Chapter 4
Urgent Biophilia: Human-Nature Interactions in Red Zone Recovery and Resilience

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Abstract This contribution builds upon earlier work on the concept of biophilia while synthesizing literatures on restorative environments, community-based ecological restoration, and both community and social-ecological disaster resilience. It suggests that when humans, faced with a disaster, as individuals and as communities and populations, seek engagement with nature to further their efforts to summon and demonstrate resilience in the face of a crisis, they exemplify an urgent biophilia. This urgent biophilia represents an important set of human-nature interactions in social-ecological systems characterized by hazard, disaster, or vulnerability, often appearing in the 'backloop' of the adaptive cycle. The relationships that human-nature interactions have to other components within interdependent systems at many different scales may be one critical source of resilience in disaster and related contexts. In other words, the affinity we humans have for the rest of nature, the process of remembering that attraction, and the urge to express it through creation of restorative environments, which may also restore or increase ecological function, may confer resilience across multiple scales.

Keywords Urgent biophilia • Restorative environments • Human-nature interactions • Disaster resilience • Vulnerability

Author Keith Tidball seeks an explanation for why people repeatedly turn to greening in the wake of catastrophe and disaster. He finds an answer to this foundational question in cultural-evolutionary arguments about human's affinity to nature ('biophilia') and in the work of environmental psychologists demonstrating the healing power of nature.

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Introduction

Can greening in red zones be explained in ecological or perhaps even evolutionary terms? Human societies have been beset with disasters for thousands of years (Diamond 2005), and have had to adapt to survive them. More recently, Lewis and Sturgill (1979, p. 330) acknowledged that we are now living in 'two worlds… within the envelope of our skin is a biological entity which, through evolution, has been tuned for survival in natural environments… [yet] around us lies not the green world in which we learned to survive and carry forward our species, but rather a world of our own creation, built of inert materials'. But do we remember in some way the lessons of that green world and deploy that memory when confronted with a crisis (Tidball et al. 2010)? This book argues that human-nature interactions represent a suite of human adaptations to disasters. Applying observations from the literatures on resilience in human development (Masten et al. 1990) and on resilience in social-ecological systems (SES) (Walker et al. 2004) may be useful in addressing diverse, massive-scale disaster situations, such as a flu pandemic, ethnic conflict and war, or natural disasters, where interdependent adaptive systems at multiple levels, from cellular to global, face destruction (Masten and Obradovic 2008).

It is certainly true that personal safety and security are of paramount concern in these contexts, as are basic and fundamental services like food and water supplies, medical support, and basic infrastructure function (IFRC 2004). It is also well known that post-disaster planning brings its own set of challenges (Tidball et al. 2008). Like other events that radically affect communities (e.g., closing of a factory in a manufacturing town, see Stedman and Ingalls, Chap. 10, this volume), disasters are known to exacerbate existing inequalities (Peacock et al. 1997; Pelling 2003; Wisner et al. 2003; Drennan 2007). Sudden disasters often destroy the physical infrastructure of marginalized or vulnerable communities (Adger et al. 2005; Daniels et al. 2006) and can severely strain social networks (Walker and Meyers 2004). Furthermore, survivors of the disaster experience considerable psychological trauma that is difficult for responders to fully understand or skillfully negotiate (Sattler et al. 1997; Inter-Agency Standing Committee 2007). In light of these challenges, it is remarkable how often one hears of stories where people have had an almost immediate 'green response' to a crisis – forming a community garden in the case of war veterans and widows in Bosnia (Brdanovic 2009), growing a few flowers in the trenches of World War I (Helphand 2006), or tending to trees that survived in Hiroshima at the end of World War II (Cheng and McBride 2006).

Given the hardships and urgent safety issues faced by civilians, soldiers, and first-responders after a disaster or during war, it seems counter-intuitive that they would engage in the simple act of gardening, tree-planting, or other greening activities. Yet, intriguing and compelling examples exist of people, stunned by a crisis, benefitting from the therapeutic qualities of nature contact to ease trauma and to aid the process of recovery (Miavitz 1998; Hewson 2001). A large literature explains the benefits of horticulture therapy more generally (Markee and Janick 1979; People Plant Council 1993; Relf and Dorn 1995; Relf 2005), as well as in more specific

contexts such as among returning war veterans (Krasny et al., Chap. 13 and Helphand, Chap. 17, this volume), in refugee contexts (see Moore, Chap. 31), and in prisons (Lindemuth, Chap. 27) to name a few. Beyond the therapeutic value of plants themselves, others have researched the value of green places, or restorative environments (Hartig and Staats 2003) to ease trauma or discomfort (Ulrich 1983; Kaplan and Kaplan 1989).

