Chapter 7
The Role of Nature in Children's Resilience: Cognitive and Social Processes

Nancy M. Wells

Abstract This chapter examines the convergence of two literatures: one addressing human resilience, the other focused on the natural environment and human well-being. Research evidence suggests that views of and access to nearby nature serve as protective factors, bolstering the resilience of youth. However little effort has been made to explicitly integrate resilience or positive psychology with nature and well-being research and theory. First, a brief historical overview of childhood resilience literature is presented with a focus on the evolution from protective factors to protective mechanisms. Second, the chapter presents research connecting nature to positive outcomes, particularly in the context of stress, adversity, and other risk factors. Third, we consider two particularly viable, well-grounded mechanisms linking nature to resilience: social relationships and cognitive functioning. Lastly, directions for future research are presented. Further examination of the intersection of resilience and the natural environment holds promise for theory as well as practice, and has the potential to substantially influence the lives of children facing the challenges of life in a red zone.

Keywords Children • Nature • Resilience

Environmental psychologist Nancy Wells integrates research on nature and children's well-being with the literature on children's psychological resilience. In so doing, she suggests cognitive and social interaction mechanisms for how interaction with nature might be a source of psychological resilience for children in red zones.

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Focus on Health and Wellness

In recent decades, a significant shift has occurred across many health and social science disciplines. Interest has re-oriented from a focus on disease and illness to an emphasis on health and well-being. This transition is rooted in the concept of health articulated by the World Health Organization:

> Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being … (World Health Organization 1946).

This definition expresses a focus on wellness rather than illness and also conveys that health is not under the exclusive purview of healthcare practitioners, but rather, is relevant to a wide variety of disciplines. This broader conceptualization of health has been associated with a gradual movement away from the historical preoccupation with negative influences on human health and well-being, from questions such as: *What are the factors that make us sick*? *What experiences lead to dysfunction or depression*? *What environmental factors result in distress or illness*? to a focus on what promotes health and successful functioning: *What are characteristics of people*, *places*, *programs that enhance well-being*? This paradigm shift has occurred across disciplines, including psychology (Sheldon and King 2000; Zautra 2009), urban planning (Barton and Tsourou 2000; Wells et al. 2010), gerontology (Rowe and Kahn 1998), and public health (Srinivasan et al. 2003; Ozer 2006) bringing attention toward salutogenesis—the origins of health, rather than pathogenesis—the origins of disease and pathology (Barton and Tsourou 2000).

In the field of psychology, an interest in *resilience and positive psychology* has emerged after decades of focus on dysfunction and disorder. Many researchers are now concerned with what factors explain the patterns exhibited by people who, despite facing considerable 'slings and arrows' of challenge and adversity, defy the odds and overcome misfortune, not merely by surviving, but by thriving. More specifically within the subfield of environmental psychology, attention has increasingly focused on environmental features that enhance health (Stokols 1992; Taylor et al. 1997), beyond the environmental stressors and toxins that undermine health and function. One substantial area of inquiry examines the beneficial effects of the natural environment on human health and functioning (Frumkin 2001; Wells and Donofrio 2011). Researchers have studied how exposure to (e.g., views of, proximity to, walks in, images and videotapes of) nature (i.e., trees, vegetation, parks and open space) relates to a variety of outcomes including social, psychological, physical, cognitive, and physiological well-being (see also Okvat and Zautra, Chap. 5, Chawla, Chap. 8, and Tidball, Chap. 4, this volume).

Remarkably, despite the seemingly convergent foci of research on human resilience and studies of nature and well-being, relatively little attention has been given explicitly to the connection between the two literatures (for an exception, see Chawla, Chap. 8, this volume). By examining the role of nature as a resilience resource in the lives of children, this chapter provides a foundation for understanding the processes

that explain how greening might contribute to the well-being of youth living within a red zone. The paper will present a brief overview of childhood resilience research followed by an examination of the literature linking nature to children's well-being, with a focus on mechanisms that could plausibly explain *how* nature contributes to children's resilience. Lastly, directions for future research will be considered.

