From Risk to Resilience:

What Role for Community Greening and Civic Ecology in Cities?

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ABSTRACT

Cities experiencing social chaos may be viewed as socio-ecological systems that, as a result of a disturbance such as disaster or conflict coupled with lack of resilience, have shifted into a qualitatively different, undesirable state. We argue that urban community greening and other "civic ecology" approaches that integrate natural, human, social, financial, and physical capital in cities, and that encompass diversity, self-organization, and adaptive learning and management leading to positive feedback loops, have the potential to play a key role in developing urban community resilience before a disaster, and in demonstrating community resilience after disaster strikes. This paper adds to existing literature on resilience by applying resilience theory to urban socio-ecological systems, by expanding comparative analysis of resilience narratives in cities to encompass more community-based and environmental approaches, and by proposing an asset- and community-based tool, i.e., urban community greening, which can serve as the focus of social learning about resilience in cities. The paper also integrates knowledge of urban community greening and the resilience theory literature to propose a new "civic ecology", which

we define as a set of tools to help people to organize, learn, and act in ways that increase their

capacity to withstand, and where appropriate to grow from, change and uncertainty, through

nurturing cultural and ecological diversity, through creating opportunities for civic participation

or self-organization, and through fostering learning from different types of knowledge. Finally,

we call for policy makers and researchers to work with community members to formally

integrate civic ecology approaches into adaptive co-management strategies, thus enhancing our

understanding of the importance of urban community greening relative to other resilience

building tools in reducing risk in cities.

I. INTRODUCTION

One of the greatest risks following a natural disaster or conflict in cities is the ensuing social

chaos or breakdown of order. Recent examples include New Orleans following Hurricane

Katrina[1] and sectarian conflict following war in Iraq. Norton has coined the term "feral cities" to

refer to urban areas where major incidents of social violence, such as war, urban terrorism, riots

or street protests, lead to the total breakdown of order. Writing four years ago, Norton claimed,

"While it may be premature to suggest that a truly feral city—with the possible exception of

Mogadishu—can be found anywhere on the globe today, indicators point to a day, not so distant,

when such examples will be easily found".[2] Others have argued that the failed state, which

received so much attention in the 1990's, is being replaced by the emergence of "failed cities", in

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1 Accounts of how much societal breakdown occurred in New Orleans vary. See
  http://en.wikipedia.org/wiki/Effect_of_Hurricane_Katrina_on_New_Orleans#Aftermath;
  http://www.cbsnews.com/stories/2005/09/10/60minutes/main832576.shtml;
  http://www.voanews.com/english/archive/2005-09/2005-09-29-voa52.cfm?CFID=55301614&CFTOKEN=44160291
2 Norton, Richard J. (2003), "Feral Cities", Naval War College Review Vol. LVI, No 4, Autumn, page 98.

which the collapse of civil order not only threatens city residents, but also may pose a regional, national, or even global security risk.[3]

Feral or failed cities can be viewed as socio-ecological systems that, as a result of a disturbance such as disaster or conflict coupled with lack of resilience, have "collapsed into a qualitatively different state that is controlled by a different set of processes".[4] Communities lacking resilience are at high risk of shifting into a qualitatively different, often undesirable state when disaster strikes. Restoring a community to its previous state can be complex, expensive, and sometimes even impossible. Thus, developing tools, strategies, and policies to build resilience before disaster strikes is essential.

The Resilience Alliance has led the way in developing a broadly interdisciplinary research agenda that integrates the ecological and social sciences,[5] along with complex systems thinking, to help understand the conditions that create resilience in socio-ecological systems. Although this work has not focused on cities, its approach is consistent with a call by the Urban Security Team at the U.S. Los Alamos National Laboratory for "an approach (to studying urban ecosystems) that integrates physical processes, economic and social factors, and nonlinear feedback across a broad range of scales and disparate process phenomena".[6.]

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3 Liotta, P.H. and James F. Miskel (2004), "Redrawing the map of the future", World Policy Journal, Volume XXI, No 1, Spring 2004.
   Stier, Ken (2004), "The fourth annual year in ideas: Feral cities", in New York Times Magazine, Dec 12.
4 Resilience Alliance, http://www.resalliance.org/1.php
5 Whereas in this paper we focus on socio-ecological processes, we also recognize that other scholars may view disaster as more of an event than a process. Oliver-Smith, Anthony (2002), "Theorizing disasters: Nature, power, and culture", in Hoffman, Susanna and Anthony Oliver-Smith (editors), Catastrophe and Culture: The Anthropology of Disaster, James Currey LTD, Oxford, pages 23-47.
6 http://www.ees.lanl.gov/pdfs/urban_sec.pdf

Through their research, the Resilience Alliance has defined three characteristics of resilience in socio-ecological systems: (1) the amount of change the system can undergo and still retain the same controls on function and structure, (2) the degree to which the system is capable of self-organization, and (3) the ability to build and increase the capacity for learning and adaptation.

Diversity is fundamental to retaining functional and structural controls in the face of disturbance. Biological diversity provides functional redundancy, so that if one species declines (e.g., a nitrogen-fixing species), other species providing the same ecosystem services will continue to function. Similarly, when diverse groups of stakeholders, including resource users from different ethnic or religious groups, scientists, community members with local knowledge, NGOs, and government officials, share the management of a resource, decision-making may be better informed, stakeholders may be more invested in and supportive of the decisions, and more options exist for testing and evaluating policies.