But what might gardening, tree-planting, and other greening activities contribute to post-catastrophe individual or SES resilience? In much of the research and practice conducted under the rubric of horticultural therapy, the individual person in need of an intervention is considered a kind of patient who is prescribed horticultural interventions by a professional practitioner. Moving toward an 'ecological' approach, researchers in the field of systemic therapies have proposed alternative strategies for healing, conducted in creative ways in nature, that address the environment not merely as a setting but as a partner in the process (Berger and McLeod 2006). In the context of SES resilience with its focus on emergent or self-organized processes (see Tidball and Krasny, Chap. 2, this volume), in this chapter I move one step further towards linking consideration of individuals with consideration of groups of people, neighborhoods and communities, who find contact with nature of their own volition, a kind of self administered therapy, as a means to cope with the aftermath of a disaster, crisis, or conflict. In so doing, I hope to contribute to the literature connecting individual resilience to the adaptive functioning of larger social systems and networks, such as neighborhoods or socio-cultural systems (Masten and Obradovic 2008).

If it is true that, at least in the short term, 'all disasters are local', and that, similarly, as Masten and Obradavic (ibid) have argued, 'all human resilience is local, emerging from the actions of individuals and small groups of people, in relation to each other and *powered by the adaptive systems of human life* and development' (emphasis added), then we must look to that which human life has *adapted to* for clues about sources of emergent human resilience. Humans have adapted to both larger and smaller living systems and sub-systems with which we share interdependence, and according to E. O. Wilson (1984) we have an affinity for those living systems, as will be discussed later in this chapter. At the same time, some scholars claim that 'there is substantial evidence to suggest that, as a species, our modern lifestyle may have strayed too far from that to which we have adapted' (Gullone 2000, p. 315). Masten and Obradovic (2008) acknowledge that a variety of systems facilitate human resilience, especially in post-catastrophe contexts, but seem to agree with Longstaff (2005) that those systems are unlikely to be directly available during an unfolding disaster. Their description of these systems includes primarily manufactured ones, such as communication, transportation, manufacturing, and others, and not ecological systems. But what if we included in this list of systems that facilitate resilience, especially after a disaster, *locally available biological and ecological systems*, *subsystems and components*, from the smallest to the largest, from the most simple to the most complex? After all, at least according to Kurakin (2009, p. 21), 'the structures and dynamics of all living organizations, from proteins and cells to societies and ecologies, embody their evolutionary histories [and] memories'. And what if,
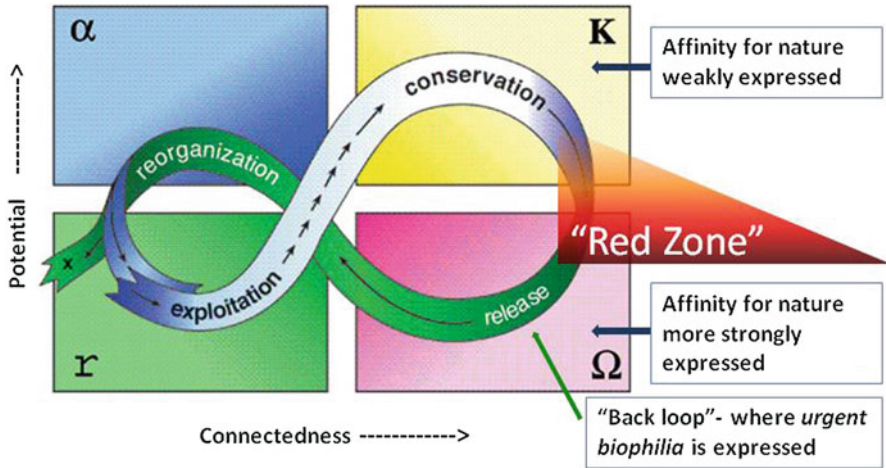
Fig. 4.1 As adapted from Holling and Gunderson (2002), a stylized depiction of the four ecosystem functions (r, K, Ω, α) and the flow of events among them. *Arrows* show flow speed in the cycle; *closely spaced arrows* represent slow change and *long arrows* represent rapid change. The cycle reflects change in two properties: (1) the Y axis is potential inherent in accumulated resources; (2) the X axis is the degree of connectedness among controlling variables. The transition from the K phase to the Ω phase is depicted here as '*The Red Zone*'. Expression of biophilia is also represented, corresponding to the Y axis and potential. Low connectedness is associated with loosely connected elements whose behavior is dominated by external relations and variability. High connectedness is associated with elements whose behavior is dominated by internal relations that control or mediate external variability. The 'back loop', in *green*, represents the stages during which *urgent biophilia* is likely expressed. The exit from the cycle at the *left* of the figure suggests the stage where the potential can leak away and where a 'flip' into a less organized and desirable system is likely