Childhood Resilience

> Biologist often talk about the 'ecology' of an organism: the tallest oak in the forest is the tallest not just because it grew from the hardiest acorn; it is the tallest also because no other trees blocked its sunlight, the soil around it was deep and rich, no rabbit chewed through its bark as a sapling, and no lumberjack cut it down before it matured. We all know that successful people come from hardy seeds. But do we know enough about the sunlight that warmed them, the soil in which they put down the roots, and the rabbits and lumberjacks they were lucky enough to avoid? (Gladwell 2008, pp. 19–20).

This section presents a brief summary of the childhood resilience literature. This is not an exhaustive review, but rather a thumbnail sketch, emphasizing the key trends and themes.

Historical Overview: Protective Factors and Protective Mechanisms

Protective Factors

A useful step to understanding resilience is to consider the historical origins of childhood resilience research. This has been presented in some detail by Luthar (2006) and is summarized here. Some of the earliest studies of resilience focused on the children of schizophrenic parents (Anthony 1974; Garmezy 1974; Rutter 1979). While prior research had examined the maladaptive behavior typically exhibited by the offspring of schizophrenics, researchers began to notice the remarkably healthy, adaptive pattern of behaviors exhibited by a subset of these children, who were referred to as 'resilient' or 'invulnerable'. Early studies focused on identifying the personal qualities of these youth. Characteristics such as creativity and competence were noted. Also in the 1970s, researchers studied children in the context of stressful life events (e.g., death, injury) and continued to identify characteristics of children who were able to cope effectively (Murphy and Moriarty 1976). These included charisma and the ability to regulate emotions, for example. Subsequently, the ground-breaking research of Werner and colleagues (Werner and Smith 1982) tracked an entire birth cohort on the island of Kauai, Hawaii. Examining a variety of risk factors ranging from poverty to family instability, additional protective factors were identified including dispositional attributes such as sociability, as well as factors outside the individual such as ties of affection within the family, and informal support outside the home.

Table 7.1 Characteristics of resilient youth (Adapted from Masten and Coatsworth 1998)

Source	Characteristic
Individual	Good intellectual functioning
	Appealing, sociable, easygoing disposition
	Self-efficacy, self-confidence, high self-esteem
	Talents
	Faith
Family	Close relationship to caring parent figure
	Authoritative parenting: warmth, structure, high expectations
	Socioeconomic advantages
	Connections to extended supportive family networks
Wider social context	Bonds to prosocial adults outside the family
	Connections to prosocial organizations
	Attending effective schools

Although childhood resilience research began with a focus on identification of personal characteristics associated with resilience, over time it was increasingly recognized, beginning with the work of Emmy Werner and others, that resilience could originate from factors outside of the child. This yielded the articulation of three sets of factors related to the development of resilience: (1) individual attributes of the child, such as self-esteem, (2) characteristics of the child's family, and (3) features of the wider social environment (Rutter 1987; Luthar and Cicchetti 2000). Table 7.1, derived from Masten and Coatsworth (1998), provides a summary of these three groups of factors related to youth resilience.

Protective Mechanisms

More recently, researchers have moved beyond the identification of protective *factors* per se toward an understanding of the *processes* that underlie resilience. Rutter (1987, p. 317) states: 'The search is not for broadly defined protective factors, but rather, for the developmental and situational mechanisms involved in protective processes'. Rutter suggests four types of mechanisms related to: (1) reduction of risk impact, (2) reduction of negative chain reactions, (3) establishment and maintenance of self-esteem and self-efficacy, and (4) opening of opportunities. An understanding of processes, Rutter argues, is particularly useful because it enables the formulation of preventive strategies and interventions.