Self-organization refers to the emergence of macro-scale patterns from smaller-scale rules, such as the emergence of ecosystem patterns related to nutrient cycling or plant size distributions as a result of evolution acting at the species level,[7] or the development of a market economy in laissez-faire political systems.[8] Participation of local residents in managing their own resources also may be viewed as a form of self-organization and can lead to adaptive learning and

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7 Levin, Simon (2005), "Self-organization and the emergence of complexity in ecological systems", BioScience Vol 55, No 12, pages 1075-1079. Note also that larger, emergent patterns also feed back to affect "adaptive individual agents." According to Levin (2005), "Evolutionary processes at smaller scales, including the coevolution of tightly interacting species, give rise to emergent macroscopic patterns at higher levels of organization (Levin 1999), which in turn feed back to influence microscopic dynamics on longer time scales and across broader spatial scales." (page 1076).
8 http://en.wikipedia.org/wiki/Self-organization#Self-organization_in_human_society

eventually greater resilience.[9] For example, following a hurricane on the island of Montserrat, local people involved in rebuilding undertook development projects, such as building a community center and implementing new farming practices, which were not directly related to disaster recovery but were integral to longer-term resilience strategies.[10] In another example, refugees living in camps in Somalia and Kenya learned new methods of growing food, which they took back to their communities following resettlement.[11]

The Montserrat and African cases provide examples of positive feedback loops, which are also critical to resilience theory. People acquired skills and new knowledge, and applied them to enhancing community development, food security, and the local environment. This, in turn, should create a system that is more resilient in the face of a new disturbance or disaster. One challenge for the development community is how to foster local leadership and action leading to positive feedback loops that lead to resilience. This is in contrast to some interventions that result in destructive, positive feedback loops, such as when following a conflict lack of meaningful employment opportunities for men leads to violence, which in turn leads to destruction of infrastructure and even fewer employment opportunities.

Building resilience through nurturing diversity, self-organization, adaptive learning, and constructive positive feedback loops is consistent with calls for a shift in disaster relief thinking from identifying what is missing in a crisis (needs, hazards, vulnerabilities) to identifying the

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9 Olsson, P., C. Folke and F. Berkes (2004), "Adaptive co-management for building resilience in social-ecological systems", Environmental Management Vol 34, pages 75-90.
10 Vale, Lawrence J and Thomas J Campanella (2005), The Resilient City: How Modern Cities Recover from Disaster, Oxford University Press, USA, 392 pages.
11 Smit, Jac and Martin Bailkey (2006), "Urban agriculture and the building of communities", in van Veenhuizen, Rene (editor), Cities Farming for the Future - Urban Agriculture for Green and Productive Cities, RUAF Foundation, IDRC and IIRR, Philippines, 458 pages, available at: http://www.ruaf.org/node/961.

strengths, skills, and resources that are already in place within communities.[12] Such thinking parallels recent calls for asset-based approaches in international development, which emphasize building on existing natural, social, human, financial, and physical capital. However, tools and policies that are consistent with asset-based approaches to building resilience in cities are sorely lacking.

In this paper, we argue that *urban community greening and other "civic ecology"[13] approaches that integrate natural, human, social, financial, and physical capital in cities, and that encompass diversity, self-organization, and adaptive learning and management leading to positive feedback loops, have the potential to reduce risk from disaster in cities through helping communities to develop resilience before a disaster, and to demonstrate resilience after disaster strikes.* In making our argument, we build on and add to existing literature on resilience as follows. First, we apply resilience theory coming out of the Resilience Alliance to *urban* socio-ecological systems, an important gap in a body of literature focusing largely on aquatic, agricultural, and marine systems. Second, we expand on the work of Vale and Campanella's comparative analysis of resilience narratives from cities experiencing historic and recent disasters, which focuses largely on the built rather than the *natural environment*, and on efforts led by government, the private sector, and outside NGOs, as opposed to *community-based* initiatives to build resilience.[14] Perhaps more important, we propose an asset- and community-

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12 International Federation of Red Cross and Red Crescent Societies (2004), World Disasters Report: Focus on Community Resilience, International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland, 231 pages.

13 Whereas the term civic ecology has been used to denote various integrated social and ecological approaches (*e.g.*, see http://www.cfr.washington.edu/research.envmind/), our use of the term is original and represents a growing initiative at Cornell University.

14 The notable exception is the chapter on recovery after the 1990s civil unrest in Los Angeles. "Rebuilding…requires not just investment in real estate, but also a variety of human capital—local infusions of community dynamism, neighborly cooperation, and no small measure of hope." Fulton, William (2005), "After the unrest: Ten years of rebuilding Los Angeles following the trauma of 1992", in Vale, Lawrence J and Thomas J

based *tool*, urban community greening, which can serve as the focus of future adaptive co-management research into resilience in cities. Such research will be aided by the sizable body of literature that has already demonstrated how this tool builds human and social capital in cities in the US, South Africa, and elsewhere. Finally, we integrate our knowledge of urban community greening and the resilience theory literature to propose a new "civic ecology," which we define as an approach to building resilience in the face of change and uncertainty, through fostering a community's ability to engage diverse stakeholders, to promote self-organization, and to learn from and adaptively apply different types of knowledge.

In building our argument, we first describe urban community greening, a term we use specifically to refer to community-based efforts to create green spaces in cities, such as community and living memorial gardens and community forestry. This definition is distinct from other definitions of greening, which may include green political movements, or more formal "pedigreed" landscapes such as city parks and botanic gardens.[15] Next we briefly discuss how engaging with green spaces builds human and social capital, following which we show how urban community greening builds multiple forms of capital but in ways that are distinctly different from other types of greening, and that contribute to diversity, self-organization, and adaptive learning and thus provide the conditions necessary for resilience in socio-ecological systems. Finally, we present a broader "civic ecology" framework in which to view urban

Campanella (editors), The Resilient City: How Modern Cities Recover from Disaster, Oxford University Press, USA, page 299. A reference in this chapter to the environment refers to attempts of The Trust for Public Land to "expand and improve parks available to local residents." page 310.

15 Landscape architect Michael Hough coined the term "pedigreed landscapes" in (2004), Cities and Natural Process, Routledge, London and New York. Note that urban community greening also is distinct from urban agriculture in its emphasis on human, social, and natural capital. Although food production is often part of urban community greening, this is not always the case (e.g., in some community forestry initiatives).

community greening and other socio-ecological, participatory, asset-based approaches to building resilient cities.

II. URBAN COMMUNITY GREENING

An example of urban community greening comes from Soweto township near Johannesburg South Africa, where local residents, many of them immigrants from more rural areas, have taken it upon themselves to reclaim a hill that was overgrown and the scene of rampant sectarian violence during apartheid. Today the Soweto Mountain of Hope[16] is a vibrant garden and outdoor "community center" incorporating protest sculptures, a women's kitchen and meeting circle, dance and drumming classes and concerts, and huts reflecting the building styles of diverse ethnic groups in South Africa. The Soweto Mountain of Hope also acts as a memorial to victims of AIDS; the garden is along a major thoroughfare leading to a large cemetery and a number of plots are planted in the shape of AIDS ribbons. Given Johannesburg's high crime rate and its designation by some as a city at risk of "failing",[17] the Soweto Mountain of Hope is an example of community-based resilience under conditions that commonly follow disaster or conflict. It also provides a test case for how such community-based efforts might enhance resilience in the face of future conflict.