in terms of human resilience, we focused on the nearly scale-free property of life itself, of the compulsion to live, of living (Kurakin 2007)?

In this chapter, I propose an urgent, nuanced addition to the idea of biophilia. I suggest that when humans faced with a disaster, as individuals and as communities and populations, seek out doses of contact and engagement with nature to further their efforts to summon and demonstrate resilience in the face of a crisis, they exemplify an *urgent biophilia*. This urgent biophilia represents an important set of human-nature interactions in SES perturbed by a catastrophe, often appearing in the 'backloop' (Fig. 4.1) of the adaptive cycle (Holling and Gunderson 2002). The relationships those human-nature interactions have to other components within interdependent systems at many different scales may be one critical source of resilience after a catastrophe. In other words, the affinity we humans have for the rest of nature, the process of remembering that affinity and the urge to express it through creation of restorative environments, which may also restore or increase ecological function, may confer resilience across multiple scales.

Thus, it is in examining people's efforts to navigate journeys of resilience through urgent circumstances that we explore individual and community yearning for and

subsequent expression of an affinity for other living things. These doses of nature go beyond simply nature contact (Louv 2005) to encompass active engagement in restoring nature in concert with other members of one's community, for example through community gardening and urban community forestry. In previous work, my colleagues and I have described such local, self-organized stewardship practices as a kind of civic ecology (Tidball and Krasny 2007; Krasny and Tidball 2010; Tidball et al. 2010; Krasny and Tidball 2012), and have suggested that these civic-ecological stewardship practices play a role in creating opportunities for learning and building adaptive capacity in urban communities (see Svendsen and Campbell, Chap. 25, this volume). I acknowledge claims that not all people recognize or act upon this affinity for nature, and for those that do, such reactions may vary according to circumstance (Kellert 1997a).

Following Kellert in his book *Building for Life* (2005) and taking his ideas a step further into the realms of recovery and resilience post-crisis, in this chapter I explore how expressing biophilia through creating restorative environments might usher in and reinforce '… a respect for all values and benefits we derive from nature…' thereby reflecting '…a dependence [upon living systems] that extends far beyond a narrow materialistic and economic calculus to embrace a broader conception of human self-interest' (p. 180). This would enable recognition of 'the widest range of values derived from our dependence on nature, one that also includes emotional connection, intellectual competence, the experience of beauty, a sound moral compass, and a world of enduring meaning and relation' (ibid). Too often recognition of these values, and opportunities to express them, are in short supply in post-conflict or post-disaster contexts.

In order to build my argument about the importance of human-nature interaction in red zone recovery and resilience I briefly review the literature on restorative environments and biophilia, and deploy these notions in terms of horticultural or nature-based interventions and responses in disaster settings. After exploring linkages between the concept of biophilia and the notion of cultivating resilience, I turn to the SES resilience literature as it applies to expressing biophilia in disaster and conflict scenarios. I conclude with a synthesis in which I forward a hypothesis about the importance of urgent biophilia as it relates to SES resilience (for in-depth discussion of SES resilience, see Tidball and Krasny, Chap. 2, this volume). This chapter is intentionally exploratory rather than data-driven. My intent is to stimulate thinking about the origin and role of greening in building adaptive capacity during and after conflict or disaster, rather than to present results of studies attempting to prove this phenomenon.

Restorative Environments

Frumkin (2001) and Hartig (2007) have traced the idea of human-nature relationships as contributing to human health from the writings of the ancient Greeks, to the New England transcendentalists (Nash 1982; McLuhan 1994; Murphy et al. 1998; Mazel 2000), and through the American landscape designers Andrew Jackson

Downing (1869) and Frederick Law Olmsted (1865/1952). Frumkin (2001) relates to us how, a century ago, the early American conservationist John Muir observed, 'Thousands of tired, nerve-shaken, over-civilized people are beginning to find out that going to the mountains is going home; that wilderness is a necessity; and that mountain parks and reservations are useful not only as fountains of timber and irrigating rivers, but as fountains of life' (Fox 1981, p. 116). Similarly, Hartig (2007) traces theories about how some natural environments promote restoration and in turn the health of individuals and populations to the writings of Andrew Jackson Downing (1869) and Frederick Law Olmsted (1865/1952).

