8 Is contact with nature important for healthy child development? State of the evidence

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We know that children need nature . . . or do we? There are certainly many reasons to think that nature plays an important role in child development. For many of us, intuition emphatically asserts that nature is good for children. We hold intuitions such as, ‘every kid needs a dog’, ‘children need a nice yard to play in’, and ‘children need “fresh air”’. Beyond these intuitions, there are also well-reasoned theoretical arguments as to why humans in general — and therefore children — might have an inborn need for contact with nature (e.g., S. Kaplan, 1995; Wilson, 1984). And there is a growing body of qualitative research consistent with this idea (Bardill, 1997; Hart, 1979; R. Moore, 1989; R. C. Moore, 1986; Naabhan, 1994; Sebba, 1991; Sobel, 1993; Titman, 1994). But what do we really know about the value of nature in promoting child development? What systematic evidence is there for or against this possibility? Is children’s need for nature established fact, yet-to-be-substantiated folk theory, or simply myth?

The question of nature’s role in healthy child development is increasingly urgent. A consistent concern among the researchers studying children and nature is that children’s access to nature is rapidly diminishing (e.g., Kahn, 2002; Kellert, 2002; Pyle, 2002; Kirkham, 2000). Not only may there be less nature for children to access, but children’s access of what remains may be increasingly sporadic. Some researchers suggest that parents are limiting children’s freedom to roam more than in previous generations (Gaster, 1991; Hillman, Adams, and Whitelegg, 1990), partly for fear of traffic and crimes against children (for reviews see Spencer and Woolley, 2000; Valentine, 1997; and Rissotto and Giuliani, this volume). Children’s lives are increasingly filled with programmed activities, leaving them with little time for exploring or free play outdoors (Davis, 1999; Rosenfeld, 2001). With the advent of video games, computers, and the Internet, children today may have more reasons to stay indoors than ever, and busy parents may be inadvertently modeling for their children a life in which nature activities have low priority.

Figure 8.1. The child’s need for contact with nature: more than a romantic notion?

Does it really matter whether children have contact with nature? If children’s need for contact with nature is simply a romantic notion, then we certainly cannot advocate spending precious resources on it. On the other hand, if contact with nature is as important to children as good nutrition and adequate sleep, then current trends in children’s access to nature need to be addressed.

This chapter reviews the literature on children and nature with an eye to answering the question: does contact with nature promote healthy child development? Because the purpose of this review is to assess evidence of a causal link between contact with nature and children’s development, the emphasis is on experimental and quasi-experimental studies, and to a lesser extent, correlational work. We focus on the ways in which nature in two broad realms — ‘green space’ and animals — fosters healthy psychological development.

Children and green space

A diverse array of studies has explored possible impacts of green spaces on healthy child development. These have examined the benefits of green
spaces in a variety of forms, including wilderness programmes, outdoor education programmes with hands-on nature activities, and green space in neighbourhoods, play settings, and schools. The specific outcomes examined have been physical, mental, social, and emotional development, and the populations studied cover a wide range of socioeconomic groups, ages, housing conditions, and countries, though mostly developed ones (with the exception of Rainatopinamp; 2003). Research has included both children in clinical populations and children in the general population.

Overall, there is a great deal of evidence for green space to important developmental outcomes. While a number of recurring methodological weaknesses in this literature limit the conclusions that can be drawn, this body of work also has notable strengths. It is encouraging that positive findings have come from studies employing different measures, research designs, and populations. To the extent that the findings reflect a real effect of green space on children's development, this effect would seem to be pervasive and generalizable to different populations and environments.

Impacts of wilderness programmes

Some of the most exciting findings are a link between contact with green space and developmental outcomes from studies examining the effects of outdoor challenge programmes on children's self-esteem and sense of self. In one such study, in which over 400 youths were surveyed and interviewed, the majority reported an increase in sense of personal autonomy, improved self-concept, a greater capacity for taking action and being decisive, and an improvement in their interpersonal skills after participating in wilderness challenge programmes (Kellert and Derr, 1998). There were similar findings from a study by R. Kaplan (1977) of over 200 youths. Here, close to half of nature programme participants showed an increase from low to high scores on a positive self-view scale (a component of self-esteem) from pre- to post-experience, whereas only a quarter of control group participants demonstrated such a change.