Similar to what occurred in Soweto, the community garden movement in North America can be viewed as a community-based response to urban crime and decay. As city dwellers in New York and elsewhere experienced rising violence and abandonment by politicians in the 1970s, they refused to accept that they and their neighborhoods were the "troubling by-products of urban

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16 Lindow, Megan (2004), "From rubble to revival: A South African man turns a dump into a cultural mecca", Christian Science Monitor, http://www.csmonitor.com/2004/0226/p14s01-lihc.html.

growth and decay...problems to be solved by politicians, city planners, and environmental professionals".[18] Instead, they took it upon themselves to transform crime- and trash-ridden vacant lots into urban landscapes that represented a new kind of nature incorporating ecological and cultural value. We contend that the active engagement of these community members, many of whom were low-income minorities and immigrants, helped to build stronger, more resilient neighborhoods prior to disaster, and that their efforts would be revisited following disaster. For example, after 9/11, many community gardens became living memorial gardens, whose purpose was to create an outlet for grief and a unifying, community-building demonstration of solidarity and support, all of which can contribute to resilience.[19]

Thus, as opposed to more formal city parks, urban community greening refers to the *leadership and active participation of city residents who take it upon themselves to build healthier sustainable communities through planning and caring for "socio-ecological spaces" and the associated flora, fauna, and structures.* Urban community greening encompasses community gardens where city dwellers share a gardening space, often by dividing it into individual family plots and common areas such as benches and casitas; memorial gardens created spontaneously by community members following disaster and conflict; trough gardens where individuals plant in troughs located throughout a city; gardening and tree planting along green areas created by transportation corridors such as railroads and highways; as well as sacred groves of trees and

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17 Norton, Richard J. (2003), "Feral Cities", Naval War College Review Vol LVI, No 4, Autumn, page 104.

18 Anderson, Kevin (2004), "Marginal nature: An inquiry into the meaning of nature in the margins of the urban landscape", University of Texas Department of Geography Urban Issues Program, http://www.utexas.edu/academic/uip/research/docstuds/coll/anderson.html.

19 In response to the overwhelming desire to honor and memorialize the tragic losses that occurred on September 11, 2001, the U.S. Forest Service created the Living Memorials Project. This initiative invokes the resonating power of trees to bring people together and create lasting, living memorials to the victims of terrorism, their families, communities, and the nation. See http://www.livingmemorialsproject.net/. Vale and Campanella (2005) also cite "remembrance drives resilience" as one of 12 axioms of resilience.

other forms of community forestry. We contend that whereas greening in general enhances

mental, physical, and community health, urban community greening builds natural, human,

social, financial, and physical capital in unique ways with important implications for building

resilience prior to and following a disaster or conflict.

III. BUILDING RESILIENCE

Numerous studies have shown that the ability to see or experience green space can reduce

domestic violence, quicken healing times and reduce stress, improve physical health, and bring

about cognitive and psychological benefits for children and adults.[20] In addition to building

human capital, green areas in apartment complexes have been demonstrated to build social

capital through fostering a sense of safety and reducing crime rates in cities.[21] Furthermore,

throughout the last century and continuing today, gardening also has been used as a means for

soldiers and victims of war to fight back for their own mental well-being, as well as for the

disenfranchised to become involved in acts of defiance. Gardens themselves represent resilience

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20 Sullivan, William and Francis Kuo (1996), "Do trees strengthen urban communities, reduce domestic violence?",
USDA Forest Service Southern Region, Technology Bulletin No. 4, Forestry Report R8-FR 55, Athens.
Ulrich, Roger (1984), "View through a window may influence recovery from surgery", Science Vol 224, 27 April,
pages 420-421.
Hartig, Terry, Marlis Mang, and Gary Evans (1991), "Restorative effects of natural environment experiences",
Environment and Behavior Vol 23, pages 3-26.
Kaplan, Rachel, and Stephen Kaplan (1989), The Experience of Nature: A Psychological Perspective. Cambridge
University, New York, 360 pages.
Taylor, Andrea, Francis Kuo, and William Sullivan (2001), "Coping with ADD: The surprising connection to
green play settings. ", Environment and Behavior Vol 33, No 1, pages 54-77.
Taylor, Andrea, Angela Wiley, Frances E. Kuo, and William C. Sullivan. (1998), "Growing up in the inner city:
Green spaces as places to grow", Environment and Behavior Vol 30, No 1, pages 3-27.
Wells Nancy (2000), "At home with nature - Effects of greenness on children's cognitive functioning",
Environment and Behavior Vol 32, pages 775-795.
21 Kuo, Frances E. and William C Sullivan (2001), "Environment and crime in the inner city: Does vegetation
reduce crime?", Environment and Behavior Vol 33, May, pages 343-367.
Kuo, Frances, Magdalna Bacaicoa, and William Sullivan (1998), "Transforming inner-city landscapes: Trees,
sense of safety and preference", Environment and Behavior Vol 30, No 1, pages 28-59.

in that they "resist not only environmental difficulty but also social, psychological, political, or economic conditions".[22]

We can expect urban community greening at a minimum to foster the same sorts of resilience-building human and social capital as other types of green space. More important, urban community greening has been demonstrated to build additional forms of capital that relate directly to the diversity, self-organization, and adaptive learning characteristics of resilient societies.

a. Diversity and the ability to maintain function and structure in the face of change

In densely populated cities, community greening contributes to landscape heterogeneity, adding multiple, small-scale, distributed patches to the green spaces created by formal parks. Furthermore, urban community gardens are sites of biological diversity generally reflecting the cultural and ethnic diversity of the surrounding community. For example, in Sacramento, Mien gardeners grow Asian varieties of squashes, eggplants, and beans; in NYC, Latin American gardeners plant alache, epazote, and papalo; and in Grahamstown South Africa, community gardeners grow a diversity of "imifino" or wild, edible greens. Whereas the biologically diversity found in community greening generally is not native, it potentially could foster ecological resilience, such as when planting little used varieties reduces risks from insect and disease. Furthermore, the genetic, species, and landscape diversity associated with small-scale agriculture gains importance when cities are viewed as socio-ecological systems.[23] For example, the

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22 Helphand, Kenneth (2006), Defiant Gardens: Making Gardens in Wartime. Trinity University Press, San Antonio, Texas, 303 pages.

