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NEARBY NATURE

A Buffer of Life Stress Among Rural Children

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ABSTRACT: Identifying mechanisms that buffer children from life's stress and adversity is an important empirical and practical concern. This study focuses on nature as a buffer of life stress among rural children. To examine whether vegetation near the residential environment might buffer or moderate the impact of stressful life events on children's psychological well-being, data were collected from 337 rural children in Grades 3 through 5 (mean age = 9.2 years). Dependent variables include a standard parent-reported measure of children's psychological distress and children's own ratings of global self-worth. In a rural setting, levels of nearby nature moderate the impact of stressful life events on the psychological well-being of children. Specifically, the impact of life stress was lower among children with high levels of nearby nature than among those with little nearby nature. Implications of these findings are discussed with respect to our understanding of resilience and protective mechanisms.

Keywords: nature; restoration; children; stress; housing

During the past 30 years, a substantial body of literature has illustrated that the natural environment has profound effects on the well-being of adult

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humans. Time spent in contact with the natural environment has been associated with better psychological well-being (R. Kaplan, 1973), superior cognitive functioning (Cimprich, 1990; Hartig, Mang, & Evans, 1991; Kuo, 2001; Tennessen & Cimprich, 1995), fewer physical ailments (E. O. Moore, 1981; West, 1986), and speedier recovery from illness (Ulrich, 1984; Verderber, 1986; Verderber & Reuman, 1987). In addition to the studies of adults, research has more recently begun to explore children's relationships to the natural environment (e.g., Bartlett, 1997, 1998; Coley, Kuo, & Sullivan, 1997; Kahn & Kellert, 2002; R. C. Moore, 1986; Sebba 1991; Sobel, 1993). And although some research has examined the direct effects of nature on children's functioning or well-being (Faber Taylor, Kuo, & Sullivan, 2001, 2002; Faber Taylor, Wiley, Kuo, & Sullivan, 1998; Grahn, Mårtensson, Lindblad, Nilsson, & Ekman, 1997; Wells, 2000), the notion that nature might buffer or moderate the effects of stress or adversity has not been studied. It is widely accepted that the environment is likely to have a more profound effect on children due to their greater plasticity or vulnerability, and yet there is need for research, especially regarding the potential buffering effects of the natural environment on children's well-being.

This article first contains a brief review of the literature regarding children's affinity for the natural environment and the research, largely of the past decade, exploring the beneficial effects of nature on children. The article then explores the notion that nature may act as a buffer or moderator, mitigating the impact of stress or adversity on children. Finally, an empirical study will be presented examining whether access to nature may act as a buffer.

CHILDREN'S PREFERENCE FOR THE OUTDOORS

Numerous studies have illustrated children's predilection for outdoor settings. The documentation of children's preference for green natural spaces is neither frivolous nor insignificant. From an evolutionary perspective, it is reasonable to expect that humans will have an affinity for settings that are beneficial, therapeutic, or healthful. As S. Kaplan and R. Kaplan (1982) pointed out, "An organism must prefer those environments in which it is likely to thrive" (p. 147). Thus, *preference* in this context is an expression of human needs. Preferred environments are likely to afford long-term survivability and are likely to be the settings in which humans are more likely to

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function effectively (R. Kaplan & S. Kaplan, 1989; S. Kaplan & R. Kaplan, 1982; Parsons, Tassinary, Ulrich, Hebl, & Grossman-Alexander, 1998; Ulrich, 1983; Zube, Pitt, & Evans, 1983).

Numerous studies have documented that children's preferred environments include a predominance of natural elements (Korpela, 2002). For example, R. C. Moore (1986) reported that when urban children aged 9 to 12 were asked to make a map or drawing of all their favorite places, 96% of the illustrations were of outdoor places. In fact, only four drawings mentioned interior spaces and just one drawing was devoted exclusively to building interiors. The children's most frequently drawn favorite places were lawns, playgrounds and schoolyards, their own home, local parks, and single trees. Similarly, a British study found that when 237 children living both on and off public housing estates were asked what they like most about where they lived, 75% of the estate children and 45% of the nonestate children answered in terms of places to play outdoors (Department of the Environment, 1973). Sobel (1993) documented the preference for natural play spaces among both British and Caribbean children. A retrospective study by Sebba (1991) reported that when asked to describe the most significant or favorite place of their childhood, 97% of adults indicated outdoor places. And in his 1977 international exploration of the experience of growing up in cities, Lynch discovered a universal appreciation for vegetation. Youth participating in the study frequently suggested that more trees be planted in their city. "The hunger for trees is outspoken and seemingly universal. . . . Landscaping should be as essential a part of the basic infrastructure of a settlement as electricity, water, sewer, and paving" (Lynch, 1977, pp. 56-57). Given the evidence, it is reasonable to expect that green natural settings, preferred by children, would also have a beneficial effect on children's well-being.

