

## Ecopolis: concepts and initiatives

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### Abstract

An Ecopolis seeks to minimise ecological footprints (biophysical) and maximise human potential (human ecology) to repair, replenish and support processes that maintain life. This chapter argues that the 'ecological polis' is the next evolutionary step for urbanism: built to fit its place, co-operating with nature, empowering the powerless, feeding the hungry, sheltering the homeless; a place of human culture that consciously sustains the cycles of atmosphere, water, nutrients and biology in healthy balance. The author presents four key propositions, defines core principles and sets out steps towards ecological city-making as the basis for strategic planning that can be translated into specific, practical policy. The challenges to achieving sustainable practices in a world where the momentum of climate change threatens to overtake institutional inertia are explored using the concept of 'urban fractals', i.e. experiences with demonstration projects.

### Mostly harmless?

*A 'sustainable city' enables all its citizens to meet their own needs and to enhance their well-being without damaging the natural world or endangering the living conditions of other people, now or in the future.'* Girardet 2000.

A city is more than the sum of its buildings; it includes services and infrastructure that consume energy and land. The making and maintenance of cities creates the greatest human impact on the biosphere. But a city is also, first and foremost, a place of culture (Register 1987b). As part of our species' survival, it is necessary for us to rapidly evolve a culture capable of constructing cities as urban ecosystems that contribute to the ecological health of the biosphere.

The eco-city, or eco-polis, is the next, and perhaps most important step in the evolution of our urban environments: built to fit its place, in co-operation with nature rather than in conflict; designed for people to live whilst keeping the cycles of atmosphere, water, nutrients and biology in healthy balance; empowering the powerless, getting food to the hungry and shelter to the homeless.

Although the ecopolis is about creating human environments specific to their time and place, the concept is both timeless and universal. To make places for everyone, in every land, for all time, cities need to be different, reflecting the characteristics of people, place and processes unique to their regional and temporal location. This 'universal regionalism' can only come about through the consistent and persistent application of

principles embedded in an explicit culture of city-making. The challenge is to embed processes in the life of a city that are as natural to it as bones are in our bodies.

There are numerous definitions of 'sustainable'/'green'/'ecological' cities, such as Girardet's above, and claims to be 'ecological cities' (notably, for its early hubris and influence, Curitiba, Brazil). There have been no widely accepted, functional definitions of what an ecological city does or what it is except as a place to be comfortable, i.e. 'mostly harmless' (Adams 1999). Just as a biologist opens a biology textbook and fails to find a definition of 'life', so those of us concerned with the fate of cities and the sustenance of our environment imagine that we know what a city is, yet lack a clear, shared definition of its fundamental purposes. To open the debate and establish some ground rules, I address the question of why we make cities and provide a testable definition of an ecological city.

Cities have to be more than 'mostly harmless'. They must support massive human populations and repair/redress the enormous damage to the natural world that humans have already done. I propose that an ecological city is exemplified by the 'eco-polis' concept in which the biophysical environmental processes of a region are sustained through conscious intervention and management by its human population. In other words, the citizens of the urban ecosystem seek to fit human activity within the constraints of the biosphere whilst creating housing and urban environments that sustain human culture. In its full realization, the ecopolis is a manifestation of a developed ecological culture, standing in contrast to the expressions of exploitative culture that are our present-day cities.

I say 'ecopolis', rather than 'ecocity', to reinforce the definitional links between social and environmental purposes. 'Eco' refers to ecological purpose and 'polis' to the ideas and ideals of governance that encompass community and self-determination. I adopted the term in 1989, constructing the word from first principles, partly in response to the term 'multi-function polis' then prevalent in Australia. It has been independently discovered or constructed around the world (Koskiaho 1994), adopted by others (Girardet 2004) and has been used to name conferences in Russia (1992), China (2004) and New Zealand (2004).

The ecopolis is about the way we organize knowledge and how we see ourselves. I suggest that architecture and planning are redefined as the art and science, theory and practice, of creating sustainable human settlement, i.e. as subsets of urban ecology. In the early days of the ecocity movement it was not unusual to hear the comment that an 'ecological city' was an oxymoron. The 'mostly harmless' definition of sustainable cities reflects a failure of the imagination, a fear about making more mistakes, about trying to do as little bad as possible. What if we set out to be genuinely 'good' instead? (McDonough & Braungart 2002: 67).