23 Researchers in Honduras found 309 species of plants in 75 Honduran home gardens, and suggest that not only commercial agriculture but also small diverse gardens should be considered as a viable tool in development efforts. Doxon, Lynn and R. H. Mattson (1989), "An Examination of plant density, diversity, and use in Honduran home gardens", Journal of Therapeutic Horticulture Vol 4, pages 39-49.

diversity of fresh produce gathered from community and school gardens in South Africa is seen as playing an important role in helping HIV/AIDS affected individuals maintain healthy immune systems, and thus contributes to individual resilience.

Community greening may also foster human diversity. For example, in South Africa, internally-displaced individuals representing a diversity of ethnic groups can be found working together in community gardens. In North America, a single community garden may include immigrants from Asia, Africa, and Latin America working alongside European-Americans and African-Americans who have migrated to the city from rural southern states in the US.[24] Furthermore, community gardens tend to be meeting places for people of all ages and sometimes of a range of economic status.

A question arises as to whether "human" diversity, such as that represented in urban community greening, is critical to resilience, and if so, what types of diversity are important (*e.g.*, ethnic, views about natural resources management, gender, age). Certainly, one can point to resilient cities in which cultural diversity was not a factor, including Tangshan China following the 1976 earthquake, Gernica following Franco's collusion with the Germans to bomb this Basque stronghold, and Tokyo following earthquakes, fires, and war.[25] In these cases, either strong governments or private industry played a major role in rebuilding, often with the express purpose of setting a political agenda (such as demonstrating a more open economy following the death of

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24 It should be noted however that not all community gardens in North America are diverse ethnically. For example, some gardens in Sacramento CA serve almost exclusively Laotian refugees, despite the fact that the surrounding neighborhoods also include Latino immigrants and European-Americans. In NYC, gardens tend to reflect the ethnicity of the surrounding neighborhood; thus, in community gardens located in ethnically homogeneous neighborhoods, one generally finds only that ethnic group. In spite of the variation of diversity within gardens, it should be noted that at a more macro-level, community gardens reflect the diversity found in cities, including new immigrants, internally-displaced populations (e.g., African-Americans), and European-Americans wanting to build stronger communities.

Mao in China, or destroying Basque culture in Gernica). On the other hand, new immigrants have been instrumental in rebuilding North American cities after disaster, including Irish and German immigrants following the 1835 fire in NYC, and Latin American immigrants following civil unrest in the 1990s in Los Angeles.[26] And efforts to foster participatory natural resources management are built on the assumption that engaging diverse stakeholders in decision-making creates a larger portfolio of more equitable and better-informed land management policies. Research addressing the differences in past rebuilding efforts, and in the ability to rebuild following future disasters, among cities varying in the degree to which they incorporate a diversity of stakeholder perspectives and cultures could help shed light on the question of the importance of human diversity in resilience in urban systems.

Some development and disaster-relief efforts specifically use community greening to nurture diversity, reconciliation, and recovery among ethnic groups that have been engaged in war and conflict. For example, Jews and Palestinians plant trees together in Israel and Palestine to promote the human contact they believe is necessary for achieving peace.[27] Through an American Friends Service Committee sponsored project in Bosnia-Herzegovina, people from different ethnic groups, including war veterans and widows, work side by side to grow food for themselves and their families.[28]

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25 Vale, Lawrence J and Thomas J Campanella (editors), (2005), The Resilient City: How Modern Cities Recover from Disaster, Oxford University Press, USA, 392 pages.

26 "When L.A.'s leaders envisioned rebuilding devastated neighborhoods after the 1992 unrest, they probably were not thinking about a Mexican supermarket chain working with a historically African-American community development corporation to ensure cross-cultural balance in daily marketing. Yet, more than a decade after the devastating civil unrest, this is what resilience has turned out to mean in Los Angeles." Fulton, William, "After the unrest: Ten years of rebuilding Los Angeles following the trauma of 1992", page 308. See also, Page, Max, "The City's end: Past and present narratives of New York's destruction," pages 75- 93. Both chapters in Vale, Lawrence J and Thomas J Campanella (editors) (2005), The Resilient City: How Modern Cities Recover from Disaster, Oxford University Press, USA.

27 http://www.seekpeace.org/Articles/serotta.shtml

28 hhttp://www.afsc.org/europe/bosnia/programoverview.htm

b. Active participation and the capacity for self-organization

In community gardens and other community green spaces we have visited across North America, we hear the stories of individuals, often refugees, who have experienced serious trauma as a result of disaster, war, or civil strife, and who while perhaps unable to find or hold a job, are welcomed into a community garden where they are able to plant seeds, water, remove weeds, and otherwise work with the land to create food and beauty while regaining emotional stability. Similarly, in South Africa, poor township women engaged in gardening were able to find solace following domestic violence, gained greater control over their household food security and consumption, and experienced a greater sense of stability in coming to new, often transient communities.[29]

These examples of "gardens as horticultural therapy"[30] demonstrate how community greening creates human capital, and we have seen in the section on diversity above how community greening fosters natural capital. Community greening also creates financial and physical capital, which, along with human and natural capital, leads to social capital. For example, in South Africa, community gardens often are designed as a means for unemployed community members to produce food and earn money, and North American gardens produce fresh food that is not otherwise available to families and elderly neighbors, and that is sometimes sold to create income for gardeners. Furthermore, through bringing in high-quality soil, constructing roof-top

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29 Slater, Rachel J (2001), "Urban agriculture, gender and empowerment: an alternative view," Development Southern Africa, Vol 18, No 5, December, pages 636-650. Although the township gardens were generally individual plots rather than community gardens, the women visited each other's gardens and shared stories; thus, these "spatially distributed" gardens acted in some ways as community gardens.