DOES NATURE MATTER? DIRECT EFFECTS OF THE NATURAL ENVIRONMENT ON CHILDREN

Studies of the direct effects of the natural environment on children's well-being include those examining the absence or inaccessibility of nearby nature and those comparing the presence of nearby trees and vegetation with circumstances where vegetation is absent or minimal. These studies employ a range of dependent variables, including cognitive, behavioral, and social outcomes.

In exploring the notion that natural environments may be beneficial to children's well-being, insight can be gained from situations when children are deprived of contact with nature, when nature is "out of reach." In two qualitative studies, Bartlett (1997, 1998) described the circumstances of

young children who, due to a confluence of poverty, lack of space, and over-taxed parents, are unable to play outside. One of the children is described as follows:

Lee often throws tantrums in the doorway when his older brothers go outdoors and tries to fight his way out. Windows are kept shut, and outside doors are locked. . . . Lee is a frustrated child. What he most wants, active play outdoors with other children, is off limits, literally out of reach. . . . In his attempts to escape . . . Lee [frequently] hurts himself. . . . He experiences himself as wild, uncontrollable, and potentially dangerous; but also as thwarted and helpless. . . . Lee has long since exhausted the limited possibilities in [the] two rooms, and his frustration alternates with listless withdrawal. (Bartlett, 1997, pp. 43-44)

Along this same vein, in his study of families in Zurich, Hüttenmoser (1995) found that 5-year-old children who, due to dangerous traffic conditions, could not easily play outdoors unsupervised exhibited poorer social, behavior, and motor skills and had fewer playmates than children with easy access to the outdoors. These data make a strong case for the importance of nature to well-being.

The majority of research exploring the beneficial effects of nature on children has been conducted since the mid-1990s, and nearly all of this work has focused on children living in urban contexts. Several studies have examined the impact of nature on children's cognitive functioning. For example, a Swedish study compared the effects of the natural environment on children's physical and cognitive abilities within two different day care settings. Grahn et al. (1997) found that children attending an "outdoors in all weather" day care facility with surrounding orchards, pastures, and woodlands had better motor coordination and greater attention capacity than did children who attended an urban day care center surrounded by tall buildings. Wells (2000), in one of the few studies to employ a longitudinal design, examined the effects of green natural residential settings on children's cognitive functioning. Children who moved to housing with more nature nearby tended to have higher levels of cognitive functioning than children who experienced less increase in the amount of nearby nature from premove to postmove. More recently, Faber Taylor and her colleagues Kuo and Sullivan (2001) documented that activities in green settings tend to lower the symptoms of children who struggle with a chronic attention deficit due to Attention Deficit Disorder (ADD). And in a second study, Faber Taylor et al. (2002) examined the effect of nearby nature on self-discipline among girls living in Chicago public housing. Findings indicated that mothers' ratings of the naturalness of

window views was predictive of the girls' ability to concentrate, to inhibit impulses, and to delay gratification. Collectively, these studies offer substantial evidence of the effects of nature on children's functioning. Other work by Kuo and Sullivan and their colleagues has focused on the social effects of the natural environment on families living in public housing complexes in Chicago. These researchers compared the behavior and activities of public housing residents in two outdoor spaces—one with many trees and the other relatively barren with few trees. Coley et al. (1997) found that the presence of trees and vegetation in outdoor public spaces was associated with greater use of these spaces by both youth and adult residents. Faber Taylor et al. (1998) found that the green spaces were more supportive of children's play and that children had more access to adults in greener outdoor spaces than in the relatively barren spaces. Areas with natural landscaping appear to promote opportunities for social interaction as well as better adult supervision of children in poor urban neighborhoods. These public housing studies are also noteworthy because of the quasi-random assignment of residents to apartments. Long waiting lists essentially ensure that residents take whatever apartment becomes available—in other words, they rarely choose a particular residence.

Together, the collection of studies described here suggests that not only do children prefer to spend time in natural settings, but disconnection from the natural environment negatively affects the well-being of children. Furthermore, the availability and use of green, outdoor spaces contributes to cognitive function and well-being as well as to social interaction and social connectedness within impoverished, urban communities.