### **Ecopolis Development Principles**

Initially drafted in association with Chérie Hoyle and Emilis Prelgauskas, the 12 Ecopolis Development Principles (EDP) were intended to provide a clear set of precepts for developing human settlement that restored, rather than destroyed, ecological health. The revised version here has 10 principles divided into 'biophysical' and 'biosocial' groups informed by the work of Norbert Schulz from Germany, an intern at Urban Ecology Australia, in 1995 (Box 1). An ecopolis seeks to minimise biophysical ecological footprints (Rees and Wackernagel 1996) and maximise human potential (human ecology) in order to repair, replenish and support the processes that maintain life.

**Box 1. Ecopolis Development Principles** (Source: Downton, <http://www.ecopolis.com.au>)

#### ***The Biophysical Principles – MINIMISE ECOLOGICAL FOOTPRINTS***

1. **Restore Degraded Land:** use urban development to restore health and vitality of land.
2. **Fit the Bioregion:** create human settlements which work with region's natural cycles.
3. **Balance Development:** balance development with the 'carrying capacity' of the land.
4. **Create Compact Cities:** reverse sprawl and stop ad-hoc development over landscape.
5. **Optimise Energy Performance:** generate and use energy efficiently.

#### ***The Human Ecology Principles - MAXIMISE HUMAN POTENTIAL***

6. **Contribute to the Economy:** create work opportunities and promote economic activity.
7. **Provide Health and Security:** create healthy and safe environments for all people.
8. **Encourage Community:** cities are for everyone.
9. **Promote Social Justice and Equity:** equal rights/access to services, facilities and info.
10. **Enrich History and Culture:** respect the past. Look to the future. Celebrate diversity.

### **Overtaken by glaciers**

City-making requires consideration of timescales that exceed the attention span of conventional commerce and politics. This is a problem. If cities are to be kept on the path of ecological fitness over time there must be concomitant socio-cultural structures and institutions to manage their passage. Brand (1999) draws attention to the lack of institutions or decision-making systems that deal with very long-term planning in contrast with traditional cultures that commonly looked back and forth across several generations.

It is ironic that just as the realization is dawning that human systems and institutions need to accommodate and adapt to the long, slow rates of change of natural systems, it seems that the climate is moving. Glaciers are overtaking us! Climate change requires a heightened alertness to the biogeophysical environment and constant activity to keep pace with the changes in natural systems precipitated by human affairs. However, there is a danger that institutional responses will remain based on 'more of the same' thinking.

The hegemony of unhealthy, energy-hungry, central air-conditioning systems has been partly due to the seductive idea that any building could be made comfortable by plugging in a machine and flicking a switch. According to the canons of the architectural priesthood, this allowed 'design freedom' by separating the function of the building envelope from the need to moderate the climate. Conversely, ecocity design is understood and practiced as a rich process of engagement by living creatures with their environment and with each other. It eschews the linear, compartmentalized process favoured by industrial society; it needs to be developmental, and it requires careful, continuous maintenance. It requires management of a different kind than that bequeathed by militarism and production line manufacturing processes.

### **Seven steps and four propositions**

Although modern planning systems, including the New Urbanism, acknowledge the importance of land-use they rarely apply available knowledge with the kind of practical ecological sensitivity demonstrated, for instance by McHarg (1971). The seven steps identified in the 'SHED' (sustainable human ecological development) process (Box 2) reinforce the need to integrate land-use planning with every aspect of ecocity making. For instance, Richard Register (1987) has cited the positive potential of *tall* buildings, with

the proviso that there is a diversity of activities in such developments. They save land for agriculture; promote energy-saving by reducing travelling distances; make commerce, culture and social diversity more easily available; and, with imagination, can include multi-level greenhouses and roof-gardens. Register reminds us that cities are three-dimensional entities, not flat maps, and asserts that a vital social life is an essential ingredient of any community claiming to be 'ecological'.

The seven steps offer a basis for framing policy and constructing development programs. Sustainable human ecological development (SHED) fundamentally depends on the connections between human and non-human life through the flow of water within ecosystems. A topographical-built form relationship between region and habitation is identifiable through their respective capacity and functions as shedders of water. Biological processes dominate the first four and provide the context for all the others, which highlight community processes. Although numbered sequentially, any step in the SHED may be the first.