30 Worden Eva C., Theodora M. Frohne, and Jessica Sullivan (2004), "Horticultural Therapy", University of Florida, http://edis.ifas.ufl.edu/pdffiles/EP/EP14500.pdf#search='horticulture%20therapy%20war.

and other water collection systems, and building "casitas" or sheds for social activities and cooking, gardeners contribute to the physical capital in cities. Community gardens also become a safe space where youth and adult neighbors come to socialize, participate in cultural events (*e.g.*, concerts, harvest celebrations), relax, learn about gardening, exercise, and enjoy nature.[31] Unlike many other development efforts, which create sense of dependency, through engaging community members in producing things of value, community greening can create independence and self-reliance.[32]

Because community gardens generally engage participants in multiple forms of communal activity and community action, they can serve as active training grounds for civic participation.[33] For example, in many cities, community greeners organize to secure and defend a right to use land that more powerful city government and business interests would like to develop commercially. They also actively plan and manage what is grown and the activities that are allowed to occur at these sites. Such planning often entails working with people from diverse backgrounds to solve problems, such as how to sanction gardeners who do not follow rules about

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31 Armstrong, Donna (2000), "A survey of community gardens in upstate New York: Implications for health promotion and community development," Health & Place Vol 6 No 4, pages 319-327.
  Hynes, Patricia (1996), A Patch of Eden: Americas Inner City Gardeners. Chelsea Green Publishing Co. White River Junction, VT. 185 pages.
  Patel, Ishwarbhai (1991), "Gardening's socioeconomic impacts," Journal of Extension 29(4), http://www.joe.org/joe/1991winter/a1.html.
  Rees, William (1997),. "Why urban agriculture?" Urban Agriculture Notes. Vancouver, BC: City Farmer, http://www.cityfarmer.org/rees.html.
  Saldivar-Tanaka, Laura and Marianne Krasny (2004), "The role of NYC Latino community gardens in community development, open space, and civic agriculture", Agriculture and Human Values Vol 21, pages 399-412.
  Schmelzkopf, Karen (1995), "Urban community gardens as contested spaces", Geographical Review Vol 85, pages 364-381.
32 Gutman, Pablo (1987), Nutrition and Urban Agriculture Food and Nutrition Bulletin Volume 9, Number 2. Note also four principles for effective engagement in recovery efforts, including creating the conditions for people, including those with low status, to acquire new civic skills, to participate in and become leaders of renewed civic institutions, to build more extensive networks for resilience, and to build a culture that values and enables collective action and learning. Berke, Philip and Thomas Campanella (2006), "Planning for post-disaster resiliency", Annals of the American Academy of Political and Social Science Vol 604, March, pages 192-207.

pesticides and weeding, or how to work with the city to provide a water system or more effective police protection. Through these activities, community greeners gain multiple competencies, ranging from how to grow food and proper nutrition to how to work in multicultural groups to advocate with city government.[34] They also create social networks, the ability to take an active role in controlling violence and other aspects of community life, and a sense of self-efficacy and empowerment.[35]

In most cases, community greeners themselves initiate the myriad of activities that occur in community green spaces, which in turn lead to increased human, social, and other forms of capital and enhanced food security. Viewed as a socio-ecological system, community gardens nurture constructive, positive feedback loops and are self-organizing—new system-level patterns emerge from the interactions of people and plants within the system, and these changes in the larger community in turn create greater opportunities for individual community members.

c. Capacity for learning and adaptation

In social systems, institutions and networks that foster learning and store knowledge and experience, create flexibility in problem solving, and balance power among interest groups play

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33 Westphal, Lynn (2003), "Urban greening and social benefits: a study of empowerment outcomes", Journal of Arboriculture Vol 29, No 3, pages 137-147.
34 Hynes, Patricia, (1996), A Patch of Eden: Americas Inner City Gardeners. Chelsea Green Publishing Co. White River Junction, VT. 185 pages.
   Pinderhughes, Raquel (2001), "From the ground up: The role of urban gardens and farms in low-income communities", Environmental Assets and the Poor, Ford Foundation.
35 Westphal, Lynn (2003), "Urban greening and social benefits: a study of empowerment outcomes", Journal of Arboriculture Vol 29, Issue 3, pages 137-147.
   Slater, Rachel J (2001), "Urban agriculture, gender and empowerment: an alternative view," Development Southern Africa, Vol 18, No 5, December, pages 636-650.

an important role in adaptive capacity.[36] Given that individuals engaged in urban community greening learn to organize and work together, and often gain a sense of empowerment and self-efficacy that leads to action and advocacy, community greening can be viewed as an institution or network that contributes to social learning related to community development and food security.

Two scenarios we have observed in New York City (NYC) provide examples of the role of community gardening and related community-supported agriculture (CSA) and farmers' markets in social learning. Brook Park Community Garden in the Bronx NYC is the center of numerous activities in the neighborhood.[37] It includes vegetable plots and memorial flower plantings to commemorate victims of 9/11. A wealth of youth education activities occur on the site and an asphalt area that has not yet been converted to green space serves as a site for dance lessons. Canoes along the border fence attest to the garden's participation in a larger advocacy campaign to restore the nearby East River. At specified times each week, community members reflecting the ethnic diversity of the surrounding neighborhood drop by to pick up farm produce that is brought in from a rural CSA farm. The diversity of people and activities present in the garden provides a rich opportunity for sharing and learning. The garden itself can be viewed as an "experiment" in managing for food security and community development in cities.

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36 Scheffer, M., W.A. Brock, and F. Westley (2000), "Mechanisms preventing optimum use of ecosystem services: an interdisciplinary theoretical analysis", Ecosystems Vol 3, pages 451-471.
   Berkes, F., J. Colding and C. Folke (2000), "Rediscovery of traditional ecological knowledge as adaptive management", Ecological Applications Vol 10, pages 1251-1262.
   Roling, Niels and Annemarie Wagemakers (1998), Facilitating Sustainable Agriculture, Cambridge University Press, Cambridge, United Kingdom, 318 pages.
37 http://www.friendsofbrookpark.org/

Compared to the richness of activities, structures, and land uses in Brook Park Community

Garden, the farmers' market next to the fence surrounding the former site of the World Trade

Centers, consisting of four long tables on a concrete walkway, may appear sterile at first glance.