NATURE AS A BUFFER

Considerable empirical research has addressed the impact of negative environmental factors on the health and well-being of children. We know, for instance, that residential crowding and chronic noise (Evans, 2001), pollutants such as lead (Needleman, 1994; Spreen, Tupper, Risser, Tuokko, & Edgell, 1984), and poor housing quality (Bartlett, 1987, 1988; Evans, Wells, & Moch, in press; Gifford, in press) all detrimentally affect children psychologically, cognitively, or physiologically. Increasingly, researchers are also exploring the idea that environmental characteristics may function as buffers or moderators of adverse conditions, serving as protective factors and contributing to resilience among children. Physical characteristics of the home environment, such as the availability of toys and materials, a variety of stimulation, and adequate space for privacy and exploration have been identified as

potentially protective factors (Bradley, Caldwell, & Rock, 1990; Wachs & Gruen, 1982). Safe play space, greater stimulation, and low residential density have been empirically linked to greater resilience among low birth weight children living in poverty (Bradley et al., 1994). Borrowing from Garbarino's (1982) risk-opportunity framework, Dunst and Trivette (1994) have proposed that factors that promote as well as those that impede children's development and well-being ought to be incorporated in theoretical and empirical work. They suggested and provided empirical evidence that "the absence of problems (risk factors) does not adequately consider the environmental conditions related to optimal performance" (p. 302). There is a need to identify environmental factors that bolster functioning and well-being of children. Wells (2000) called for further exploration of the notion that the natural environment, in particular, might buffer the potential effects of stress and adversity, contributing to the resilience of children, adults, families, and communities.

Buffer is another term for an interaction effect or a moderator (Baron & Kenny, 1986; Evans & Lepore, 1997). A moderating variable changes the impact of another independent variable, explaining how or under what circumstances the independent variable affects the outcome variable. Although a moderator or buffer may occur in the presence of a direct or main effect, this is not necessarily the case. A main effect of nature means such exposure directly affects health or well-being. A buffering effect means that nature attenuates the adverse effects of stressors or other adverse main effects on health or well-being. Herein, we examine both the main (direct) effects of nature and stressful life events alone and the moderator (interactive) effects of nature and life stress on children's well-being.

Perhaps access to vegetation and natural areas can help to bolster the resilience of children and others encountering stress, challenge, or adversity. Although research has not explicitly examined the buffering hypothesis, a few laboratory studies with adults suggest that the effects of stressors on well-being may be moderated by exposure to nature. With respect to the amount of nature in commuters' roadside views, Parsons and his colleagues (1998) found that participants who viewed videotapes of nature-dominated drives experienced quicker and more complete recovery from induced stress than did participants who viewed artifact-dominated drives. And in another study, participants presented with videotapes of natural settings recovered faster and more completely from their exposure to a stressful movie than did those presented with a videotape of an urban setting (Ulrich et al., 1991). Recovery from illness also shows parallel trends (Ulrich, 1984). And although no empirical research with children has addressed the role of nature

as a potential buffer, much of Kuo, Sullivan, Faber Taylor, and colleagues' work (Coley et al., 1997; Faber Taylor et al., 1998, 2002; Kuo, Sullivan, Coley, & Brunson, 1998) is suggestive of such a possibility, as they explore the benefits of nearby nature on children living within an impoverished, often treacherous, setting. Furthermore, Kuo (2001), although not statistically examining nature as a moderator, found that nearby nature, by bolstering the attention resources of adult inner-city public housing residents, enhanced their ability to function effectively and make life decisions.

We examine nearby nature as a buffer of the impact of stressful life events on the well-being of children, with two standardized measures of psychological distress (maternal report) and global self-worth (child self-report). We hypothesize that there will be an interaction effect—that the adverse impact of stressful life events will be less severe in the presence of nearby nature. In addition, we predict direct effects of both stressful life events and nature on children's psychological distress and global self-worth. We examine these buffering and main effect hypotheses among a sample of rural children.

METHOD

PARTICIPANTS

A total of 337 children participated in this study. The children lived in small towns in five rural upstate New York communities. They were in Grades 3 through 5 (mean age = 9.2 years). Of these, 49% of the participants were female. Regarding the children's parents, 56% were married and 44% were single, divorced, or widowed. A majority (95%) were White; 3% were Black. Of the children's mothers, 63% had completed at least some college; 33% had 2-year, 4-year, or graduate degrees. The mean income-to-needs ratio for these families was 1.79 (standard deviation 1.66), where a ratio of 1.0 or below represents the U.S. government's definition of poverty. The income-to-needs ratio is an annually adjusted, per capita index comparing household income to federal estimates of minimally required expenditures for food and shelter.