Hartig and Staats (2003) noted that the idea of restorative environments has caught the attention of increasing numbers of environmental psychologists, as well as researchers in the environment–behavior–design (Betrabet 1996; Cooper Marcus and Barnes 1999) and public health fields (e.g., Frumkin 2001; King et al. 2002; Svendsen and Campbell 2005a). According to Hartig and Staats (2003), the study of restorative environments complements research on the conditions in which our functional resources and capabilities diminish, such as what we refer to as red zone contexts like natural disasters and war (see Tidball and Krasny, Chap. 1, this volume). Hartig and Staats (2003) argue that this complementarity has theoretical and practical aspects; the theoretical aspect involves specifying those qualities of person-environment transactions that promote restoration (precedents acknowledged by Hartig and Staats in this effort include work by Berlyne (1960), Driver and Knopf (1976), Kaplan and Kaplan (1989), Kaplan and Talbot (1983) and Ulrich (1983)). Hartig and Staats (2003) also call for further work that would reinforce the understanding that an absence of those demands or conditions that make a red zone a red zone, were that possible, would not necessarily make for an optimal restorative environment. In practical terms, they argue that the elimination of physical, social and temporal conditions that impose unwanted demands, red zone conditions if you will, does not necessarily leave us with a restorative environment. Rather, Hartig and Staats (ibid) claim that, following the lead of Frederick Law Olmsted, planners, landscape architects, land managers, public health workers, politicians and others can make efforts to modify, maintain, and regulate environments so that they not only present fewer unwanted demands, but also have physical, social, and temporal characteristics that promote restoration (see, e.g., Brett et al. 2007).

More recently, studies (Hartig and Staats 2006; Van Den Berg et al. 2007; Bell et al. 2008) have shown that the ability to see or actively experience plants and green spaces can, among other things, reduce domestic violence, quicken healing times, reduce stress, improve physical health, reduce poor birth outcomes, and bring about cognitive and psychological benefits in individuals (Ulrich 1984; Kaplan and Kaplan 1989; Hartig et al. 1991; Sullivan and Kuo 1996; Faber Taylor et al. 1998; Wells 2000; Donovan et al. 2011) and populations as a whole (Hartig et al. 1991). For example, in the 1989 National Gardening Survey of 2000 randomly selected households (Butterfield and Relf 1992), just over half of the respondents agreed with the statement, 'The flowers and plants at theme parks, historic sites, golf courses, and restaurants are important to my enjoyment of visiting there', and 40% agreed with the statement 'Being around plants makes me feel calmer and more relaxed'.

Kuo et al. (1998) and Kuo and Sullivan (2001) further present research demonstrating that exposure to trees in urban settings can foster a sense of safety and reduce crime rates, thus contributing to social well-being. In short, considering the voluminous research reviewed above, the 'seeing green' implications for human health and well-being of so-called 'plant-people interactions' (Salick 1995; Elings 2006; Relf 2006) appear to be well documented.

But is there more to this story than the value of *seeing* green? What about *doing green*? Most relevant to my interests, and building on research on restorative environments (Ulrich 1983, 1984; Kaplan and Kaplan 1989), Helphand (2006; see also Helphand, Chap. 17, this volume) claims that *the act* of gardening historically has been a means for soldiers and victims of war to fight back for their own mental well-being, and for the disenfranchised to become involved in acts of defiance resisting 'not only environmental difficulty but also social, psychological, political, or economic conditions'. This is consistent with what my colleagues and I have argued elsewhere, that civic ecology practices, including urban community forestry, community gardening, and other self-organized forms of stewardship of green spaces in cities (Tidball and Krasny 2007), are manifestations of how social and ecological memories can be instrumentalized through social learning to foster SES resilience following crisis and disaster (Tidball et al. 2010). We proposed that civic ecology communities of practice (see Wenger et al. 2002; Wenger 2003) that emerge within and across red zones help to leverage these social-ecological memories (for more on social-ecological memories, see Barthel et al., Chap. 11) into effective practices, and that such communities of practice serve as urban iterations of the collaborative and adaptive management practices that play a role in SES resilience in more rural communities (Berkes et al. 2003; Davidson-Hunt and Berkes 2003). Others have also highlighted various values of *doing green* for enhancing human health and well-being (Miles et al. 1998; Austin and Kaplan 2003; Ryan and Grese 2005); many examples of this are found in this book.