In another study, questionnaires and content analyses were used to assess the experiences of youth in wilderness programmes across various age groups. During their wilderness experience, the participants reported experiencing increased self-confidence and increased self-awareness; after their return to everyday life, they reported greater self-confidence and an improved self-concept from pre- to post-experience, whereas only one in ten of control group participants showed such a change. Similarly, pre- and post-experience surveys of youth and adult wilderness programme participants indicated an increase in psychological

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energy (including feeling self-confident, in control, and able to concentrate), positive outlook, and a decrease in feeling hassled after their wilderness experience (R. Kaplan, 1984). Only one study examining self-esteem before and after an Outward Bound programme obtained null findings, but this null finding may have been due to the small sample size involved (R. Kaplan, 1974).

A few researchers have examined the relationship between nature and educational outcomes. In a study of teenage participants in a residential treatment programme based on wilderness camping, post-treatment parent and teacher reports showed that the majority of youths demonstrated improved interpersonal skills and school performance, but there was no improvement in disruptive behaviours compared to the pre-treatment ratings (Behar and Stephens, 1978). A study of troubled youths in a therapeutic wilderness programme showed an increase in scores on a measure of self-concept and positive findings have come from studies employing and parent reports indicated a reduction in problem behaviours from pre- to six weeks, post-experience (Bandura and Scherer, 1994). Only weak support comes from a study in which Outward Bound participants with Attention Deficit Hyperactivity Disorder (ADHD) and Conduct Disorder (CD) were rated as showing only slight reductions on measures of disruptive behaviours, inattention, and impulsivity, although no statistical tests were reported (Gatcher, 2000). It is interesting to note that four studies included longitudinal measures and found that participants continued to report benefits longer (ranging from six weeks to several years after) their nature experience (Bandura and Scherer, 1994; Behar and Stephens, 1978; R. Kaplan, 1977; Kellert and Derr, 1998).

These findings suggest that contact with green space may have benefits for children's development, but two methodological weaknesses make interpretation of these findings difficult. While this large volume of data (R. Kaplan, 1977; S; R. Kaplan and Tailliet, 1983; Kellert and Derr, 1998) is almost entirely consistent with a systematic relationship between wilderness programmes and several developmental benefits, a limitation is the reliance on self-report measures. Such measures can be biased by participants' beliefs, a desire to please the researcher or by wanting to support the programmes. Another limitation is the confounding of experiences of participants across twenty-five outdoor challenge activities. Most of the effects seem plausibly attributable to the programme activities rather than the wilderness setting. Specifically, it seems likely that the need for participants to be self-reliant in unfamiliar and physically challenging environments is enough to promote self-identity (L. Kaplan and Talbot, 1983).
the extent that the outcomes of wilderness experiences are attributable to the environment, these findings suggest that the potential benefits of wilderness for children's self-esteem, sense of self, and perhaps even their behavior may be profound.

Impacts of outdoor education programmes

Several studies have found consistency with the possibility that there is a systematic relationship between outdoor curricula in green space and learning. Of four studies comparing outcomes associated with outdoor versus indoor classroom curricula, three have found more learning after the outdoor classroom curricula. Children with outdoor classroom curricula scored higher on measures of knowledge transfer (Zasile, 2000), performed better on standardized tests of academic achievement, earned higher grades, point averages (Lieberman, 1998) and demonstrated greater knowledge gain (Katarasopijard, 2001), than children with indoor curricula. One found children did not show greater learning in an outdoor classroom than those taught in a combination of indoor and outdoor classrooms or those taught in an indoor classroom (Hosie, 1974). As in the wilderness programme research, making interpretation difficult. It is not clear to what extent the outcomes are caused by the different activities taking place in the different settings versus the settings per se. These cautions notwithstanding, the findings are consistent with the notion that outdoor education programmes may be widely effective in promoting learning.

Green space and children's play

Studies comparing patterns of play and creative play - important means of cognitive, social, and emotional development - in green versus built spaces are consistent with green space supports healthy child development. In one such study, children observed in a school yard with both green play spaces and built play spaces engaged in more creative forms of play than children in barren outdoor spaces. In another study, children observed in green outdoor spaces engaged in more play and creative forms of play than children in barren outdoor spaces. In this same study children observed in green outdoor spaces also had more access to adults than children in barren spaces; while not a developmental outcome in itself, access to adults increases a child's potential for interaction with adults, which in turn fosters social development (Faber-Taylor, Kuo, and Sullivan, 1998). However, a weakness of these studies is that children were self-selecting the spaces in which they played. Perhaps green space does not foster creative play, but rather when given a choice, children choose green spaces when they intend to engage in creative play.