CONSTRUCTS AND MEASURES

Naturalness. A naturalness scale of the residential environment was developed as part of a detailed housing scale instrument (Evans, Wells, Chan,

TABLE 1
The Four-Item Naturalness Scale

<i>Naturalness Scale Item</i>	<i>Area of House</i>
What is the view? 3 = > 1/2 natural, 2 = < 1/2 natural, 1 = no natural, 0 = none	Living room, kitchen
How many live plants are in the room? 2 = > 3 plants, 1 = 1 to 3 plants, 0 = none	Living room
Yard—What material is it? 3 = grass, 2 = dirt, 1 = concrete, 0 = other	Outdoors

& Saltzman, 2000) for a larger study of housing quality and mental health. The Naturalness scale consists of four items regarding the amount of nature in the window view, the number of live plants indoors, and the material of the outdoor yard. The Naturalness scale items are summarized in Table 1.

Children's stressful life events. The Lewis Stressful Life Events Scale (Lewis, Seigel, & Lewis, 1984) was used to assess the frequency of stressful events in the children's lives. This 20-item scale was originally developed and tested on a large sample of 5th- and 6th-grade children. Sample items include "In the last three months, did your family move from one home to another?" "How often were you picked on or made fun of by other kids?" "How often did you fight or argue with your parents?" "How often did someone make you try something new like a cigarette that you really didn't want to try?" and "How often have you been punished or gotten in trouble at school?" For this study, only the frequency of stressors was employed, not the severity ratings. Response options used were *a lot*, *sometimes*, and *never*.

Children's psychological distress. Two measures were used as indicators of children's distress. First, the Rutter Child Behavior Questionnaire was used to assess the children's psychological distress. The Rutter scale is a standardized instrument designed to measure psychological health in nonclinical samples of children. The Rutter scale is a widely used instrument and has well-documented psychometric properties (Boyle & Jones, 1985; Rutter, Tizard, & Whitmore, 1970). The scale consists of 26 items concerning common childhood symptoms indicative of behavioral conduct disorders (e.g., bullies other children) as well as symptoms of anxiety and depression (e.g., often appears miserable, unhappy, tearful, or depressed). These items are rated by the mother on a 3-point continuum (0 = *does not apply*, 1 = *applies somewhat*, 2 = *certainly applies*).

The Global Self-Worth subscale of the Harter Competency Scale (Harter, 1982) was used to index children's self-perception of psychological well-being. This instrument requires that children respond in a forced-choice format, choosing which of two bipolar behavioral descriptions are "really true or sort of true of you." The 6-item subscale includes items such as "Some kids like the kind of person they are *but* other kids often wish they were someone else" and "Some kids are often unhappy with themselves *but* other kids are pretty pleased with themselves."

PROCEDURE

All data were collected using a uniform protocol within the home. One researcher conducted a series of survey and interview questions with the mother. These items included the Rutter Child Behavior Questionnaire. The second researcher conducted a detailed housing characteristics checklist, which included the Naturalness items, and also administered the Harter Competency Scale and the Lewis Stressful Life Events Scale to the child.

RESULTS

The focus of our analytic strategy was to assess whether nearby natural elements would moderate the effects of stressful life events on children's well-being. In addition, we examined whether nearby nature and life stress each had direct effects on children's well-being. Identical analytic procedures were followed for both of the dependent measures—children's psychological distress (Rutter) and global self-worth (Harter). Using hierarchical regression analyses, the families' socioeconomic status as measured by the income-to-needs ratio was entered first to control for its effects. Next, the main effects of first nearby nature and then stressful life events (Lewis) were each examined while controlling for income. Last, the interaction of stressful life events and nearby nature was examined following the inclusion of the covariate (income) and both main effects in the model. Each of the four steps is represented by one line in Tables 2 and 3.

