



HEALTH BENEFITS TO CHILDREN FROM CONTACT WITH THE OUTDOORS & NATURE

NOTE: The following are taken from four volumes of research developed by the Children & Nature Network (C&NN) and available at www.childrenandnature.org. These C&NN Annotated Bibliographies of Research and Studies were written by Cheryl Charles, Ph.D., President, Children & Nature Network and Alicia Senauer, Yale University.

Greenspace supports children's quality of life

Bell and colleagues critically review the last 10 years of research that has examined relationships between greenspace and quality of life. Major areas reviewed in this report are: health and well-being, social and community value, economic value/impacts, environmental value, and planning and design. Research related to children is one of the main topics highlighted in the various sections of this report. In their review, Bell and colleagues also discuss their criteria for article inclusion, highlight methodological limitations of studies conducted to date, and identify key research gaps.

Author Affiliation: The authors are with the OPENspace research center in the UK.

Bell, S., Hamilton, V., Montarzino, A., Rothnie, H., Travlou, P., & Alves, S. (2008). Greenspace and quality of life: a critical literature review. Greenspace Scotland. This report is available online at: <http://www.greenspacescotland.org.uk/default.asp?page=465> (Volume 4)

Time spent outdoors supports many aspects of children's health

In this report, Muñoz reviews literature concerning the linkage between spending time outdoors and health, with a primary emphasis on research related to children. She reviews research and policy related to outdoor use and health more generally and then takes an in-depth look at topics related to

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play spaces, access to natural spaces, the use of outdoors in children's education, and research related to people and factors that constrain and enable children's outdoor play. Finally, in concluding her literature review, Muñoz identifies methodological considerations, research gaps, and provides suggestions for advancing knowledge in this area.

Author Affiliation: Muñoz is with the Sustainable Development Research Centre in Scotland.

Muñoz, S. A. (2009). Children in the outdoors: a literature review. Sustainable Development Research Centre. This report is available online at: <http://www.countrysiderecreation.org.uk/Children%20Outdoors.pdf> (Volume 4)

Readers may also be interested in the following related report:

Scottish Natural Heritage. (2009). Health and the natural heritage-the evidence base. Retrieved September 7, 2009, from <http://www.snh.org.uk/pdfs/strategy/Healthevidence.pdf>

Contact with nature provides a variety of health benefits

In this report, C. Maller and colleagues reviewed published literature demonstrating health and well-being benefits from contact with nature, with an emphasis on park settings. Particularly in urban areas, parks play an important role in providing people with access to nature. The authors encourage a reframing of our traditional view of parks as places for leisure and sport towards one that emphasizes a full range of physical, mental, and social health benefits. Maller and colleagues provide valuable background material on the concept of health and the connection between nature and health. The authors then review evidence of the health benefits of various forms of contact with nature, including viewing nature, being in nature, contact with plants, and contact with animals. Maller and colleagues provide a number of recommendations, including the need for additional research, the repositioning of parks, and the integration of parks and nature into public health strategies and management actions. The authors present a number of useful summary tables, which provide quick access to major findings about the health benefits of contact with nature.

Maller, C., Townsend, M., St.Leger, L., Henderson-Wilson, C., Pryor, A., Prosser, L., and Moore, M. (2008). "The health benefits of contact with nature in a park context: A review of relevant literature." Deakin University and Parks Victoria. The original 2002 review and annotated bibliography are available online at: http://www.parkweb.vic.gov.au/1process_content.cfm?section=99&page=16. The updated 2008 review is available for a nominal fee by contacting Mardie Townsend at mardie.townsend@deakin.edu (Volume 3)

Readers may also be interested in the following documents:

A fact sheet on the health benefits of the natural environment by the National Environmental Education Foundation. This fact sheet is available online at: <http://www.neefusa.org/assets/files/NIFactSheet.pdf>

An article by Howard Frumkin and Richard Louv about the important role natural landscapes play in protecting public health. This article is available online at: <http://atfiles.org/files/pdf/FrumkinLouv.pdf>

Children's play in natural settings provides a suite of benefits

In this report, Stuart Lester and Martin Maudsley provide an extensive review of the literature related to children's natural play. The authors begin by examining the human relationship with the natural world and the importance of play and direct interaction with the physical environment to children. Lester and Maudsley then review the important opportunities that natural play provides, such as the creation of special places, and the numerous documented and potential benefits of children's play in natural settings, including the development of a sense of self and independence.