Green space and attention

There is compelling evidence for a link between green space and enhanced capacity to pay attention in children. This link appears to hold when comparing different children's attention-focusing in, or after being in, different settings. Two studies have compared different children in different settings, but did not employ random assignment. One study, compared two Swedish day nurseries, and found that children at the day nursery with a more natural school yard, which was incorporated into the curriculum allowing children to spend a great deal of time in it, were rated higher on a measure of concentration than children with a more built school yard, which was used in a more traditional manner (Graham, 1997). Another study, found the greener the typical play space of a child, the lower their parental rating of overall symptom severity (Faber-Taylor, Kuo, and Sullivan, 2001). Graham (1997) was limited because only two spaces were compared, but in another study Faber-Taylor et al. (2001) also compared multiple green and barren spaces and had similar findings. A weakness of both of these studies is that participants self-selected their settings. Well-functioning families, with potentially well-functioning children, may choose to send their child to a greener school, and children with ADHD may choose to play in greener settings when they are in relatively high-functioning states. Two other studies comparing different children in different settings help address the concerns about self-selection. Wells (2000) examined children who had moved from relatively barren housing to greener housing through a self-help housing programme; it is unclear how much, if any, influence participants had on their housing assignment. Those children who moved to places with more greenery had the greatest increase in naturalness scores and the highest ratings on concentration by their parents after the move. Were parents' ratings influenced by their beliefs about the benefits of moving to a greener home? It seems unlikely, but a second study addressed this concern; using objective concentration, Faber-Taylor and colleagues examined view and concentration in children randomly assigned to architecturally identical apartments within the same development. The greener a girl's view from her
apartments, the higher she scored on standardized performance measures of concentration. Boys showed no relationship between view and concentration. One interpretation of this latter finding is that in that public housing setting boys may not have been spending much time near their home and perhaps a measure of the greenness where they played would have been positively linked with their functioning (Faber Taylor, Kuo, and Sullivan, 2002). Indeed other research supports this interpretation (e.g., Faber Taylor et al., 2001).

Two studies have compared the same children under different settings and have also found links between green space and nature. In one study, parent ratings of activities' effects on their child's ADHD symptoms indicated a greater reduction in symptoms after engaging in activities in green spaces compared to indoor and built outdoor spaces. Activities nominated by parents as helpful in reducing ADHD symptoms were disproportionately likely to take place in green outdoor settings, and activities nominated as exacerbating symptoms were disproportionately likely to take place in non-green settings (Faber Taylor et al., 2001). A study of over 450 children with ADHD also showed that parent ratings of activities' effects on symptoms indicated a greater reduction in attention deficit symptoms after engaging in activities in green outdoor spaces compared to indoor and built outdoor spaces. These findings were quite consistent across gender, age, child's severity of symptoms, co-morbid disorders, diagnosis, region of the United States, and community size (Kuo and Faber Taylor, 2004). But a weakness of these studies is that they are based on parent-report, making the findings susceptible to bias. Nonetheless, this set of findings strongly suggests viewing and being in relatively natural settings enhances attention in children and supports the idea that contact with nature is a valuable resource for children's healthy development.

Green space, conduct and well-being

Two studies focused on green space and children's conduct and well-being. Wells and Evans (2000) studied rural children and found that those with more nature near their home received lower maternal ratings on a measure of behavioral conduct disorders, anxiety and depression, indicating that they were less psychologically distressed than peers with less near-home nature. Children with more near-home nature also rated themselves higher on a global measure of self-worth than peers with less. This study also suggests that near-home nature buffered the effects of stressful life events on children's psychological distress. As described above, Faber Taylor et al. (2002) found that the greener a girl's view

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from her apartment the higher she scored on several standard psychological performance measures of impulse inhibition and delay of gratification. In addition, in that study when measures of concentration, impulse inhibition, and delay of gratification were combined as an index of self-discipline, the greener a girl's view from her apartment the higher she scored. However, in the same study, measures of impulse inhibition, delay of gratification, and a self-discipline index did not correlate with greenness of their apartment view.

Both studies compared existing groups (i.e., subjects not fully randomly assigned to conditions). In Wells and Evans (2003) there is the possibility that psychologically more robust people may have self-selected to live in natural settings and this might explain why psychological distress is lower for those living in natural settings and why the impacts of life stressors are less for those living in natural settings. However, this alternative explanation is less plausible in the case of Faber Taylor et al. (2002). This latter study also relied on existing groups, but the housing-assignment process was such that opportunities for self-selection into green or not-green housing were rare. With the exception of one set of null findings with a sample of boys, these studies' findings suggest a link between green space and children's conduct and well-being, and thereby add additional support to the notion that green space is a valuable resource for healthy child development.