First we examined children's psychological distress as the dependent variable. The initial step of the analysis (line 1 in Table 2) controlled for the explanatory power of socioeconomic status, $F(1, 336) = 49.57, p < .001$. This shows that children of higher socioeconomic status tend to have significantly lower levels of psychological distress. Next, the direct effect of nearby nature is taken into account, $F(2, 335) = 6.27, p = .05$. This is also significant, indicating

TABLE 2
Regression of Children's Psychological Distress (Rutter) Onto Nature, Life Stress, and the Interaction of Stress × Nature, Controlling for Income

<i>Model</i>	<i>Predictor</i>	<i>Total R²</i>	<i>ΔR²</i>	<i>F(ΔR²)</i>	<i>df</i>	<i>b</i>	<i>SE b</i>	<i>p</i>
Control	Income	.129	.129	49.57**	1, 336	-1.99	.283	.000
Main effect	Nature	.145	.016	6.27*	2, 335	2.36	.941	.013
Main effect	Life Stress	.240	.113	53.14**	2, 336	-.352	.050	.000
Interaction	Nature × Life Stress	.259	.011	4.73*	4, 333	-.313	.144	.030

NOTE: Differences in degrees of freedom for main effect analyses reflect variations in sample size.
 * $p < .05$. ** $p < .001$.

TABLE 3
Regression of Children's Global Self-Worth Onto Nature, Stressful Life Events, and Interaction of Stress × Nature, Controlling for Income of Family

<i>Model</i>	<i>Predictor</i>	<i>Total R²</i>	<i>ΔR²</i>	<i>F(ΔR²)</i>	<i>df</i>	<i>b</i>	<i>SE b</i>	<i>p</i>
Control	Income	.050	.050	15.86**	1, 299	.118	.030	.000
Main effect	Nature	.066	.016	5.05*	2, 298	-.228	.102	.025
Main effect	Life Stress	.164	.114	40.54**	2, 298	.034	.005	.000
Interaction	Nature × Life Stress	.200	.029	10.64*	4, 296	.052	.016	.001

NOTE: Differences in degrees of freedom for main effect analyses reflect variations in sample size.
 * $p < .05$. ** $p < .001$.

that children with more nature near the home exhibit less psychological distress. The third line examines the direct effect of children's stressful life events on levels of psychological distress, $F(2, 336) = 53.14, p < .001$. This is highly significant and indicates that children exposed to greater stressful life events experience greater psychological distress. The last line incorporates the interaction of nearby nature and stressful life events. This is also statistically significant. Nearby nature was found to buffer the effects of stressful life events on children's psychological distress, $F(4, 333) = 4.73, p < .05$. The effect of stressful life events on children's psychological distress varies as a function of the amount of nearby nature to which the children are exposed. Specifically, the impact of stressful life events on psychological distress is weaker under conditions of high nature than under low nature conditions. The interaction effect is illustrated in Figure 1.¹ The difference in levels of psychological distress between low nature exposure and high nature exposure was particularly pronounced among children who experienced the highest levels of stressful life events.

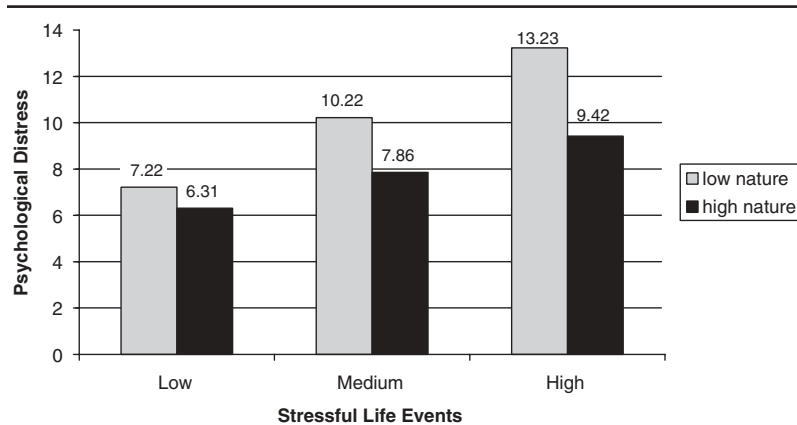


Figure 1: Nature Moderates Effects of Stressful Life Events on Psychological Distress

Identical analyses were conducted with respect to the second dependent measure, children's global self-worth (Table 3). The first line reveals that socioeconomic status, the control or covariate, is positively related to children's global self-worth, $F(1, 299) = 15.86, p < .001$. Degrees of freedom vary because of missing data. Next, there was a main effect of nature, $F(2, 298) = 5.05, p < .05$, such that higher nature corresponds to higher global self-worth. In addition, there was a highly significant main effect of stressful life events, $F(2, 298) = 40.54, p < .001$. Analyses also revealed an interaction effect of nature and stressful life events on global self-worth, $F(4, 296) = 10.64, p < .001$. As shown in Figure 2, nature moderates the impact of stressful life events on the self-worth of rural children. The link between stressors and self-worth is weaker for those children with greater exposure to nature.