The authors discuss evidence demonstrating a decline in children's access and opportunities to play in natural spaces and provide a range of suggestions to support children's opportunities to play in natural settings, such as through the design of effective playgrounds, school grounds, and environmental play projects, as well as ensuring adequate access to parks and nature reserves.

Lester, S., & Maudsley, M. (2006). "*Play, naturally: A review of children's natural play.*" **Children's Play Council.** This report is available online at:
<http://www.playday.org.uk/PDF/play-naturally-a-review-of-childrens-natural%20play.pdf> **(Volume 3)**

The importance of designing spaces that support children's contact with nature

In this book chapter, Robin Moore and Clare Cooper Marcus review health threats that face many of today's children, including sedentary behavior and attention deficit disorder; the benefits that contact with nature provides to children's mental, social, and physical health; and current barriers limiting children's access to nature. The authors provide examples of designed environments, specifically in urban areas, that support children's contact with nature, including examples of innovative childcare centers and preschools, school grounds, neighborhood parks, and community institutions. Moore and Marcus emphasize the importance of the residential environment and the need to understand and incorporate children's ideas and preferences into the planning and design of spaces. The authors discuss four models of child-friendly case study environments of c265re

and other commercial sources. http://www.cnaturenet.org/02_rsrch_studies/PDFs/Kellert_BuildingforLife.pdf
(Chapter 3). (Volume 1)

Unstructured free play brings cognitive, social and health benefits to children

Unstructured free play in the out-of-doors brings a host of benefits to children —from being smarter to more cooperative to healthier overall. This well-documented article by two physicians builds a strong case for the importance of unstructured free play in the out-of-doors for all age groups, and especially young children. While concerned about the “obesity epidemic” in young children, the authors say that the health benefits from outdoor play are only one aspect of the overall benefits. They suggest that the concept of “play” is more compelling and inviting to most adult caregivers, parents and guardians than “exercise.” The authors cite cognitive benefits from play in nature, including creativity, problem-solving, focus and self-discipline. Social benefits include cooperation, flexibility, and self-awareness. Emotional benefits include stress reduction, reduced aggression and increased happiness. Children will be smarter, better able to get along with others, healthier and happier when they have regular opportunities for free and unstructured play in the out-of-doors. (Synthesis)

Burdette, Hillary L., M.D., M.S.; and Robert C. Whitaker, M.D, M.P.H. “Resurrecting Free Play in Young Children: Looking Beyond Fitness and Fatness to Attention, Affiliation and Affect.” © 2005 American Medical Association. http://www.cnaturenet.org/02_rsrch_studies/PDFs/Burdette_LookingBeyond.pdf (Volume 1)

Contact with nature is important for children

Andrea Faber Taylor and Frances E. Kuo have contributed important research to the understanding of the impact of nature on people’s lives, and specifically to the well-being of children. This particular article is a recent review of the literature and establishes what is known, and what is still missing, about the effects of contact with nature on children’s lives. While the evidence is growing, this article is an important call to action for further research.

Taylor, Andrea Faber; and Frances E. Kuo. “Is Contact with Nature Important for Healthy Child Development? State of the Evidence.” In Spencer, C. & Blades, M. (Eds.), Children and Their Environments: Learning, Using and Designing Spaces. Cambridge, UK: Cambridge University Press, 2006. <http://www.lhhl.uiuc.edu/documents/Faber2006Iscontactwithnature.pdf> (Volume 1)