The seven steps are ultimately about building environments where architecture and planning are set within the framework of the biophysical and biosocial realities of place as part of the conscious making of ecological civilization, instead of attempting to incorporate sustainable processes within architecture and planning. Barton (2000: 28) has pointed out that, 'The real challenge facing us is not one of building eco-villages, but of making the modern city, and the way of life lived in it, environmentally sustainable'. The intertwined relationships between cities, place and culture, and human and biophysical ecology suggest four sets of propositions about the necessary conditions for making ecocities (Downton 2002):

1. City-region: A city is part of its place.
2. Integrated Knowledge: All knowledge must be integrated (harnessed/holistic).
3. Cultural Change: Ecocities need to establish strong cultural structures that recognise social and ecological inter-dependency.
4. Cultural (Urban) Fractals: Small demonstration projects are vital as catalysts for cultural change.

Box 2. Seven steps in the 'SHED' (sustainable human ecological development) process



SHED 1 SHEDDING – identifies the biophysical context and its inherent developmental constraints for city making: watersheds; 'bioregioning'; 'design with nature' methodology (McHarg 1971); carrying capacity; ecological footprints; environmental space.



SHED 2 PLACING – explores cultural and spiritual aspects of a bioregional (Sale 1991) analysis, placing people, seeking non-physical structures as a basis for maintaining deep continuities: 'genius loci'; 'spiriting' (discovering spirit of place); geomancy; Feng Shui; 're-inhabitation' (Berg 1981).



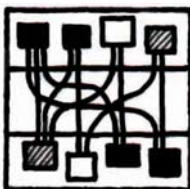
SHED 3 BIOZONING – locates food and biological resource sites on the basis of proximity or energy planning: biome identification; soil analysis; integrated land management techniques, Permaculture.



SHED 4 LIFELINING – identifies and maps the minimum weave of ecosystem elements vital to continued ecosystem connectivity and functionality: living links; island biogeography; ecological corridors; waterways; 'keylines' (Yeoman 1971); ecological restoration; natural infrastructure; interface between urban and pre-urban ecological structure; conservation and restoration.



SHED 5: PROXIMATING – locates cultural, social, economic and community resource centres on the basis of proximity or least energy planning: human links, proximity planning (Register 1987), designing and 'registering'; recognising historical somatic energy patterns of pre-industrial 'walkable' urban form; exchange space (Engwicht 1992), markets and meeting places; e.g. city squares in the urban fabric.



SHED 6 PATTERNING – identifies essential patterns for creating urbanity/community: invisible structures, citification vs urbanisation; and libertarian municipalism (Bookchin 1991, 1992); patterning neighbourhoods (Alexander *et al* 1977); predicting urban growth patterns and morphologies through fractal scaling laws (Batty and Longley, in Ball 1999: 244). Use of local cultural codes e.g. Islamic precepts for town planning in Arabia.



SHED 7 ARCHITECTING – designs with the principles of Gaean (Gaian) architecture and the Ecopolis Development Principles: six skins (Brand 1997, 1999) Ecological architecture fits the climate, saving energy and creating healthy buildings that respond to the needs of their occupants whilst respecting and reflecting local character and a 'cradle to grave' concern for the impact of a building over the whole of its lifecycle.

### The Frogstick – An urban ecology checklist

Environmental indicators are essential for measuring ecological performance in urban design and planning. Many such indicators have been created during the last decade. The 'Frogstick' (Downton 1991: 54) was inspired by (Wells 1981: 33-40) – 'frog' because, as a species which is extremely sensitive to its environment, its presence or absence in a preferred habitat provides an indication of the habitat's relative health. Designed for novices to understand, elements of the frogstick measure can be adapted/augmented to in-depth scientific enquiry (Box 3).

### Box 3. An example of a frogstick scoresheet

*Frogstick– City of Adelaide*

	Away from Sustainability	-10	-7.5	-5	-2.5	+2.5	+5	+7.5	+10	Towards Sustainability
1 Air	Pollutes									Purifies
2 Water	Pollutes/Wastes									Purifies/ Recycles
3 Earth (soil)	Destroys									Renews
4 Fire (energy)	Non-renewable									Renewable
5 Biomass	Decreases									Increases/ Stable
6 Food	Consumes									Creates
7 Biodiversity	Decreases									Increases
8 Habitat	Destroys									Creates
9 Ecolinks	Reduces									Increases
10 Resources	Wastes									Recycles/ Reuses
<b>TOTAL PERFORMANCE</b>		-50	-22.5	-10						= minus 82.5%

