessary innovations as people dialogue through options to reduce their ecological footprint, which in turn creates social capital that is the basis for on-going community life and economic development (Beatley and Manning, 1997; Beatley, 2005). City dwellers in many countries increasingly want to know where their food is grown, where their wine comes from, where the materials that make up their furniture come from. In addition to a slow movement for local foods, a slow fibre and slow materials movement for local fabric and building purposes can also help create a sense of place and make greater resilience.

Cities need to be able to assess the carbon reduction potential and cost –benefits of different ways of bringing local jobs and slow products into their community. Perhaps this can be done through resilience planning.

7. The sustainable transport city

Transport is the most fundamental infrastructure for a city, because it creates the primary form of the city (Newman and Kenworthy, 1999). Cities, neighbourhoods and regions are increasingly being designed to use energy sparingly by offering walkable, transit-oriented options, more recently supplemented by vehicles powered by renewable energy. Cities with more sustainable transport systems can increase their resilience by reducing their use of fossil fuels through reduced urban sprawl and reduced dependence on car-based infrastructure. Such matters should be part of assessment processes but are not yet required in most cities.

The agenda for large sprawling cities now is to become a Polycentric City where real cities in the suburbs are rapidly developed as local centres of jobs, services and the focus for bringing distributed infrastructure. This will significantly reduce car use and help cities face peak oil and the need to decarbonise – the first signs of which are now appearing in all US and Australian cities as car use per capita declines and transit grows dramatically (Newman and Kenworthy, 2011).

Sustainable transport strategies will need to incorporate: (i) quality transit down each main corridor that is faster than traffic; (ii) dense Transit Oriented Developments (TOD) built around each station; (iii) pedestrian and bicycle strategies for each centre and TOD, with cycle links across the city; (iv) plug-in infrastructure for electric vehicles as they emerge; (v) cycling and pedestrian infrastructure as part of all street planning; and (vi) a green wall growth boundary around the city preventing further urban encroachment (Newman, Beatley and Boyer, 2009).

Each of the above policy options need to be fed into a tool that can enable cities to rapidly assess the cost and carbon implications of various design and investment options, to assess a city's resilience.

Conclusions

The environmental policy transition has moved from the environmental regulatory approach of the 70's and 80's into the sustainability era of the 90's and 00's; both have a continuing important role to play in governance. However the new era, increasingly being termed resilience, is pressing its case that something more transformative is required. The planning profession needs to be part of this new paradigm. The emerging elements of resilience are emerging as discussed. Each of these can be used to reformulate the outcomes that we want from urban development, projects and plans, and form the basis of resilience assessment and planning with its own set of practices and tools. Such

practices and tools would need to be web-based and community-oriented, enabling 21st century planning policy to be assessed in terms of the resource consumption issues that we face and much bigger goals on these matters need to be set for the urban agenda.

References

Beattie C, Bunning, J, Stewart J and Newman P (2011) 'Carbon assessment tools for urban development' *Greenhouse Gas Measurement and Management* (in press).

Beatley, T (2005) *Native to Nowhere*, Washington, DC: Island Press.

Beatley T (2010) *Biophillic Cities*, Island Press, Washington DC.

Beatley, T and K Manning (1997) *The Ecology of Place,* Washington, DC: Island Press.

Beatley T with Newman P (2009) *Green Urbanism Down Under*, Washington DC, Island Press.

Benedict, M and E MacMahon (2006) *Green Infrastructure: Linking Landscapes and Communities*, Washington, DC: Island Press.

Brown L (2006) *Plan B 2.0: Rescuing a Planet Under Stress and a Civilisation Under Trouble* **,** Norton, New York.

City of Hannover (1998) *Hannover Kronsberg: Model for a Sustainable New Urban Development*, City of Hannover.

City of Malmö (2005) *Sustainable City of Tomorrow: Experiences of a Swedish Housing Exposition*, Stockholm.

Deffeyes K S (2005) *Beyond Oil : The View from Hubbert's Peak,* Hill and Wang, New York.

Droege, P (2006) *The Renewable City*, Chichester: Wiley.