City parks bring social, community health and economic benefits

The Trust for Public Land (TPL) is a premier conservation organization, responsible for protection of special public lands throughout several generations. Today TPL is concerned not just about setting lands aside for future generations, but making sure that young people and families enjoy them today. TPL recognizes that to connect with nature is to appreciate nature, now and for the long term. This comprehensive report, “The Benefits of Parks: Why America Needs More City Parks and Open Space,” offers a clear look at socioeconomic factors affecting the availability of parks, the history of city parks, and the hopes for a revival of commitment to city parks. The report outlines benefits in a number of areas: physical, including remedies for inactivity and obesity; economic, with increased property values; environmental, with pollution abatement; and social, from crime reduction to strengthening communities. Add this report to your collection of those that serve to document how safe places for children to play contribute to everyone’s health and well being. (Synthesis)

http://www.tpl.org/content_documents/parks_for_people_Jul2005.pdf (Volume 1)

Children with ADHD concentrate better after walking in a park

Building off of their recent work related to children with Attention-deficit hyperactivity disorder (ADHD) and different types of activity settings, in this study, Andrea Faber Taylor and Frances Kuo investigate the impacts of three different outdoor environments on the attention of seventeen 7- to 12-year-old children diagnosed with ADHD. After completing a series of puzzles that required focused attention, each child, over the course of three different weeks, participated in a 20 minute guided walk in three different outdoor settings (an urban park, a downtown area, and a residential area). After each guided walk, children completed a concentration test and answered several questions about their walking experience. Importantly, the authors controlled for a number of potential confounding factors, including the order of environments experienced, the time of day and day of week, terrain, and season. In analyzing the data, Faber Taylor and Kuo found that children concentrated better after walking in a park setting as compared to either a downtown or residential setting and that the effect of walking in a park on concentration helped close the gap between children with ADHD and those without ADHD with regard to the concentration measure used and that the effect was similar to that of two common types of ADHD medication. In addition, the authors found that children rated their experiences more positively in the park setting than in the other two settings. Faber Taylor and Kuo discuss these findings in light of Attention Restoration Theory and their previous studies related to different environments and children with ADHD and suggest additional avenues for research and the potential of using nature in the treatment of ADHD.

Faber Taylor, A., & Kuo, F. E. (2008). Children with attention deficits concentrate better after walk in the park. *Journal of Attention Disorders OnlineFirst*. This article will be published in print in 2009 and may be available in a library near you or can be purchased online at: <http://jad.sagepub.com>. (Volume 3)

Natural settings provide psychological benefits

“Coping with ADD: The Surprising Connection to Green Play Settings,” by Andrea Faber Taylor; Frances E. Kuo; and William C. Sullivan (2001) is one of the earliest studies to explore the potential for contact with nature to have a positive effect in reducing the impact of attention deficit disorder in children. The study was designed to test two hypotheses: 1) Attention deficit symptoms will be more manageable after activities in green settings than after activities in other settings; and 2) The greener a child’s everyday environment, the more manageable their attention deficit symptoms will be in general. The results were positive. (Original Research)

Taylor, Andrea Faber; Frances E. Kuo; and William C. Sullivan. In *Environment and Behavior*, Vol. 33, No. 1, January 2001. © 2001 Sage Publications, Inc. Available on the web site of the University of Illinois Urbana-Champaign. <http://www.lhhl.uiuc.edu/> (Volume 1)

Nature activities soothe ADD symptoms

Contact with the natural world can significantly re

be used in communities to disseminate this positive information based on sound research. (Original Research)

Kuo, Frances E.; and Andrea Faber Taylor. "A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder: Evidence from a National Study." In American Journal of Public Health, Vol 94, No. 9, September 2004. © American Public Health Association. The study and the educational Power Point are available on the web site of the University of Illinois Urbana-Champaign. <http://www.lhhl.uiuc.edu/> (Volume 1)

Nearby nature reduces stress in children

This study, reported in 2003, by Cornell assistant professor Nancy Wells, focuses on rural children and finds that even a view of nature — green plants and vistas —helps reduce stress among highly stressed children. Further, the more plants, green views and access to natural play areas, the more positive the results. (Original Research)