A question may arise at this point about the availability of the benefits of seeing green and doing green to more than just individual humans. Although therapy, rehabilitation, and restorative environments involve focusing, at least tacitly, on the specific needs of individuals, and working with the restorative environments proximate to individuals can serve the goals of therapy or rehabilitation specified by a health professional (Cimprich 1993), Hartig (2007) argues that by focusing on recurring human needs for restoration:

> …our scope of application opens to the *population* (italics added) and, as with other public health interventions, changes the living environment of that population. It is not necessary to work with each and every individual in the population in some deliberate way. Improving the availability of settings that support restoration can have positive effects on the health of the population as a whole, if not on every individual within the population… Especially in the urban areas where populations have increasingly concentrated, we can promote the health of people by providing opportunities to quickly, easily and regularly access places that support restoration, including but not limited to gardens, parks and forests (p. 4).

This movement from the individual to the community or even the population level, is echoed in the social science sphere by Granovetter (1973), who in stating

'personal experience of individuals is closely bound up with larger-scale aspects of social structure, well beyond the purview or control of particular individuals' (p. 1377), provides further impetus for exploring the role of greening activities at the community and higher levels in post-crisis contexts. Further elaboration and analysis of this scaling up to the community level of the benefits of green space is found in two recent studies of green space in Stockholm (Barthel et al. 2005; Ernstson et al. 2008).

Biophilia

Documentation of these notions of the benefits of seeing or doing green can be traced to the aforementioned early works of Stephen and Rachel Kaplan (1989) and Roger Ulrich (1983, 1984) in restorative environments, and seem to resonate with Wilson's (1984) biophilia hypothesis in which he suggests that biophilia describes 'the connections that human beings subconsciously seek with the rest of life'. In this domain, Wilson and his colleagues accomplished two things. First, they identified a phenomenon, i.e., that humans have an affinity for other living things. Second, they proposed the possibility that the phenomenon of humans having deep affiliations with nature is rooted in our biology (Kellert and Wilson 1993). These two observations should not be surprising given our evolutionary past, and may be useful in efforts to escape the problems and traps of the human-nature dichotomy (Reardon et al. 2009) and the mythology of human exemptionalism and exceptionalism (Dunlap 1980; Dunlap and Catton 1994; Vitousek et al. 1997; Williams 2007). The connection between Wilson's biophilia hypothesis and the work of the Kaplans and Ulrich is explicitly made by Ke-Tsung (2001), who argued that both Ulrich's and the Kaplans' theories are based on an evolutionary perspective. Wilson's hypothesis has been acknowledged (Born et al. 2001) to have found empirical support (for example, Kaplan 1995; Kahn 1999). Gullone (2000) argues that the research related to biophilia to date is consistent with the proposal that predispositions that evolved in our ancestral environment continue to be present today despite their more limited relevance for modern humans. Further, as Masten and Obradovic (2008) remind us, 'the adaptive systems for positive human adaptation and development, *legacies of biological and cultural evolution*, must be considered and enjoined to promote resilience' (emphasis added).

Wilson's (1984) notion of biophilia may provide an explanation for the restorative value of nature contact. First used by Erich Fromm (1964) to describe a psychological orientation of being attracted to all that is alive and vital, the term, and the book by the same name, attempt to shed light on 'how the human tendency to relate with life and natural processes might be the expression of a biological need' (Kellert 1993). Wilson suggested the possibility that the deep affiliations humans have with nature are part of our evolutionary past. As opposed to phobias, which are the aversions and fears that people have of things in the natural world,

Table 4.1 The wide range of values derived from human biophilic dependence, as adapted by Gullone (2000) and Kellert (2005)

Kellert's typology of values in nature	
Aesthetic	Physical appeal of and attraction to nature
Dominionistic	Mastery and control of nature
Humanistic	Emotional attachment to nature
Moralistic	Moral and spiritual relation to nature
Naturalistic	Direct contact with and experience of nature
Negativistic	Fear of and aversion to nature
Scientific	Study and empirical observation of nature
Symbolic	Nature as a source of metaphorical and communicative thought
Utilitarian	Nature as a source of physical and material benefit

philias are the attractions and positive feelings that people have toward certain habitats, activities, and objects in their natural surroundings. Wilson elsewhere argued that some behaviors are at least partly inherited and can be affected by natural selection, and that these behaviors have evolved over time, similar to the way that physical traits are thought to have evolved (Wilson 1975). This sociobiological perspective has been hotly contested since its initial presentation by Wilson and his colleagues (Allen et al. 1975; Lewontin et al. 1984; Segerstråle 2000).