Linking Resilience and Nature Research

In an attempt to assess the plausible linkages between the resilience literature and the nature and well-being evidence, I first briefly present research connecting nature

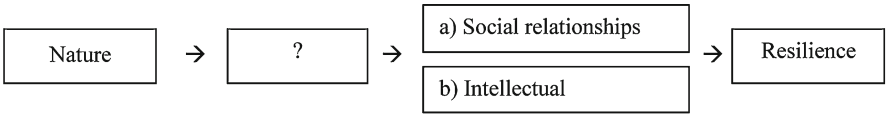

Fig. 7.1 Linking nature to children's resilience

to positive outcomes, particularly in the context of stress, adversity, or other risk factors. Second, I consider the viable mechanisms linking nature to resilience. Interestingly, the two factors most solidly grounded as predictors of resilience are both particularly well-represented in the literature examining nature and human well-being. In reference to Table 7.1, Masten and Coatsworth (1998, p. 212) state 'the two most widely reported predictors of resilience appear to be relationships with caring prosocial adults and good intellectual functioning'. Building on Rutter's (1987) call for an understanding of *processes* through which protective factors are acquired, the following section reviews the nature and well-being evidence and considers the two most plausible linkages between nature exposure and resilience: how access to nature (1) supports social relationships and (2) bolsters intellectual (cognitive) functioning (Fig. 7.1).

Nature: What Role in Youth Resilience?

> Pharoah… crouched in the weeds nearby, his legs tucked underneath him, and picked at the vegetation, which now reached his neck. He was lost in his thoughts…. He didn't want to leave this place, the sweet smell of wildflowers and the diving sparrow. There was a certain tranquility here, a peacefulness that extended into the horizon like the straight, silvery rails[1] (Kotlowitz 1992, p. 7).

In his book, *There are No Children Here*, author and journalist Alex Kotlowitz describes the experiences of two brothers, Pharoah and Lafayette, growing up in inner-city Chicago public housing. In this hostile urban environment, the boys face gang warfare, violence, poverty, and even the death of friends. For 9-year-old Pharoah, the small patch of nature offers a place to retreat from this threatening world—a safe haven amid the chaos. Pharoah's experience may represent youth in a variety of 'red zones'—ranging from military regions to areas stricken by natural disaster to treacherous urban neighborhoods like his own (see also Chap. 8 by Chawla, this volume). In this section, evidence is briefly reviewed suggesting that the natural environment might bolster functioning in the context of adversity.

Numerous studies have examined the effects of nature on individuals faced with stress or adversity. The variety of risks or stressful scenarios addressed has ranged from physical health crises to stressful life events to economic hardship

[1] 'Rails' refers to railroad tracks.

and the concomitant stressors of poverty. Although not all studies have examined youth, the findings provide insight into the influence of the natural environment on children. Researchers have explored, for example, how views of nature speed surgery recovery (Ulrich 1984); how contact with nature helps to buffer the impact of life stressors (Wells and Evans 2003); how nearby vegetation enhances the coping skills of women living in inner city poverty (Kuo 2001); and how activities in nature bolster functioning among women recently diagnosed with breast cancer (Cimprich and Ronis 2003). Although these studies all address how people faced with stress or adversity manage to cope or adapt effectively, they have not explicitly been linked to the resilience literature. Herein, we examine studies of nature and well-being in the context of resilience theory and explore plausible underlying mechanisms.

One study explicitly examining the role of nature as a buffer or moderator (i.e., effect modifier) of life stress among children studied more than 300 rural youth (Wells and Evans 2003). Findings indicated that access to nearby nature buffered the impact of stressful life events such as being picked on at school, being subject to peer pressure, fighting with siblings, moving to a new home, and the death of a grandparent. After controlling for family income, children with more nature near their homes were less affected by stressful life events in terms of both psychological distress and global self worth. This study, however, fails to examine the possible mediating mechanisms that could explain the buffering effect of nature. In the following section, we discuss plausible mediators, with particular focus on two themes: (1) social relationships and (2) cognitive functioning (Fig. 7.1).

Social Relationships

Various studies provide evidence that nature fosters social interaction and contributes to the development of social relationships. This clearly relates to both the 'bond to prosocial adults outside the family' and to 'connections to extended supportive family networks' (Masten and Coatsworth 1998) cited in Table 7.1 as key characteristics of resilient children and youth.