Children and animals

The research on children's contact with animals includes two distinct groups of studies: those on the impacts of contact with pets; and with animals trained for use in therapy such as dogs, horses, and dolphins. In our review of the literature, we did not find any empirical research focused on undomesticated animals such as urban wildlife. Like the research on green space, the studies on children and animals touched on cognitive, social and emotional development and involved diverse subpopulations of children. Overall, the evidence for contact with animals promoting healthy child development is promising. While there is ambiguity in the findings of individual studies, the persistence of positive findings across different studies with different methodological weaknesses lends confidence that this is a real effect.

Pet ownership and bond and development

A number of studies have examined the potential effects of pets on child development with mostly positive results with the exception of a few
null findings. Of the studies with pets, two studies have examined potential impacts on self-esteem or self-concept. Coret (1985) found that those who own pets scored higher on a measure of self-esteem than those who did not. Another study found that adults' self-concept was related to the age when they first had a pet with a pet, those who had a first pet during their teen years or when they were less than six years old scored higher on a measure of self-concept as an adult than adults who had a first pet between the ages of six and twelve (Poesky, Hendryx, Mosier and Samuels, 2001). It is worth noting that two non-pet studies involving random assignment to conditions with and without animals also linked increased self-esteem/self-concept with animals. In Diener (1984), children interacting with horses during therapy sessions had a greater increase in scores on a measure of self-esteem than those receiving therapy without a horse. In Katcher (2000) youths who participated in a programme that incorporated hands-on learning with animals and natural ecosystems scored higher on a measure of self-concept than youths participating in the regular school programme.

Five studies with pets have examined their impact on children's social development. Gutman (1984) found that boys who owned a pet performed better on measures of their capacity for decoding non-verbal information, potentially making them better at communication, than boys who did not own a pet. Three studies found that young children with a strong bond or close relationship with their pet scored higher on a measure of empathy than children with a weak relationship to their pet (Poesky, 1990, 1996; Vidovic, Stene, and Brooks, 1999) and children with no pet (Vidovic et al., 1998). In Melson, Peci and Sparks (1991) five-year-old boys and fifth-grade boys and girls who were attached to a pet scored higher on measures of empathy, but for secondary school children in the study the findings were mixed or essentially null. Melson et al. also found that primary school children scores on a measure of perceived competence was related to their attachment to a pet. To date, the research on pets shows mixed evidence of a link between pets and child development. As present what is completely unclear is whether this link, if it exists, is due to pre-existing differences in the kinds of families who choose to have pets versus those who do not, or the kinds of children who form bonds with family pets versus those who do not. In other words, socially oriented, empathic children may be more likely to form bonds with pets, and socially oriented, empathic parents may be more likely to get pets for their children.

Figure 8.2. Contact with animals may increase capacity for empathy.
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**Companion animals and emotional self-regulation**

Several findings are consistent with the notion that companion animals may support children's emotional self-regulation and thus be valuable for healthy child development. Survey studies have found that the majority of pet owners turn to their pet for comfort when sad or upset (Covert, 1985; Roz, 1994; Triebenbacher, 1998). This raises the intriguing possibility that contact with pets might promote a later capacity for emotional regulation even when a pet is not available. Further, a study of children undergoing physical examinations found that those with a dog present in their exam room were rated as exhibiting less behaviourally distress than those without a dog present, though there was a null finding with physiological measures of stress (Hansen, Messinger, Baun and Megel, 1999). In this study, however, raters were not blind to the presence or absence of a dog, and thus could have biased ratings of the children's behaviour.

**Animals in the context of therapeutic/educational interventions**

A set of mixed findings comes from studies of animals in therapeutic and educational interventions, and thus are only somewhat consistent with the notion that animals contribute to children's cognitive and social functioning in school environments. These findings are difficult to interpret, because most have confounds and rely on potentially biased raters. In one such study, youths with AD/HD and CD in a programme involving hands-on contact with animals were rated as displaying a greater reduction in inattentiveness and impulsivity on a measure of symptom severity than the children in an outdoor challenge programme (Katcher, 2000). Another study found children with a dog incorporated into their classroom activities demonstrated greater improvement in their field independence, which plays a role in the development of autonomy, than children in a class without a dog present (Hergeriovich, 2002).

A few studies have examined whether the presence of animals enhances social behaviour. In Hergerlovich (2002), teacher ratings showed a greater increase in social integration among students and a greater decrease in children rated as aggressive after a dog was present in their classroom for three months than were found among comparable students without a dog in their classroom. However, there was one null finding with a performance measure of social intelligence. Linson (1997) found that children with Down's Syndrome displayed greater sustained focus towards and interaction with their therapist when a live dog was present than when a life-like imitation dog was present (Limonad.