However, it is important to note that Wilson and others describe both an innate and a learned component of biophilia, suggesting that biophilia develops through a process of gene-culture evolution (Sideris 2003). Kahn (1997) points out that Kellert and others seem to argue that while evolutionary biology has an important place, 'it should not be construed as rigid or deterministic, but rather as setting loose parameters in human lives' (p. 11). So for example, humans may have an innate tendency to spend time tending plants, but this tendency is reinforced culturally through watching and then helping parents and other older, more experienced members of society care for plants.

Proponents of biophilia argue that, rather than referring to a single behavior, biophilia encompasses a broad complex of responses to nature, which include affinities to landscapes and domestic and wild animals, as well as aversions to snakes and cliffs or other high places that pose a threat to humans (Soule 1993). Kellert (2005) further describes the wide range of values derived from human biophilic dependence (see Table 4.1) and argues that individuals may vary in the types and degree of biophilic responses they express.

As briefly mentioned above, the implications for biophilia of Wilson's (1975, 1984) broader sociobiological project have been the source of years of debate (Allen et al. 1975; Lewontin et al. 1984; Segerstråle 2000). These debates tend to be over concern about this perspective's implied determinism (Kitcher 1987), and discomfort with its potentially dogmatic tone. The implication of these concerns is that those mired in urban poverty and cut off from nature may lead a less fulfilling existence; therefore the sociobiological thesis may be accused of cultural and class bias (Kellert and Wilson 1993). Sideris (2003) further notes two additional contradictions

inherent in the notion of biophilia; first, that despite their affinity for nature humans readily kill animals,[1] and second, that by proposing that humans have averse reactions to dangerous animals such as snakes, biophilia may inadvertently serve as a basis for destroying certain groups of animals rather than for conservation of all biodiversity as originally intended by Wilson (1984).

Despite the furor caused by Wilson and what some deem as implied determinism in his sociobiological thesis (Kitcher 1987), notions of biophilia resurface regularly. Examples of works picking up on or elaborating upon the themes of Wilson's biophilia hypothesis include Kellert and Wilson's (1993) edited volume *The Biophilia Hypothesis*, Lewis's (1996) *Green Nature/Human Nature*, and Kellert's (1997a) *Kinship to Mastery* and (1997b) *The Value of Life*, as well as his more design oriented books (2008) *Biophilic Design* and (2005) *Building for Life*. More recently the Meristem Forum released a book entitled *Restorative Commons*: *Creating Health and Well-being through Urban Landscapes* (Campbell and Wiesen 2009), which invokes the concept biophilia frequently in examples of humans restoring landscapes. Other books incorporating the notion of biophilia into design and planning continue to appear, such as Beatley's (2010) *Biophilic Cities* and Almusaed's (2010) *Biophilic and Bioclimatic Architecture*.

Perhaps most recognizably in the popular press, Richard Louv (2005) introduced the world to the term nature-deficit disorder among children, which refers to the alleged trend that children are spending less time outdoors, resulting in a wide range of behavioral problems. One could argue that nature-deficit disorder is what happens when biophilia is suppressed among people, especially children. When interviewed for the *Why Files*, an online science magazine, Louv gave credence to the linkage between biophilia and nature-deficit disorder by noting that biologist E.O. Wilson and his colleagues have long talked about *the biophilia hypothesis* and that even as people are migrating to cities around the world, 'We are still hunter-gatherers biologically'. Louv adds, 'There is something in us that needs nature. When we don't get it, we don't do so well'.[2]

In short, a preponderance of evidence exists suggesting the restorative effects of seeing and doing green. Delving further into a potential mechanistic explanation for the source of these restorative effects, Wilson and colleagues' biophilia hypothesis provides one plausible and compelling explanation with a strong evolutionary bias. I leave to the reader the question of whether or not, in the wake of a crisis or catastrophe, the impetus to pursue a kind of horticultural or nature restorative intervention can be explained fully or in part by *the biophilia hypothesis*. However, regardless of the explanation, it is hard to ignore the accumulated evidence compiled in this chapter and the other chapters of this book that people continue to turn to greening in times of crisis.