### Three Urban Fractals

*Models and strategies are required for eco-neighbourhoods in urban areas in order to practically demonstrate innovative and appropriate solutions which could be readily applied by other neighbourhoods. (Rudlin & Dodd 1998: 2)*

The ecopolis theory has been applied in three projects undertaken by the author and his colleagues in South Australia during the last decade and a half. Each project has been initiated through the non-profit group Urban Ecology Australia Inc. (conveners of the 1992 Second International EcoCity Conference). The most complete example presented is that of the 'Christie Walk' ecocity project currently nearing completion in Adelaide. The projects tested the propositions that there was enough extant knowledge and adequate techniques and technologies to begin making ecological cities (Proposition 2) and that driving forces depended on 'communities' and 'active citizenship' (Proposition 3). The ecopolis projects described were all conceived as ecocity microcosms – urban cultural fractals (Proposition 4).

### **Project 1: Halifax EcoCity Project**

The Halifax EcoCity Project (HEP) and Urban Ecology Australia Inc (UEA) evolved during the late 1980s and early 1990s. The HEP proposal was for an ecocity microcosm for 800 people: community facilities, cafés, shops, offices, an Ecology Centre, market place etc. The car-free, mixed-use development of 3-5 storeys was planned to be a similar density to traditional European cities. It was conceived as a means of catalysing redevelopment in the City of Adelaide and as a device for promulgating development that integrated social justice and community control with strong ecological goals.

Rudlin and Dodd (1998: 1-3) have identified the HEP as an exemplary case study of a ecological development highlighting a genuine sustainable urban neighbourhood. Environmental targets included: reducing the eco-footprint of the neighbourhood to an ecologically sustaining level; analysing lifecycle costs and impacts; using ecological design principles and environmental purchasing criteria; eliminating fossil fuels for power and heat; creating a closed water system; exploring food production possibilities; reducing car use; and developing a community planning approach.

An important goal of the HEP was to be influential in the wider community and raise consciousness of the potential of action in urban development and community-based politics. The project's success can be seen in the number of academic citations and courses that have incorporated the project as a case study, publications that refer to the project, media reports, exhibitions, and awards received for, or because of, the project.

Though the HEP never eventuated as a physical edifice, it does exist still as a cultural construct and as historical experiment in participatory, community development (Orszanski 1993). In the *Ecopolis Now* video documentary (Sam Stegman 2000) it was referred to as the 'Holy Grail' of urban environmentalism, indicating that virtual cultural fractals can be effective too.

### **Project 2: Whyalla EcoCity Development**

Following several moderately successful public workshops, a 15 hectare site in the heart of Whyalla was zoned 'EcoCity' with subsequent developments and modifications on-site. The Whyalla EcoCity Development succeeded in attracting a 'critical mass' of support in a town of just 27,000 people. This small city has a significant group of citizens, many closely associated with local religious and cultural organisations, who understand and are committed to the ecocity vision. Their knowledge and advocacy skills have been tested in response to pressure from economic reductionists seeking to replace community areas with commercial interests. It is interesting to note that the Whyalla EcoCity Development which has a partial physical presence has had little impact whilst the theoretical Halifax EcoCity Project continues to exert international influence.

### **Project 3: Christie Walk**

A key aspect of Christie Walk is its location in the most mixed-use, least wealthy and most culturally diverse part of the City of Adelaide, which required the design to address complex inner-urban contextual demands (Reardon *et al* 2005). However, the context supplied solutions as well as challenges – transport energy use is minimised by the capacity to walk to all major urban facilities and closeness of public transport. A total site area of just 2000 m<sup>2</sup> (equivalent to two traditional quarter-acre blocks) is being developed with 27 dwellings, including an apartment building with community facilities on the Sturt Street frontage. Community gardens, including South Australia's first roof garden, have been organised, planned and managed by residents. A number of housing types are represented, some linked physically, and all connected through landscaping that has been designed to be an integral part of the passive climate response of the dwellings.

This project expresses important aspects of ecopolis practice, including:

- community processes/structures based on mutual aid and direct democracy;

- at-a-distance impacts related to financial decision making (Community Aid Abroad Ethical Investment Trust and Bendigo Community Bank);
- demonstrating how various aspects of design address key technologies: water capture and re-use, solar power, etc;
- showing how urban forms reduce transport demands and how high densities facilitate community and conviviality;
- demonstrating how technology and funding reinforce local community processes to achieve sustainable human ecological development.