Several studies conducted within the Robert Taylor Homes public housing complex in Chicago provide the bulk of the evidence that nearby natural areas are frequently used, facilitate social interaction, and contribute to the development of social bonds. Coley et al. (1997) found that the outdoor public spaces with trees and vegetation were associated with greater use by both youth and adult residents. Using observational data, Sullivan et al. (2004) replicated these findings. They document that nearly twice as many people used the green spaces compared to the barren areas and that 83 % more social activities occurred in green versus barren spaces. With respect to children, Faber Taylor and colleagues (1998) documented that green spaces were both more supportive of children's play and that children had more access to adults in green outdoor settings than in the more barren outdoor spaces.

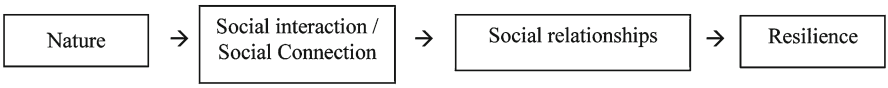

Fig. 7.2 Social relationships: the protective mechanism linking nature to resilience

The green spaces enabled more intergenerational interaction, including greater contact with family as well as non-family members. The evidence from these studies is reinforced by data from Eubanks Owen (1988) who found that natural areas are highly valued by adolescents—particularly as places to interact with peers.

Another group of Chicago public housing studies, rather than examining activities within outdoor spaces, examines differences between building residents. This work takes advantage of a natural experiment that allows researchers to compare residents of architecturally identical public housing buildings which differed only in the amount of nearby trees and vegetation. Some buildings were surrounded by trees, while others stood in a relatively barren landscape. Public housing residents were essentially randomly assigned to their housing units, thus reducing the likelihood that differences between the groups as a result of self-selection would play a role. In a study of older residents of the public housing complex (age 64–91), Kweon and colleagues (1998) found that those living in buildings surrounded by trees had higher levels of social integration than those with little nearby vegetation. They knew their neighbors well, had a greater sense of belonging, and experienced higher levels of social support and stronger social ties (Kweon et al. 1998). In addition, Kuo et al. (1998) studied 145 residents of Robert Taylor Homes and found that not only did residents of greener building complexes have stronger social ties than residents of the less green housing, but the relationship between vegetation and neighborhood social ties was mediated, or explained, by social interaction.

Together, the evidence strongly suggests that green settings serve as a social magnet, drawing people together and fostering social interaction, the development of friendships, and the formation of neighborhood social ties. This literature provides a clearer understanding of one plausible mechanism that might link nature access to childhood resilience (Fig. 7.2).

Cognitive Functioning

The second mechanism linking nature with resilience is cognitive functioning (or 'intellectual functioning' in Masten and Coatsworth's (1998) list, see Table 7.1). Note that while it is common to consider the *trait* of intellectual ability as a relevant protective factor in one's resilience or ability to adapt when confronted with risk and adversity, beyond that, the *state* of cognitive functioning is also relevant to coping and adaptation. For example, day-to-day cognitive functioning (attentional capacity

in particular) has been associated with management of major life issues (Kuo 2001). Considerable research, grounded in Attention Restoration Theory (Kaplan and Kaplan 1989; Kaplan 1995), has documented nature's beneficial effects on cognitive functioning. We will consider first the theory and then, related evidence.

Attention Restoration Theory

Attention restoration theory (ART) is rooted in William James' (1892) proposal that humans have two types of attention: directed or voluntary attention and involuntary attention. Directed attention, defined as 'the ability to control distraction through the use of inhibitory mechanisms', requires effort. Directed attention is employed when we focus or concentrate on a task such as balancing a checkbook, studying for an exam, or writing a manuscript. When directed attention is used for prolonged periods with little rest, a state of directed attention fatigue (DAF) occurs. DAF is characterized by difficulty concentrating, distractibility, reduced inhibitory control, and often, irritability. ART posits that the inherently fascinating features of nature, such as a babbling brook or lush green leaves, easily and gently engage involuntary attention and thereby allow the mechanisms underlying the more effortful directed attention to rest and recharge (Kaplan 1995; Kaplan and Kaplan 1989).