DISCUSSION

Consistent with our hypothesis, the results of this study suggest that the presence of nearby nature moderates or buffers the impact of life stress on children. The psychological effects of stressful life events such as family relocation, being picked on or punished at school, or being subject to peer pressure varied depending on the amount of nearby nature to which the children, aged 6 through 12, had access. This moderating effect occurred with both dependent measures—parent-reported psychological distress and children's own reports of global self-worth. With respect to psychological

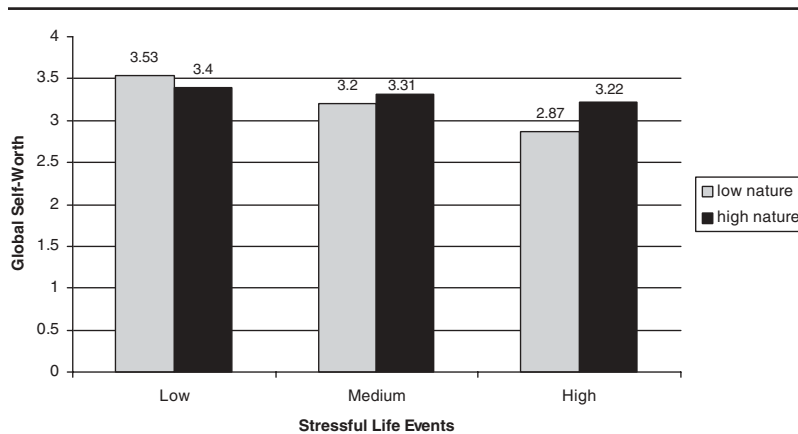


Figure 2: Nature Moderates the Effects of Stressful Life Events on Global Self-Worth

distress, the expected elevations in response to greater life stress are attenuated in the presence of greater exposure to nearby nature. As shown in Figure 1, stressful life events have less impact on psychological distress under *high nature* conditions than under *low nature* conditions. And in the case of global self-worth, nature also buffers the effect of stressful life events. Children with a high degree of exposure to nature seem to be protected from the impact of life stress. This buffering appears to be greatest for those at most risk—those experiencing the highest levels of life stress. Nature's role as a moderator in these analyses is illustrated by comparing the slopes of low nature versus high nature in Figures 1 and 2. The slope of the high nature line is less steep—representing a dampening of the effects of life stress.

Together, these results offer evidence of the potential for nearby nature to moderate the impact of life stress on rural children. The findings, for both dependent measures, are consistent with Rutter's (1987) criteria for a protective effect—that the moderator “either has no effect in low risk populations or its effect is magnified in the presence of the risk variable” (p. 317). One sees here (Figures 1 and 2) a greater buffering effect for those with exposure to greater life stress. The protective or buffering effects of nearby nature are strongest for the most vulnerable children—those experiencing the highest levels of stressful life events. This illustrates an attenuating interactive effect (Evans & Lepore, 1997).

The data also provide support for the hypothesized direct effects of life stress and nature. The direct effects of both nature and life stress were significant for both psychological distress and global self-worth. Children

experiencing more nature were rated by their mothers as being lower in symptoms of psychological distress. These same children also perceive themselves as being higher in self-worth. Analogously, children experiencing more stressors in their lives rated themselves as lower in self-worth and were judged by their mother to have more symptoms of psychological distress. These patterns of results are noteworthy from a methodological perspective given the cross-rater stability.

This study makes several contributions. First, the findings are significant because, unlike those of prior research, they provide evidence of the natural environment's *buffering effect*—indicating that the impact of life stress varies depending on levels of nature exposure. In addition, this work is relatively unique in its focus on children. Most prior work examining the effects of nature has focused on adults, whereas relatively little prior research has examined the impact of the natural environment on children (Grahn et al., 1997; Faber Taylor et al., 1998, 2001, 2002; Wells, 2000). Third, the relatively green *rural context* of this study means that our tests are conservative. Findings of a similar study in an urban setting, where the amount of nearby nature is likely to be more variable, would likely be stronger. Moreover, the use of two *dependent variable measures* further enhances the validity of these findings. Last, this work also differs from prior research in its measurement of nature as a *continuous variable*. The measurement of nature as a continuous, rather than a dichotomous, variable allows us to more confidently rule out possible confounding variables, which might be collinear with nature in a circumstance where nature is measured dichotomously. For example, in some situations the absence or presence of nearby nature is likely to covary with other factors, such as the overall quality of the environment.