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[1] The author does not believe that killing animals must necessarily indicate less affinity for life or nature; see Tantillo, J. (2001). Sport Hunting, Eudaimonia, and Tragic Wisdom. *Philosophy in the Contemporary World*, Vol 8, No. 2.

[2] See http://whyfiles.org/shorties/211kid_nature/

From Biophilia to Cultivating Resilience?

Fredrickson et al. (2003) hypothesize that resilient people are buffered from depression by positive emotions, and that resilient people thrive through emotions (see also Okvat and Zautra, Chap. 5, this volume). In a study entitled 'What Good are Positive Emotions in Crisis? A Prospective Study of Resilience and Emotions Following the Terrorist Attacks on the United States on September 11th, 2001', Fredrickson et al. (2003) conclude that: (a) positive emotions do not disappear in times of acute and chronic stress but rather are present and functional during crisis, and (b):

> efforts to cultivate and nurture positive emotions in the aftermath of crisis pay off both in the short-term, by improving subjective experiences, undoing physiological arousal, and enhancing broad-minded coping, and in the long-term, by minimizing depression and building enduring resources, the hallmark of thriving (p. 374).

They further suggest that 'finding positive meaning may be the most powerful leverage point for cultivating positive emotions during times of crisis' (ibid).

The use of the word cultivation in the passages above is appropriate at two levels, both explicit and metaphorical. The metaphoric level, and its nod towards biophilia which I link to both the *creation of* and *benefit from* restorative environments, appears more clearly with further study of the word's many meanings. Cultivation has its roots in the transitive verb cultivate, which is defined[3] as:

1. (a) To improve and prepare (land), as by plowing or fertilizing, for raising crops; to till.
   (b) To loosen or dig soil around (growing plants).
2. To grow or tend (a plant or crop).
3. To promote the growth of (a biological culture).
4. To nurture; foster.
5. To form and refine, as by education.
6. To seek the acquaintance or goodwill of; make friends with.

Keeping in mind these definitions of cultivation, and recognizing their relationship to Kellert's typology above, it is intriguing to contemplate aspects of cultivation within the literature on positive emotions and nature. In a study of positive emotions in residential environments in post-war settlements in Germany, Graff (2006) found a strong positive response to greenery, confirming yet again the work of Ulrich, Kaplan and others. Similarly, evolutionary psychologist Haviland-Jones and others (2005) have used language reminiscent of systems thinking's use of positive feedback loops (Tidball and Stedman, 2013 Weinstein and Tidball 2007), which are

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[3] http://education.yahoo.com/reference/dictionary/entry/cultivate;_ylt=Al3kDE0jJEFvFFovLHdfB2CsgMMF

often important features of resilient systems, to describe the relationship between humans cultivating plants and cultivating positive emotions:

> (C)ultivated flowers fit into an emotional niche – their sensory properties elicit human positive emotions. The flowering plants are thereby rewarding to humans and in return, the cultivated flowers receive propagation that only humans can provide. Demonstration of such a phenomenon fills several gaps in the literature. It supports the basic significance of emotion for survival. As a corollary it supports the adaptive function of positive as well as negative emotion…and opens an area of investigation into the psychological relationships between humans and other species through their sensory properties that have been relatively neglected (Haviland-Jones, J., Rosario, H., et al., 2005, p. 127).

Lohr and Pearson-Mims (2006) similarly report that people experience more positive emotions, such as friendliness and fewer negative emotions, such as sadness, when they are looking at urban scenes with trees than when looking at the same scenes containing inanimate objects (pp. 676–677).

Several other studies have pointed to the value individuals, as well as communities, place on trees and other aspects of nature immediately after a catastrophe, alluding to notions of cultivation's characteristics of nurturing and protection. An example can be found in Hull's work in which he identified urban forests as the most significant feature that was damaged by a hurricane, despite the fact that there was significant damage to buildings (Hull 1992; see also Hull, Chap. 19, this volume). According to residents, of the numerous values associated with the urban forest post-Hurricane Hugo, positive emotions evoked by trees were most important, followed by the importance of trees in defining Charleston as a community or place. According to Hull (1992), 'the role of urban forests as symbols of cherished meanings and memories needs to be emphasized as a major benefit deriving from urban forestry…. Trees symbolize spiritual values, personal memories, reminders of the past, preservation and endurance' (p. 3). This cultivation of trees as important symbolically as well as functionally is dealt with in greater depth in Tidball, Chap. 20, this volume.