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Linson, 1997). Likewise, children with autism were rated as displaying an increase in pre-social behaviour directed at the therapist and a decrease in self-absorption after a dog was incorporated into therapy sessions. Children with mental disabilities were rated as engaging in more verbal responding to therapist's lessons with a dolphin present than when their favourite water toy was present (Nathanson and de Faria, 1993). Finally, youths in a programme with hippopotami (described earlier) received better ratings on two measures of childhood conduct disturbances, indicating fewer aggressive behaviours and more cooperative behaviours, than the control group (Katcher, 2000).

It is important to note that two studies with more rigorous methodologies provide additional evidence of a link between the presence of animals and social outcomes in some environments. In Bailey (1987) exposure to animals in a classroom setting was found to impact children's capacity for empathy. Children with a puppy incorporated into a curriculum about pet care showed a greater increase in their ability to predict others' feelings and emotional states than children with the same curriculum without a puppy present or children in a control group. A longitudinal measure indicated a lasting change. In O'Muke (1984) children with learning disabilities and language disorders who were taught language skills in conjunction with horseback riding demonstrated increases on measures of complexity of language structure, appropriateness and efficient use of speech, and sensorimotor integration. In contrast, children who were taught the same language curriculum in a classroom setting without animals, but which included activities such as motor skills, only showed improvements in language complexity. However, a weakness in both these studies is that there is a chance that the outcomes were due to differences between teachers or therapists rather than contact with animals, as the animal and non-animal conditions did not have the same teacher or therapist. However, in both studies the strengths of children were randomly assigned to conditions and the raters were blind to the condition in which the children had been placed.

**Animals as positive stimulation for infants**

Findings from studies examining the impact of animals' presence on infants' behaviours are consistent with the possibility that a relationship exists between animals' and infants' behaviours. Kidd and Kidd (1983) found that infants spent more time observing and interacting with their family dog or cat than an interactive toy dog or cat. Ricard (1992) found infants spent more time observing and exploring in the
presence of a live rabbit than they spent observing or exploring in the presence of a toy turtle (that lit up, made noises and moved) or in the presence of an unfamiliar woman. Unfortunately, in both studies the non-animal condition differed from the animal condition in ways other than just the presence or absence of an animal, and these differences make it difficult to determine if the group differences were attributable to the animal. In addition, rats were not blind to condition and thus could have given biased ratings.

Conclusion

Intuition commonly holds that nature is good for children. Does contact with nature really enhance children's functioning and development? While evidence in many forms of the relationship between nature and child development has been accruing, in this chapter we have focused on assessing the evidence of a causal link between nature and child development. With a few exceptions, most of the studies have methodological weaknesses that need to be addressed through future research. However, given the pattern of findings pointing in the same direction and persisting across different sub-populations of children and different settings, it is more parsimonious to accept the fact that nature can promote healthy child development. While we await more carefully controlled studies providing evidence of a causal relationship, current evidence suggests that the general hypothesis may be correct: contact with nature is supportive of healthy child development in several domains – cognitive, social, and emotional. Until proven otherwise, we can continue to assume, just as they need good nutrition and adequate sleep, children may very well need contact with nature.

To bolster the evidence for children's need for nature, additional qualitative and correlational studies are needed, but the greatest need is for controlled experimental studies. The current body of research, though relatively small and with limitations, seems consistent enough to encourage us to take the next step towards controlled studies. Future research should attempt to overcome weaknesses of the current body of research. This would include using random assignment of participants to conditions rather than using participants who self-selected conditions, and objective evaluations of outcomes, such as raters who are blind to conditions. Also keeping activity or programme characteristics constant across conditions is important. Future researchers should also try to show whether or not nature is uniquely necessary for healthy development. In other words, researchers might be able to show that not only does nature promote healthy development, but it also promotes healthy development more effectively than the activities and settings commonly used in place of nature. Finally, future researchers might answer questions such as, how much, in terms of quantity, richness, and type of interaction (passive vs. active), is enough for beneficial effects? Such quantified findings could provide a great deal of leverage in influencing policy makers and the general public's beliefs about the value of nature for children. While taking the next step to conduct controlled studies and gather causal evidence will be expensive, such findings could have important impacts on the fight for preserving and increasing the amount of nature accessible to children.

Sometimes we get a glimpse of children experiencing nature, such as a child studying an intimate green space in search of 'treasures' – violets, insects, and the like. Or we see an infant who is plopped on a patch of lawn, or another infant tugging at a dog's woolly fur or pulling fine, cool grass. Children's obvious delight in nature, and the growing body of research evidence, should spur researchers onward to continue investigating the benefits of contact with nature, and verifying its impacts on children's development.

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