### Conclusions

The HEP and Christie Walk were self-directed social experiments undertaken by people who freely chose to be part of an innovative, non-government initiative. The HEP managed to achieve semi-mythic status as an example of something genuinely achievable with Christie Walk reinforcing its credibility as a partial realisation of the HEP, in microcosm. They express the four propositions mentioned above: 1) the three projects were all designed in a consciously determined relationship to their broader regional contexts; 2) the concepts, principles and techniques required to create human settlements that fit within the ecological systems of the biosphere whilst sustaining their biogeochemical functionality do exist; 3) the creation of ecocities will be dependent on cultural change to transform the deep cultural inertia in local government; 4) dependence of each project on a created community with shared ideas and preparedness to translate those ideas into activity. Whether the broader community can be more completely involved with a relatively high level of consciousness of its evolutionary role can only be tested in time.

The role of 'community' as a system of mutual aid based on direct democracy is central to the ecopolis idea. Catalysing 'cultural fractals' can only be brought about with a high level of participation from the wider community in their design, development and maintenance'. Direct democracy and active citizenship require approaches to architecture, planning and urban design that are as responsive to the body politic and social demands as they are to the sun, the weather, and the living processes of the biosphere. Community-based 'bottom up' planning strategies, rather than top down planning strategies, are fundamental to the foundation and sustenance of any ecologically viable human settlement in the long term.

Cities are a habitat for human survival and evolution and the theory of ecopolis is predicated on an approach to the making of architecture and cities that defines them as potential living systems, as extensions of the human organism. If the constructions of living creatures can be seen as extensions of their physiology (Turner 2000: 27) then buildings and cities can be conceived as components of living systems. Such a proposition promises to be a rich field of enquiry. If the making and maintenance of cities was analysed on the basis of them being extended phenotypes of the human gene, it might be possible to look forward to achieving a kind of 'unified theory' of urban ecology. Architecture and associated creative activity could then be seen as integral to life processes, as ways of making our habitat function better as well as increasing our chance of survival as a species.

### **Bibliography**

- Alexander Christopher 1997 'Design for Living Structures' in Zelov, C. and Cousineau, P. (eds) *Design Outlaws on the Ecological Frontier* 3<sup>rd</sup> edition, Knossus Publishing, Philadelphia.
- Alexander, Christopher et al 1977 *A Pattern Language: Towns, Buildings, Construction*. Oxford University Press, New York.
- Ball, Philip. 1999. *The Self-Made Tapestry: Pattern Formation in Nature*. Oxford University Press. New York.
- Barton, Hugh (ed) 2000 *Sustainable Communities: The Potential for Eco-Neighbourhoods* Earthscan, London.
- Berg, Peter 1981 'Devolving Beyond Global Monoculture' in *CoEvolution Quarterly* Sausalito (32) Winter (Northern Hemisphere) pp. 24-30.
- Berg, Peter 1988 *Discovering Your Life-Place: A First Bioregional Workbook* Planet Drum Books, San Francisco.
- Bookchin, Murray 1991 'Libertarian Municipalism - An Overview' in *Green Perspectives* (24) October.
- Bookchin, Murray 1992 *Urbanization Without Cities - The Rise and Decline of Citizenship* Black Rose Books, Institute of Policy Alternatives, Montréal.
- Bookchin, Murray 1986 *The Limits of the City* Black Rose Books, Montréal-Buffalo.
- Brand, Stewart 1997 (revised edition) *How Buildings Learn: What Happens After They're Built*. Phoenix Illustrated/Orion. London.