Kaplan and Kaplan (1983) have suggested that four characteristics are necessary for an environment to facilitate recovery from DAF. *Fascination* is found in environments that draw one's attention effortlessly, thereby engaging involuntary attention. *Being away* is the experience of taking a mini-vacation from daily concerns. This may be provided by a very brief experience such as gazing out the window, or by a longer outing, such as a walk in the woods or a vacation in a national park. *Extent* is the depth or scope of the experience; an experience in which one can become immersed has extent. *Compatibility* refers to the match between the environment and one's purposes or inclinations, such that directed attention is not needed and is allowed to rest. Because these four characteristics are most commonly found in natural settings, nature proves to be the most reliable source of mentally restorative experiences (Kaplan and Kaplan 1989; Kaplan 1995).

Several studies with adult participants have provided support for ART by documenting that views of, or access to nature enhances cognitive functioning. Studies have employed different operationalizations of nature ranging from the window view from one's residence, to exposure to nature images, to a walk in a natural setting. For example, Tennessen and Cimprich (1995) found that college students with views of nature (e.g., trees, a lake) from their dormitory rooms performed significantly better on cognitive tasks and reported functioning more effectively in daily life than students who had views of the built environment (e.g., streets and buildings). In a study by Hartig and colleagues (1991), backpacking enthusiasts were randomly assigned to: an urban vacation, a backpacking vacation, or no vacation. Those in the backpacking (nature) condition showed an improvement in cognitive performance (i.e., proofreading) following the trip, whereas those who went on an

urban vacation or no vacation showed no improvement. In a second study, the same authors compared the cognitive performance of participants who took a walk in a natural setting, others who took an urban walk, and a third group who engaged in passive relaxation following 40 min of attentionally fatiguing tasks. As with the first study, the group that engaged in the nature experience performed highest on the proofreading task (Hartig et al. 1991). More recently, in a laboratory study, Berto (2005) induced cognitive fatigue and then presented participants with nature images (e.g., fields, hills, lakes), built images (e.g., buildings, cars, streets), or geometric figures. Comparing pre- and post-tests of attentional capacity, only individuals in the nature condition showed improvement. In addition, Berman et al. (2008) conducted a pair of studies to examine the influence of nature on cognitive functioning. In the first study, participants were randomly assigned to walk either in a nearby park or in an urban area. People in the nature condition showed significantly greater improvement in performance from pre-walk to post-walk. The second study differentiated various aspects of cognitive functioning, showing that only those predicted to improve based on nature exposure (i.e., attention tasks involving executive functioning, which relates to planning, cognitive flexibility, initiating tasks and inhibiting inappropriate behaviors) improved following exposure to nature images compared to urban images, while other tasks (i.e., orienting and alerting tasks) remained relatively stable. These studies and others document the beneficial effects of nature on the cognitive functioning of adults.

Studies of children provide additional evidence linking nature to cognitive or intellectual functioning. In the first study to examine attention restoration theory with respect to children, Wells (2000) studied youth whose families relocated to new homes. Findings indicated that improvements in cognitive functioning from pre-move to post-move were explained by increases in nearby nature (and not by changes in housing quality). Subsequently, researchers examined the effects of nature exposure among children diagnosed with attention deficit hyperactivity disorder (ADHD) (formerly known as attention deficit disorder (ADD)). The premise underlying this line of research is that ADHD, though more chronic and persistent than DAF, may have some fundamental similarities with DAF in terms of brain functioning and symptoms. Both conditions are characterized by behaviors such as difficulty focusing or concentrating, inability to complete tasks, and impulsivity. Faber Taylor et al. (2001) examined a group of children diagnosed with ADHD. Based on a survey administered to parents of children with ADHD, children were reported to function better than usual after activities in green settings compared to activities in non-green settings. Moreover, the 'greener' the child's play area, the less severe his or her ADHD symptoms were reported to be. One participating parent who had recently begun taking her child to a nearby park for 30 min each morning prior to school noted:

> Come to think of it, I have noticed his attitude toward going to school has been better, and his school work has been better this past week. I think it's because spending time at the park is pleasurable, quiet, calming.
>
> Parent (Faber Taylor et al. 2001, p. 66)