Ehrlich P, Ehrlich A and Holdren J (1970) *Population, Resources, Environment***,** Freeman, San Francisco.

Folke C et al (2002) *Resilience and Sustainable Development:*
Building Adaptive Capacity in a World of Transformations, Scientific Background Paper on Resilience for the process of The World Summit on Sustainable Development on behalf of
The Environmental Advisory Council to the Swedish Government, EAC, Stockholm.

Gladwell M (2000) *The Tipping Point: How Little Things Can Make a Big Difference,* Little Brown.

Halweil, B and D Nierenberg (2007) Farming Cities in O'Meara M (ed) *State of the World, 2007*, Worldwatch Institute, Washington, DC.

Hardoy J, D Mitlin and D Satterthwaite (2001) *Environmental Problems in an Urbanising World,* London: Earthscan.

Hargrove, C and M Smith (2006) *The Natural Advantage of Nations,* London: Earthscan.

Hawkens, P, A Lovins and H Lovins (1999) *Natural Capitalism: The Next Industrial Revolution*, London: Earthscan.

Holland, John H. (1999). *Emergence: from chaos to order*. Reading, Mass: Perseus Books.

Holling CS (2002), *Panarchy: understanding transformations in human and natural systems*. Edited with L. Gunderson, Washington, DC: Island Press

Lerch, D (2007) *Post Carbon Cities: Planning for Energy and Climate Uncertainty*, Portland, OR: Post Carbon

Marsh, George P (David Lowenthal ed. 1965) (1864). *Man and Nature; or, Physical Geography as Modified by Human Action*. Cambridge, Ma: Belknap Press of Harvard University

McCormick, J (1991) *Reclaiming paradise: the global environmental movement,* Indiana University Press

McDonaugh W and Braungart D (2002) *Cradle to Cradle: Remaking the Way we Make Things*, North Point Press, New York.

Newman, P. (2006) 'The environmental impact of cities' *Environment and Urbanization* **18**(2): 275–295

Newman, P and I Jennings (2008) *Cities as Sustainable Ecosystems,* Washington, DC: Island Press.

Newman, P and J Kenworthy (1999) *Sustainability and Cities: Overcoming Automobile Dependence*, Washington, DC: Island Press.

Newman, P, T Beatley and H Boyer (2009 *Resilient Cities: Responding to Peak Oil and Climate Change*, Washington, DC: Island Press.

Newman P and Kenworthy J (2011) Peak Car use: Understanding the Demise of Automobile Dependence, *World Transport Policy and Practice,* 17(2):32-42

Newman P (2010) Resilient Cities and Application to Singapore, *Environment and Urbanization Asia,* 1(1):149-170.

Putnam, R (1993) *Making Democracy Work: Civic Traditions of Modern Italy*, Princeton, NJ: Princeton Architectural Press.

Sawin, J L and K Hughes (2007) Energizing Cities in *State of the World, 2007*, Washington, DC: Worldwatch Institute, pp90-107.

Scheurer, J and P Newman (2008) *Vauban: A Case Study in Public Community Partnerships,* Case Study for United Nations Global Review of Human Settlements, and on www.sustainability.curtin.edu.au

Sirolli, E. (1999) *Ripples from the Zambezi: Passion, Entrepreneurship, and the Rebirth of Local Economies,* New Society Publishers, Vancouver, BC. See also www.sirolli.com

Sususki D and Dressell H (2002) *Good News for a Change,* Greystone Books, Vancouver.

Walker B, D Salt and W Reid (2006) *Resilience Thinking: Sustaining Ecosystems and People in a Changing World,* Washington, DC: Island Press.

Wallington, T.J., Hobbs, R., Moore, S.A. 2005, 'Implications of Current Ecological Thinking for Biodiversity Conservation: a Review of the Salient Issues', *Ecology and Society*, 10, 1, pp. Article number 15

Went A, James W and Newman P (2008), Renewable Transport: Integrating Electric Vehicles, Smart Grids and Renewable Energy, *CUSP Discussion Paper*, www.sustainability.curtin.edu.au/renewable transport