But viewed as a community initiative to bring activity and life to the site's rubble, imposing

signs extolling the recovery efforts, and grandiose plans for a new monument, the "ground zero"

farmer's market takes on new significance. The individuals who were engaged in the farmer's

market prior to 9/11 watched the falling towers; today they see the market as the first step in

creating the ecological, social, and cultural diversity needed to bring back their community.[38]

The American Community Gardening Association[39] provides a network for learning from these

and the thousands of other community greening programs across North America, but often

greening efforts in poor communities do not have the resources to participate in its activities. In

Africa, Asia, and Latin America, we can find numerous examples of urban and community

agriculture involving multiple NGO and community partners, and the Resource Centres on

Urban Agricultural and Food Security provides a network for learning from these efforts.[40] A

need exists for greater networking to further leverage the social learning potential of these and

the many other community greening initiatives internationally.

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38 For example, Kernie Kernan, a farmer who sold produce at the market and witnessed the twin towers collapse, has returned to the site, perhaps to aid his own healing. He commented, "My heart's kind of down there…That was my favorite, favorite, favorite place".
   http://www.downtownexpress.com/de_57/smallergreenmarketreturnig.html
39 http://www.communitygarden.org/
40 www.ruaf.org. See also, Smit, Jac and Martin Bailkey (2006), "Urban agriculture and the building of communities", in van Veenhuizen, Rene (editor), Cities Farming for the Future - Urban Agriculture for Green and Productive Cities, RUAF Foundation, IDRC and IIRR, Philippines, 458 pages, available at: http://www.ruaf.org/node/961.

IV. WHAT'S MISSING? ADAPTIVE CO-MANAGEMENT AND CIVIC ECOLOGY

Thus far, we have argued that urban community greening, through creating human, social, and other forms of capital, plays an important role in fostering diverse, self-organizing, and adaptive communities, *i.e.*, communities that one would expect to show resilience in the face of disaster. We also have provided examples from Bosnia-Herzegovina, the Middle East, and NYC where community greening was used as an intervention strategy specifically to promote resilience following conflict or disaster. Other examples of the use of greening as an intervention following disaster include using raised beds to grow traditional foods in mobile home parks following Hurricane Katrina, and community agriculture projects implemented at refugee camps to address environmental, economic, and psychological damage following the 2005 tsunami in Sri Lanka, and after fighting in Somalia. Interestingly, through participating in agricultural training programs in camps, refugees may take home new and more varied agricultural techniques than they had before displacement, and thus foster adaptive learning more broadly.[41]

What then remains to be done? We contend that the next step is for policy makers and researchers to work with urban community greening participants to formally integrate urban community greening into adaptive co-management strategies for building communities that are resilient prior to disaster, and able to recover after disaster.[42] One possibility is to examine radically different cases, such as comparing urban agriculture in Cuba as a means of resilience following decline in Soviet aid or prior to any future changes in power structure and possible

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41 *Ibid.*
42 Adaptive co-management, in drawing on local knowledge and leadership, and in creating both horizontal networks among greening participants and vertical networks among greening participants, NGOs, and the research and policy communities, can be viewed as one form of self-organization. Olsson, Per, Carl Folke, and Fikret Birkes (2004), "Adaptive comanagement for building resilience in social-ecological systems", Environmental Management Vol. 34, No 1, pages 75–90.

conflict, vs greening following disaster and ethnic conflict in the former Yugoslavia or South Africa. In this way, we will be able to enhance our understanding of the importance of urban community greening relative to other resilience building tools in cities. As part of this adaptive co-management strategy, we should seek to mobilize the cooperation and "spontaneous leadership" that emerge through urban community greening to build networks that will participate in management and research decisions.[43]

To guide these efforts, we propose an approach that builds on four factors identified as critical to natural resource management during periods of change and reorganization: (1) learning to live with change and uncertainty; (2) nurturing diversity for resilience; (3) combining different types of knowledge for learning; and (4) creating opportunity for self-organization towards social-ecological sustainability.[44] Our approach also expands on our ongoing work using community gardens as sites for community and youth sustainability education in cities, through which we have developed a program that integrates multi-cultural and intergenerational understanding, learning from community members and scientists, and civic action.[45] Combining these perspectives, we propose "civic ecology" as an approach to natural resources management, education and empowerment, and community development. *Civic ecology seeks to help people to organize, learn, and act in ways that increase their capacity to withstand, and where appropriate to grow from, change and uncertainty, through nurturing cultural and ecological diversity, through creating opportunities for civic participation or self-organization, and through fostering*

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43 Our recommendations build on the work of Weinstein and Tidball, who suggest that policy makers, NGOs, and international agencies should seek to *shape the environment* by creating an enabling environment for development and growth, security, peace, stability, and societal healing through leveraging existing local skills, infrastructure and markets. Weinstein, Elon and Keith Tidball (2007), "Environment shaping: an alternative approach to development and aid", Journal of Intervention and Statebuilding Vol 1, Spring.

44 Folke, C (2002), "Entering adaptive management and resilience into the catchment approach", in Balancing Human Security and Ecological Interests in a Catchment – Towards Upstream/Downstream Hydrosolidarity. Stockholm International Water Institute, Report 17. Stockholm, Sweden, pages 39-43

learning from different types of knowledge. In the context of this discussion, the ultimate goal of civic ecology is to build socio-ecological resilience prior to and following disaster or conflict in cities.