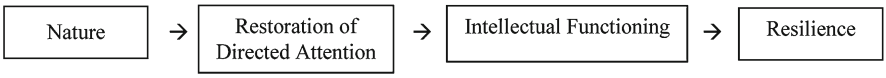

Fig. 7.3 Intellectual functioning: the protective mechanism linking nature to resilience

An online survey with a national sample of parents of ADHD children yielded similar findings (Kuo and Faber Taylor 2004). Most recently, a true experiment supported the findings of the survey research. Faber Taylor and Kuo (2009) conducted a within-subjects comparison of the cognitive performance of children diagnosed with ADHD following a nature walk, a neighborhood walk, or a downtown walk. Following the nature walk, children's cognitive performance was significantly better than following the downtown or neighborhood walks.

Another study, part of the program of research conducted within Chicago public housing discussed above, examined the influence of nearby nature on the self-discipline of children. Researchers examined three aspects of self-discipline: concentration, inhibition, and delayed gratification. Findings indicated that among girls, the amount of nature viewed from home was systematically related to all three measures of self-discipline, suggesting that exposure to nature bolsters the executive functioning of the brain. Among boys however, no such pattern was found. The absence of a relationship with respect to boys is presumably due to the fact that boys tend to spend less time in and near the home environment and have a larger territorial range (Faber Taylor et al. 2002).

Together, the evidence provides a compelling argument for the bolstering of cognitive functioning as a plausible protective mechanism explaining how exposure to the natural environment contributes to children's resilience (Fig. 7.3).

The Natural Environment and Children's Resilience: Future Research

Further research is needed to consider the potential role of nature access in human resilience. Luthar (2006) suggests that researchers ought to examine the role of therapeutic intervention studies such as those involving music, art and pets. The natural environment should be added to this list. Although not typically studied within the resilience framework, the nature and well-being literature offers abundant evidence that nature enhances human functioning. Greater integration of these areas of inquiry is likely to be fruitful.

Other Possible Mechanisms

We have focused on the two most plausible and empirically-grounded connections linking nature access to children's resilience: social relationships and intellectual or

cognitive functioning. Other mechanisms are also possible although less clearly established. For example, drawing again from Masten and Coatsworth's (1998) list of characteristics of resilient youth, *self-efficacy*, *self-confidence and high self-esteem* might also be bolstered by experiences in nature. Active stewardship of the land (Svendsen 2009) and community gardening activities (Ober et al. 2008) have been linked to themes of empowerment and self-esteem. These topics merit further research attention.

In addition, the physiologically-oriented work of Roger Ulrich and colleagues regarding *recovery from stress* provides a link to the resilience theme of 'bouncing back' (Luthar 2006). For example, in a laboratory study, Parsons and colleagues (1998) found that participants who viewed nature-dominated videotapes experienced quicker and more complete recovery (i.e., heart period and skin conductance response magnitude) from induced stress than participants who viewed artifact-dominated scenes. Similarly, measuring physiological recovery with several indices (i.e., pulse transit time, electrocardiogram, and skin conductance response), Ulrich et al. (1991) found that subjects shown a videotape of natural settings following exposure to a stressful movie recovered more quickly and completely than individuals shown a videotape of an urban setting following the stressful movie. Future research might employ measures of physiological stress to further investigate nature as a resilience resource.