Links Between Urgent Biophilia and Resilience

This chapter has as one of its aims the examination of the linkages between urgent biophilia and resilience from individual, through family, neighborhood, community, and larger spatial and temporal scales in disaster and other crisis contexts. Urgent biophilia, or the idea that human-nature interactions and the positive emotions they elicit can rapidly and unexpectedly play an important role in conferring resilience across scales in post-disaster contexts, will undoubtedly be met with resistance, given such other equally urgent needs as personal safety and security, food, water, medical supplies, and re-building functional infrastructure. Despite this, and referring to resilience scholars Walker and colleagues (2002), understanding where resilience *resides* in the system, and when and how it can be lost or gained, is required to manage a system for resilience.

Here I hypothesize that one source of SES resilience after a catastrophe is humans' affinity for nature and the urge to express that affinity through creation of restorative environments, which may also restore ecological function. In other words, resilience in a perturbed red zone system may reside in places like memories of the value of interacting with plants (Tidball et al. 2010) or other life forms, in the *act* of expressing urgent biophilia as argued here, or in the planted, restored spaces themselves. I suspect that resilience in perturbed red zone systems likely resides in a combination of all of these. As it relates to the adaptive cycle (Holling and Gunderson 2002; for more on resilience and adaptive cycles, see Tidball and Krasny, Chap. 2, this volume) it would appear that the contribution of urgent biophilia to SES resilience resides or flourishes in the 'back loop', the time of greatest potential for the initiation of change in the system (Walker and Salt 2006, p. 82; see also Fig. 4.1). In this vein, I propose revisiting Folke et al.'s (2002) statement that '*erosion* of the sources of resilience leads to *fragile* social-ecological systems, with *consequences* for human livelihoods, vulnerability, security, and conflicts' (emphasis added, p. 51). Instead, tailoring the Folke et al. statement as a way of understanding urgent biophilia as a source of resilience, I posit that: *cultivation* of the sources of resilience may lead to *vital* social-ecological systems, with *positive implications* for human livelihoods, vulnerability, security and conflicts. Greening in the red zone, then, can be imagined as a manifestation of a conscious, urgent biophilia acting as and activating a source of resilience in post-conflict and post-disaster settings.

Conclusion

In summary, integrating Wilson's (1984) notions of biophilia with more recent research on positive responses to plants and green spaces including in post-disaster settings, I have proposed the following explanation for an urgent biophilia. During more stable periods, humans exhibit varying degrees of affinity for nature at what Wilson and others argue is a mostly sub-conscious level. We often use gardening and other forms of nature stewardship to recover from personal hardship. However, in post-disaster contexts, plant-people interactions and the positive emotions they elicit may compellingly and suddenly come to the fore in heretofore unexpected ways, and be manifested in *immediate* and *conscious* actions, often beyond merely individuals to include neighborhoods, communities, and whole societies.

Further, such manifestations of affinity for nature after a disaster, *urgent biophilia*, may play a critical role in the ability of humans and larger social-ecological systems to recover post-disaster. This switch from base-line sub-conscious biophilia during times of growth and stability, to conscious urgent biophilia during times of collapse followed by reorganization reflects cyclic changes described as the adaptive cycle in SES resilience writings (see Gunderson and Holling 2002). Once war, hurricanes, or another disaster threatens to 'flip' a SES into a less desirable state, humans may respond to feeling threatened or a sense of loss by seeking physical and emotional affiliation with other living organisms, and in so doing, may aid themselves, as well

as other parts of the system, in recovery. Should this biophilic response also include individuals working collectively to enhance their local environment, e.g., through community forestry and community gardening, it may further contribute to recovery of other ecological elements of the larger SES. Although this urgent response does not necessarily take us in the direction that Wilson and others envisioned when proposing biophilia (i.e., furthering the claims of sociobiology or conservation of biodiversity), it may have implications for better understanding human-nature interactions in SES perturbed by catastrophe, and the relationship those human-nature interactions have to SES resilience. Such an understanding of human-nature interaction in terms of resilience can only help when disaster or war strikes, and it is my hope that future research into urgent biophilia as it is manifested in greening in red zones will contribute to efforts by governments, NGOs, and others to reduce pain and suffering of all citizens of social-ecological systems, human and non-human, in the aftermath of crisis.

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