South Africa provides some good examples of civic ecology approaches other than urban community greening being incorporated into government and foreign donor policy, in particular through programs of the South African National Biodiversity Institute. For example, the Cape Flats Nature initiative employs poor urban township residents in leading biodiversity monitoring and management efforts, with the goal of preserving native plant communities and promoting ecologically- and socially-conscious tourism.[46] The end result is community members becoming involved in civic action that integrates biological diversity with ecological, social justice, and economic concerns, and thus creates more resilient communities. Another example is the Greening the Nation Programme, which seeks to create jobs, alleviate poverty, and build human capacity through engaging people in creating indigenous species nurseries and gardens at schools, street tree planting, greening of cemeteries, and other greening-related work.[47] Similarly, through a joint Columbia University-UNESCO effort in Cape Town, a team of foreign and local specialists drawn from government and civil society are collaborating to create an urban biosphere reserve as a tool for socially inclusive and environmentally friendly forms of urban management.[48] Although none of these projects is specifically described as building

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45 www.gardenmosaics.org
46 Davis, George (2005), "Biodiversity conservation as a social bridge in the urban context: Cape Town's sense of "The Urban Imperative" to protect its biodiversity and empower its people," in Trzyna, Ted (editor), The Urban Imperative, California Institute of Public Affairs, Sacramento, California, http://www.interenvironment.org/pa/davis.htm
47 http://www.sanbi.org/frames/educatfram.htm.
48 Columbia University/UNESCO Joint Program on Biosphere and Society, http://www.earthinstitute.columbia.edu/cubes/sites/southafrica.html.

resilience, their integrated social equity and environmental objectives would indicate their potential in building a society able to bounce back from ongoing violence and conflict.[49]

V. CONCLUSION

Speaking in 2000, United Nations Secretary-General Kofi Annan claimed: "We have entered the urban millennium. At their best, cities are engines of growth and incubators of civilization. They are crossroads of ideas, places of great intellectual ferment and innovation... Cities can also be places of exploitation, disease, violent crime, unemployment, and extreme poverty... We must do more to make our cities safe and livable places for all." [50] This paper addresses the question of how we can use the ideas and innovations created by city dwellers from all walks of life to address the risks cities face.

We have used a socio-ecological systems framework to help understand the potential of urban community greening and other civic ecology approaches in building resilience and thus reducing risk in the face of disaster and conflict. Other approaches may focus more on the intersection of ecology and social justice or emancipation. For example, Desfor and Keil claim, "Ecology provides much of the base for urban conflict. It is the matter through which urban regimes reorganize themselves, with which elites embroider their projects of state and market control. Yet it is also the basis—forever rejuvenated in new waves of subversive urbanism—for a new urban political ecology strongly articulated with projects of emancipation, democracy, and

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49 In the US, the efforts of civic ecologists are often marginalized by government and commercial development interests, as in the late 1990s in NYC, when former Mayor Guiliani attempted to destroy over 100 community gardens to make way for housing and commercial development.

50 Annan, Kofi (2000), Inaugural address to Urban 21: Global Conference on the Urban Future, UN Press Release SG/SM/7479, http://www.un.org/News/Press/docs/2000/20000705.sgsm7479.doc.html

justice."[51] Similarly, education scholars have called for the integration of place-based approaches focusing on local ecology and biodiversity, with Freirean critical pedagogy focusing on social justice for oppressed populations, and with learning from the traditional cultures and knowledge that have enabled communities to live sustainably for generations.[52] Urban community greeners and other civic ecologists integrate place-based activities, such as planting community gardens or monitoring local biodiversity, with learning from multiple forms of knowledge including that of community members and outsiders, often leading to civic activism such as advocating for green spaces, for financial security, and for reduction of crime and violence. In so doing, they build human, social, natural, financial, and physical capital that becomes integrated into constructive, positive feedback loops. In this way, community greeners integrate diversity, self-organization, and learning to create the conditions that spawn resilience in the face of disaster and conflict.

Thus, urban community greening, local biodiversity monitoring, and similar activities are tools that could become part of a larger civic ecology "tool kit" or approach for building urban resilience. Should relief and development NGOs, governments, international agencies, the scientific community, and community greeners work together to foster, implement, and assess the impact of civic ecology approaches as an adaptive co-management strategy before and after disaster, we will be one step further in understanding how to build resilience in urban socio-ecological systems. Ultimately, such research and adaptive co-management efforts should be

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51 Desfor, Gene and Roger Keil (2004), Nature and the City: Making Environmental Policy in Toronto and Los Angeles. The University of Arizona Press, Tucson, AZ, page 231.
52 Gruenewald, David A (2003), "The best of both worlds: a critical pedagogy of place," Educational Researcher Vol 32, No 4, pages 3-12.
Bowers, Chet A (2002), "Toward an eco-justice pedagogy," Environmental Education Researcher Vol 8, No 1, pages 22-34.

directed to helping policy makers understand the role of civic ecology tools in building resilience

in cities both before and after a disaster or conflict.

REFERENCES CITED

Anderson, Kevin (2004), "Marginal nature: An inquiry into the meaning of nature in the margins of the urban landscape", University of Texas Department of Geography Urban Issues Program, http://www.utexas.edu/academic/uip/research/docstuds/coll/anderson.html.

Annan, Kofi (2000), Inaugural address to Urban 21: Global Conference on the Urban Future, UN Press Release SG/SM/7479,
http://www.un.org/News/Press/docs/2000/20000705.sgsm7479.doc.html

Armstrong, Donna (2000), "A survey of community gardens in upstate New York: Implications for health promotion and community development," Health & Place Vol 6 No 4, pages 319-327.

Berke, Philip and Thomas Campanella (2006), "Planning for post-disaster resiliency", Annals of the American Academy of Political and Social Science Vol 604, March, pages 192-207.

Berkes, F., J. Colding and C. Folke (2000), "Rediscovery of traditional ecological knowledge as adaptive management", Ecological Applications Vol 10, pages 1251-1262.

Bowers, Chet A (2002), "Toward an eco-justice pedagogy," Environmental Education Researcher Vol 8, No 1, pages 22-34.

Davis, George (2005), "Biodiversity conservation as a social bridge in the urban context: Cape Town's sense of "The Urban Imperative" to protect its biodiversity and empower its people," in Trzyna, Ted (editor), The Urban Imperative, California Institute of Public Affairs, Sacramento, California, 168 pages.

Desfor, Gene and Roger Keil (2004), Nature and the City: Making Environmental Policy in Toronto and Los Angeles. The University of Arizona Press, Tucson, AZ, 274 pages.

Doxon, Lynn and R. H. Mattson (1989), "An Examination of plant density, diversity, and use in Honduran home gardens", Journal of Therapeutic Horticulture Vol 4, pages 39-49.

Folke, C (2002), "Entering adaptive management and resilience into the catchment approach", in Balancing Human Security and Ecological Interests in a Catchment – Towards Upstream/Downstream Hydrosolidarity. Stockholm International Water Institute, Report 17. Stockholm, Sweden, pages 39-43

Fulton, William (2005), "After the unrest: Ten years of rebuilding Los Angeles following the trauma of 1992", in Vale, Lawrence J and Thomas J Campanella (editors), The Resilient City: How Modern Cities Recover from Disaster, Oxford University Press, USA, pages 299-312.