- Brand, Stewart 1999 *The Clock of the Long Now: Time and Responsibility* Phoenix, London.
- Downton, Paul F. 2006 [www.ecopolis.com.au](http://www.ecopolis.com.au)
- Downton, Paul F. 1990 'Ecopolis, the New Frontier (Ecopolis Now)' in Young, J.M.R. and Dyer, K.F. (eds) *Changing Directions: Ecopolitics IV Proceedings*, Adelaide.
- Downton, Paul F. 1991 'Solar Cities for a Sustainable World - Making Places Fit for Frogs' in *Solar 91 - Energy for a Sustainable World, Proceedings Volume One* Australian and New Zealand Solar Energy Society, Flinders University of South Australia, Adelaide, pp.44-56.
- Downton, Paul F. 1994 & 1996 *The Halifax EcoCity Project - A Community Driven Development - AKA The World's First Piece of Eco-city* Centre for Urban Ecology, Adelaide.
- Downton, Paul F. (ed) 1996 *EcoCity Whyalla booklets: 1. Urban Design Principles for Arid Regions; 2. Ecology and Bioregions; 3. Energy, Architecture and Design; 4. Earth Construction Technologies; 5. Core Site Design - Principles in Practice; 6. Integration and Overview; 7. Guidelines for the Future* Centre for Urban Ecology, Adelaide.
- Downton, Paul F. 1998 'Adelaide and Whyalla: The Practice of Urban Ecology in Two Australian Eco-city Projects' in Breuste, J., Feldmann, H., Uhlmann, O. (eds) *Urban Ecology* Springer-Verlag, Berlin.
- Downton, Paul F. 2002 'Making Place in an Urban Sense' in *Artlink* (2) Vol 22 pp.48-51.
- Downton, Paul Francis 2002 *Ecopolis: Towards an Integrated Theory for the Design, Development and Maintenance of Ecological Cities* (unpublished thesis), Mawson Graduate Centre for Environmental Studies, Department of Geographical and Environmental Studies, Faculty of Humanities and Social Sciences, University of Adelaide.
- Downton, Paul F. 2004 'Architecture and Planning - People and Environment: Designing the urban ecology of Ecopolis from the scale of individual buildings to city-regions' in *Adaptive Ecopolis Development, the Proceedings of International Ecopolis Forum, Scientific Committee on Problems of the Environment*, Ningbo.
- Engwicht, David 1992 *Towards an Eco-city - Calming the Traffic* Envirobook, Sydney.
- Girardet, Herbert. 2000 'Cities, People, Planet' *transcript from the Schumacher Lectures*, Liverpool, April.

- Girardet, Herbert. 2004 *Cities People Planet: Liveable cities for a sustainable world*, Wiley-Academy.
- Koskiahio B. 1994 *Ecopolis - Conceptual, Methodological and Practical Implementations of Urban Ecology* Ministry of the Environment, Finland.
- McDonough, W & Braungart, M 2002 *Cradle to Cradle: Remaking the way we make things*, North Pint Press, New York.
- McHarg, Ian L. 1971 *Design with Nature*, Doubleday/Natural History Press. New York.
- Orszanski, Roman 1993 *The Design and Production of EcoCities: A Case Study of the Halifax Project* (unpublished Masters dissertation) Mawson Graduate Centre for Environmental Studies, University of Adelaide, Adelaide.
- Reardon, C. et al (eds). 2005 *Medium Density -Christie Walk case study in 'Your Home'* Commonwealth of Australia, section 7.3 pp.1-6. See also:  
<http://www.greenhouse.gov.au/yourhome/technical/fs73.htm>
- Rees, William, E., and Wackernagel, Mathis 1996 *Our Ecological Footprint - Reducing Human Impact on the Earth*. New Society Publishers. Gabriola Island, BC/Philadelphia, PA.
- Register, Richard 1987a *Ecocity Berkeley: Building Cities for a Healthy Future* North Atlantic Books, Berkeley.
- Richard Register, 1987b Ecocities: Building the New Paradigm, in *The Elmwood Newsletter*, Vol.3 #1, California 1987.
- Register, Richard 2002 *Ecocities: Building Cities in Balance with Nature*. Berkeley Hills Books, Berkeley.
- Register, Richard and Peeks, Brady (eds) 1997 *Village Wisdom - Future Cities: The Third International Ecocity and Ecovillage Conference* Ecocity Builders, Oakland.
- Register, Richard 2005 Personal communication on 'urban fractals'
- Rudlin, David and Dodd, Nick 1998 'Eco-neighbourhoods: A Brief for a Sustainable Urban Neighbourhood' in *Sun Dial: The Journal of the Sustainable Urban Neighbourhood Initiative* # 6 Spring (Northern Hemisphere) pp.1-3
- Sale, Kirkpatrick 1991 *Dwellers in the Land: the Bioregional Vision* New Society Publishers, Philadelphia.
- Wells, Malcolm 1981 *Gentle Architecture* McGraw-Hill, New York.
- Wilson, Edward O. 1984 *Biophilia* Harvard University Press, Cambridge MA and London.
- Yeomans, P.A. 1971 *The City Forest - the Keyline Plan for the Human Environment* Keyline Publishing, Sydney.