ALTERNATIVE INTERPRETATIONS

Our findings suggest that nature buffers the adverse impact of stressful life events on psychological distress and global self-worth. It is important however, in field studies such as this, to consider the possibility of a self-selection bias—the notion that a person may “select into” a housing situation or other circumstance and that this accounts for the reported effects. In other words, perhaps it is not the case that nature buffers the impact of stressful life events but, rather, that some parental characteristics such as personality or socioeconomic status influence the choice of a home with natural surroundings and/or the level of stressful life events experienced by the child. We believe that the selection bias explanation is unlikely for four reasons. First, because we control for income in the first step of our analyses, we eliminate the possibility that family socioeconomic status underlies our results. This is critical

because many housing selection biases are associated with income. Second, generally there is evidence in the literature against the self-selection explanation of relationships between residence characteristics and well-being. For example, Evans et al., (2000) documented that changes in housing quality explained changes in psychological well-being when people relocated from inadequate housing to better housing. Furthermore, in another housing study where families were randomly assigned to residences, housing characteristics were associated with psychological health (Fanning, 1967). Third, because we focus on children, who do not choose where they live, effects of parent selection biases would have to operate cross-generationally. Fourth, any alternative explanation for our results, including selection bias, has to account for the *interaction* of nature and life stress on the outcomes. Recall that our principal focus herein is on the *buffering* or *interactive effects*, not the main effects, of nature. The argument that personality or some other construct is a viable alternative explanation is much more difficult to make for interaction outcomes.

EXPLANATORY MECHANISMS

This study illustrates that access to nearby nature can buffer the effects of stressful life events on psychological distress among children. The result makes the powerful suggestion that vegetation and natural elements in or near a residential setting may be among a variety of potential protective factors that can partially shield children from the impact of stress and adversity—contributing to their resilience. What this work does not tell us is explicitly *how* or *why* this occurs. Identifying protective factors is not enough; it is essential to also delineate the specific *mechanisms* through which such protection occurs (Evans & Lepore, 1997; Rutter, 1987). Although the data in the current study are insufficient to allow an empirical exploration of this question, prior theory and empirical research provide a framework for further speculative interpretation. Two potential explanatory mechanisms will be briefly explored: (a) social support and (b) attention restoration.

Social support is one possible candidate for a mechanism to explain the moderating function of nearby nature. Perhaps natural areas, even in relatively rural settings, draw children together, providing a context for making friends. The social support provided by these rural children's friendships may in turn help to buffer the impact of life stress. Consistent with the notion that green, outdoor spaces foster social interaction and community networks is Hüttenmoser's (1995) finding that both children and parents who lived in places that allowed for outdoor access had more than twice as many

playmates or friends than did those living in places with restricted outdoor access due to traffic. Additional support for this idea is provided by Coley et al. (1997), Faber Taylor et al. (1998), and Kuo (2001), who showed that landscaped areas support social interaction, children's play, and neighborhood social ties in an urban setting. Numerous studies indicate that social support buffers the effects of stress in both adults (Cohen, Underwood, & Gottlieb, 2000; McNaughton, Patterson, Irwin, & Grant, 1992; Roy & Steptoe, 1994; Vaux, 1988) and in children (Cauce, Reid, Landesman, & Gonzales, 1992; Wills, Blechman, & McNamara, 1996). The idea that nature, by fostering social support, may buffer the impact of life stress merits further exploration, particularly with respect to children.