Nature's Relation to Protection and Vulnerability

Another area for future research concerns more clearly examining nature's presence as protective as well as nature's absence as a vulnerability factor. Some vulnerability indices are unipolar (for example child maltreatment or physical injury) in that they can lead to disorder or dysfunction when present, but do not lead to excellence when absent, or conversely, can bolster functioning when present, but are not associated with failure when absent. However, most vulnerability indices are bipolar, with effects occurring at both extremes—protection at one extreme and vulnerability at the other (Rutter 1987; Masten 2001; Luthar 2006). Thus, labeling a factor as 'protective' or 'vulnerability' is often somewhat arbitrary. With respect to the influence of the natural environment on children's resilience, the topic of bipolarity suggests fruitful avenues for future research aiming toward a clearer understanding of the dose–response effects of nature access. While the focus herein has been on the presence of nearby nature as a protective factor in the context of stress or adversity, future research could more explicitly examine the consequences of various levels of nature access including nature deprivation (Louv 2005). Theorists and practitioners alike would benefit from an understanding of the dose–response relation between the natural environment and resilience. From a theoretical standpoint, such information would help to clarify whether specific thresholds exist in terms of nature's capacity to bolster functioning and resilience and whether the requisite amounts of nature exposure differ for various types of benefits (e.g., social, cognitive, psychological, etc.). Moreover, from a practical standpoint, greater clarity regarding dose–response relations could translate into

the development and implementation of evidence-based 'green' intervention strategies aimed at children living within red zones such as post-natural disaster contexts, war zones, or impoverished inner-city neighborhoods. In these contexts, 'shovel-ready' strategies that can be efficiently implemented could significantly bolster resilience and thereby enhance the capacity of millions of youth to not merely survive, but potentially, to thrive, despite their perilous and hostile surroundings.

Nature as a Buffer

Within the framework of resilience, more research is needed to explicitly examine the role of nature as a buffer or protective mechanism (Rutter 1987). Protective (or vulnerability) factors can be conceived in two ways. First, such factors may be viewed as simple additive models in which the protective factor has a main effect on the adaptive outcome or resilience indicator (e.g., people with more (versus less) nature access exhibit better social, physical, or cognitive well-being). Alternatively, protective (or vulnerability) factors may be characterized through interactive models in which the protective factor moderates[2] (interacts with) the risk or adversity exposure such that the detrimental impact of the risk factor is reduced (Luthar and Cicchetti 2000) (e.g., people with more (versus less) nature access exhibit less psychological or physiological effects of stress exposure). Most of the literature linking nature to resilience is of the first type in which nature is associated with resilience outcomes or with mediators plausibly linked to resilience. Relatively few studies have adopted the second model (Ulrich et al. 1991; Parsons et al. 1998; Wells and Evans 2003). Further research is needed to more explicitly look at the second type of model, in which nature, by interacting with the stress or adversity variable, serves a protective or buffering function, reducing the negative effects (e.g., a child living in poverty will have a less negative outcome in terms of academic performance, for example, if he or she has access to a nearby park or natural area. In other words nature access will moderate or buffer the effect of poverty on academic performance). Research examining moderators or interaction variables would be particularly relevant to the study of youth within red zones, where nature has the potential to enhance resilience. Investigations adopting an interaction model

[2] **Moderators**, also known as 'interaction variables' or 'effect modifiers' address issues of *when*, *for whom*, *it depends*, or *under what circumstances*. For example, being raised in an abusive household may have less detrimental effects for children who have a positive relationship with an adult outside of the home (the protective factor) than for children who do not have such a relationship. In other words, the effect of an abusive household on child outcomes varies according to (or depends upon) positive adult relationship outside the home (the moderator). **Mediators**, in contrast, concern explanatory mechanisms or causal pathways linking variables. Mediators address questions of *how* or *why*. For example, why does access to nature enhance cognitive functioning?—by reducing directed attention fatigue. In this case, directed attention fatigue mediates the relation between nature and cognitive functioning. See Baron and Kenny (1986) and Wells et al. (2007).

will help to further integrate the resilience literature and the nature-well-being literature by more explicitly linking risk and vulnerability factors (e.g., poverty, maltreatment, etc.) with nature as a protective factor.

Conclusion

This paper has attempted to initiate an integration of the childhood resilience literature with the natural environment and children's well-being research. Considerable evidence suggests that views of and access to nearby nature serve as a protective factor, bolstering the resilience of youth. Moreover, in keeping with the interest in the resilience field to move beyond the mere identification of resilience factors toward an understanding of processes, the extant literature provides considerable insight into plausible developmental mechanisms. Further examination of the intersection of these two areas of study holds promise for theory as well as practice, and has the potential to substantially influence the lives of children facing the profound challenges of life in a red zone.

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