Gruenewald, David A (2003), "The best of both worlds: a critical pedagogy of place," Educational Researcher Vol 32, No 4, pages 3-12.

Gutman, Pablo (1987), Nutrition and Urban Agriculture Food and Nutrition Bulletin Volume 9, Number 2.

Hartig, Terry, Marlis Mang, and Gary Evans (1991), "Restorative effects of natural environment experiences", Environment and Behavior Vol 23, pages 3-26.

Helphand, Kenneth (2006), Defiant Gardens: Making Gardens in Wartime. Trinity University Press, San Antonio, Texas, 303 pages.

Hough Michael (2004), Cities and Natural Process, Routledge, London and New York.

Hynes, Patricia (1996), A Patch of Eden: Americas Inner City Gardeners. Chelsea Green Publishing Co. White River Junction, VT. 185 pages.

International Federation of Red Cross and Red Crescent Societies (2004), World Disasters Report: Focus on Community Resilience, International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland, 231 pages.

Kaplan, Rachel, and Stephen Kaplan (1989), The Experience of Nature: A Psychological Perspective. Cambridge University, New York, 360 pages.

Kuo, Frances E. and William C Sullivan (2001), "Environment and crime in the inner city: Does vegetation reduce crime?", Environment and Behavior Vol 33, May, pages 343-367.

Kuo, Frances, Magdalna Bacaicoa, and William Sullivan (1998), "Transforming inner-city landscapes: Trees, sense of safety and preference", Environment and Behavior Vol 30, No 1, pages 28-59.

Levin, Simon (2005), "Self-organization and the emergence of complexity in ecological systems", BioScience Vol 55, No 12, pages 1075-1079.

Lindow, Megan (2004), "From rubble to revival: A South African man turns a dump into a cultural mecca", Christian Science Monitor, http://www.csmonitor.com/2004/0226/p14s01-lihc.html.

Liotta, P.H. and James F. Miskel (2004), "Redrawing the map of the future", World Policy Journal, Volume XXI, No 1, Spring 2004.

Norton, Richard J. (2003), "Feral Cities", Naval War College Review Vol. LVI, No 4, Autumn, page 98.

Oliver-Smith, Anthony (2002), "Theorizing disasters: Nature, power, and culture", in Hoffman, Susanna and Anthony Oliver-Smith (editors), Catastrophe and Culture: The Anthropology of Disaster, James Currey LTD, Oxford, pages 23-47.

Olsson, P., C. Folke and F. Berkes (2004), "Adaptive co-management for building resilience in social-ecological systems", Environmental Management Vol 34, pages 75-90.

Patel, Ishwarbhai (1991), "Gardening's socioeconomic impacts," Journal of Extension 29(4), http://www.joe.org/joe/1991winter/a1.html.

Pinderhughes, Raquel (2001), "From the ground up: The role of urban gardens and farms in low-income communities", Environmental Assets and the Poor, Ford Foundation.

Rees, William (1997),. "Why urban agriculture?" Urban Agriculture Notes. Vancouver, BC: City Farmer, http://www.cityfarmer.org/rees.html.

Roling, Niels and Annemarie Wagemakers (1998), Facilitating Sustainable Agriculture, Cambridge University Press, Cambridge, United Kingdom, 318 pages.

Saldivar-Tanaka, Laura and Marianne Krasny (2004), "The role of NYC Latino community gardens in community development, open space, and civic agriculture", Agriculture and Human Values Vol 21, pages 399-412.

Scheffer, M., W.A. Brock, and F. Westley (2000), "Mechanisms preventing optimum use of ecosystem services: an interdisciplinary theoretical analysis", Ecosystems Vol 3, pages 451-471.

Schmelzkopf, Karen (1995), "Urban community gardens as contested spaces", Geographical Review Vol 85, pages 364-381.

Slater, Rachel J (2001), "Urban agriculture, gender and empowerment: an alternative view," Development Southern Africa, Vol 18, No 5, December, pages 636-650.

Smit, Jac and Martin Bailkey (2006), "Urban agriculture and the building of communities", in van Veenhuizen, Rene (editor), Cities Farming for the Future - Urban Agriculture for Green and Productive Cities, RUAF Foundation, IDRC and IIRR, Philippines, 458 pages.

Stier, Ken (2004), "The fourth annual year in ideas: Feral cities", in New York Times Magazine, Dec 12.

Sullivan, William and Francis Kuo (1996), "Do trees strengthen urban communities, reduce domestic violence?", USDA Forest Service Southern Region, Technology Bulletin No. 4, Forestry Report R8-FR 55, Athens.

Taylor, Andrea, Francis Kuo, and William Sullivan (2001), "Coping with ADD: The surprising connection to green play settings. ", Environment and Behavior Vol 33, No 1, pages 54-77.

Taylor, Andrea, Angela Wiley, Frances E. Kuo, and William C. Sullivan. (1998), "Growing up in the inner city: Green spaces as places to grow", Environment and Behavior Vol 30, No 1, pages 3-27.

Ulrich, Roger (1984), "View through a window may influence recovery from surgery", Science Vol 224, 27 April, pages 420-421.

Vale, Lawrence J and Thomas J Campanella (editors), (2005), The Resilient City: How Modern Cities Recover from Disaster, Oxford University Press, USA, 392 pages.

Weinstein, Elon and Keith Tidball (2007), "Environment shaping: an alternative approach to development and aid", Journal of Intervention and Statebuilding Vol 1, Spring.

Wells Nancy (2000), "At home with nature - Effects of greenness on children's cognitive functioning", Environment and Behavior Vol 32, pages 775-795.

Westphal, Lynn (2003), "Urban greening and social benefits: a study of empowerment outcomes", Journal of Arboriculture Vol 29, No 3, pages 137-147.

Worden Eva C., Theodora M. Frohne, and Jessica Sullivan (2004), "Horticultural Therapy", University of Florida,
http://edis.ifas.ufl.edu/pdffiles/EP/EP14500.pdf#search='horticulture%20therapy%20war.