Another possible explanatory mechanism involves the theory that exposure to natural elements help to restore the ability to focus one's attention—in other words, “directed attention capacity.” According to this theoretical perspective (R. Kaplan & S. Kaplan, 1989; S. Kaplan, 1995; S. Kaplan & R. Kaplan, 1983), exposure to nature bolsters one's cognitive resources by allowing neural inhibitory mechanisms to rest and recover from use. This recovery occurs due to four characteristics, most often found in natural environments. Nature's tendency to draw one's attention effortlessly (*fascination*) allows inhibitory mechanisms that underlie attention to rest, while at the same time, the sense of *being away* from one's daily concerns permits a mental vacation, and the *extent* of the environment provides a scope or depth in which one can become immersed. Last, a setting that is *compatible* or well-matched with one's inclinations allows attention to rest. A person whose attention resources have been restored will be able to inhibit the urge to respond to potentially distracting stimuli, able to focus attention, and able to more effectively manage the challenges of daily life. Support for attention restoration theory has been found among breast cancer patients (Cimprich, 1990), backpackers (Hartig et al., 1991), and college students (Tennessen & Cimprich, 1995), among others. Nature's bolstering of attention resources may enable children to think more clearly and cope more effectively with life stress. Greater cognitive clarity may enable children to seek out activities or resources to fortify themselves against life stress as well as enable them to resist the inclination to react to certain stressors or potential distractions. Related to this are the findings of Faber Taylor et al. (2002) that nature fosters self-discipline among urban girls and Kuo (2001) that attention function mediates the relationship between nature and life functioning (i.e., coping and decision making) among urban women. The explanatory linkage or mechanism underlying the buffering effect of nature needs to be explored in future research.

FUTURE RESEARCH

In addition to further exploration of the mechanisms underlying nature's capacity to bolster resilience, research ought to explore the generalizability of the present findings. In an urban setting, where barren treeless spaces are more common and the amount of nature is more variable, it is possible that nature might play a stronger role as a moderator of stress or adversity. Future work might explore whether nearby nature has a similarly buffering effect in more urban settings and with other populations and ages.

Longitudinal work would be a valuable adjunct to this study. First, it would enable a more rigorous causal evaluation. Second, it would provide insight into the impact of nearby nature on human well-being through the life course. Research from a life course perspective might explore questions such as, How do people's relationships with the natural environment change throughout a lifetime? How might frequent exposure to nature in infancy or childhood affect reaction to stressors and general functioning later in life? Longitudinal research exploring people's relationships to nature over time and during various periods of life would be a valuable contribution to our understanding of human/natural environment relationships.

IMPLICATIONS

The implications of this work may be particularly relevant with respect to impoverished children. If access to nearby nature is indeed a protective factor, contributing to the resilience of children and youth, then if nearby nature is lacking, it is one more strike against poor children who already face tremendous disadvantage (Evans & Kantrowitz, 2002; McLoyd, 1990). Moreover, it is the case that, in urban areas, children from low-income families have less access to natural areas. In New York City in 1989, for example, poor children lived in neighborhoods with less than half the park space as nonpoor children. The average poor child in New York City had 17 square yards of park space per child in his or her community district; a nonpoor child lived in a community district with 40 square yards of park per child (Sherman, 1994). Moreover, there is parallel evidence with respect to adults. In the United Kingdom, manual laborers in comparison to professionals are twice as likely to have no access to a private garden area and 4 times more likely to have an outdoor space that is too small to sit outside in the sun (Townsend, 1979). The current data indicate that the link between income or socioeconomic status and access to the natural environment also exists in a rural context, $F(1, 338) = 4.72, p < .05$. Although not a focus of the analysis in this article, it is striking that access to the natural environment appears to be related to socioeconomic

status even in rural areas. Although we might expect such a relationship in an urban context, where wealthier families may live close to parks and have yards surrounding their own dwellings, this is surprising in a rural area. Remarkably, the ubiquitous environmental justice issue documented in metropolitan areas (Evans & Kantrowitz, 2002) may be mirrored in rural settings as well.

The notion that nature plays a buffering or moderating role in protecting children from the brunt of life stress has powerful implications for policy and design. Natural areas proximate to housing and schools are essential features in an effort to foster the resilience of children and perhaps to promote their healthy development. Moreover, the fact that this result occurs within a rural context is particularly noteworthy. Although a recent body of empirical research has indicated that nature is beneficial to urban youth, little work has explored the effects of nature on rural children. The data herein suggest that there is little "ceiling effect" with respect to the benefits of exposure to the natural environment. Even in a setting with a relative abundance of green landscape, more appears to be better when it comes to bolstering children's resilience against stress or adversity.

NOTE

1. The plots presented in Figures 1 and 2 are created by centering both independent variables (i.v.) (subtracting the mean from each value). Regressions are then rerun using centered i.v.s with normal dependent variables (d.v.). Unstandardized beta coefficients from the regression analysis are then used to determine the equation describing the d.v. Dichotomized or trichotomized independent variable values (derived by adding and subtracting the standard deviation to zero—the mean of the centered variable) are then entered into the equation to represent the results in categorical terms. These values are then plotted (Aiken & West, 1991).

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