Wells, N.M., and Evans, G.W. "Nearby Nature: A Buffer of Life Stress Among Rural Children." Environment

girls; the prevalence of overweight increased significantly between 2001 and 2004 for both younger and older children, as well as boys and girls; and among the older children, boys generally spent significantly more time outside than girls. Cleland and colleagues also found that older children who spent more time outside were generally more physically active and had a lower prevalence of overweight than children who spent less time outside. For example, the researchers found that each additional hour older girls spent outside during the cooler months was associated with an extra 26.5 minutes per week of MVPA and that each additional hour older boys spent outside during the cooler months was associated with an extra 21 minutes of MVPA. When examining changes over the three-year period, Cleland and colleagues found that the more time older girls and boys spent outside on weekends at baseline (2001), the higher their MVPA on weekends at follow-up (2004). In addition, the researchers found that in 2004, the prevalence of overweight among older children was 27-41% lower for those children who spent more time outside in 2001. With regard to younger children, Cleland and colleagues found few associations between time spent outdoors, physical activity, and overweight. While this study may be limited due to its reliance on parental self-report of children's time spent outside, the cross-sectional and longitudinal nature of this study and objective measurement of physical activity provide an important contribution to the literature. The results of this study suggest that encouraging 10- to 12-year-old children to spend more time outdoors may help increase physical activity levels and reduce the prevalence of overweight.

Author Affiliation: Cleland, Crawford, Hume, Timperio, and Salmon are with Deakin University in Australia. Baur is with the University of Sydney in Australia.

Cleland, V., Crawford, D., Baur, L. A., Hume, C., Timperio, A., & Salmon, J. (2008). A prospective examination of children's time spent outdoors, objectively measured physical activity and overweight. *International Journal of Obesity, 32*

complementing more traditional school ground areas and improving the quality and quality of elementary school children's physical activity.

Author Affiliation: Dymont is with the University of Tasmania in Australia. Bell is with Evergreen in Canada.

Dymont, J. E., & Bell, A. C. (2008). Grounds for movement: green school grounds as sites for promoting physical activity. *Health Education Research, 23*(6), 952-962. This study may be available in a library near you or can be purchased online through the publisher at: <http://her.oxfordjournals.org/> (Volume 4)

Schoolyard size and landscape quality influence children's satisfaction and weight

Outdoor school grounds are an important environment to consider when striving to promote children's physical activity and reduce childhood obesity. In this study, Ozdemir and Yilmaz investigate linkages between the physical characteristics of children's schoolyard environments and their attitudes, physical activity, and body mass index (BMI). The researchers interviewed nearly 300 3rd and 4th grade students, as well as teachers, and administrators in five public schools in Ankara, Turkey. Ozdemir and Yilmaz also measured students' weight and height, and had professionals assess the schoolyard environment based on factors such as size, material, vegetation cover, and maintenance. Although schoolyards differed, the researchers found that students generally had no direct contact with vegetation and that the amount of outdoor space was limited given the number of students using the space. While most students were satisfied with their schoolyard, which the researchers speculate may be due to acclimation, unsatisfied students highlighted the lack of trees and greenery as the primary reason for their dissatisfaction. Among their many findings, Ozdemir and Yilmaz report that the size of the schoolyard was significantly related to students' BMI, with students in larger yards having lower BMI values than students in smaller yards. The researchers also found that yard landscape characteristics were significantly associated with children's BMI values, but in the opposite direction than expected: students from schools with "advanced" landscape features had higher BMI values than students from schools with "low" landscape features, although BMI values were still in the normal range. While this study may be limited due to its relatively small sample size and reliance on self-report measures, it highlights the importance of participatory and well-thought-out school landscape design, as well as the need for adequate financing and maintenance of schoolyards.

Author Affiliation: The authors are with Ankara University in Turkey.

Ozdemir, A., & Yilmaz, O. (2008). Assessment of outdoor school environments and physical activity in Ankara's primary schools. *Journal of Environmental Psychology, 28*(3), 287-300. This study may be available in a library near you or can be purchased online through the publisher at: http://www.elsevier.com/wps/find/journaldescription.cws_home/622872/description#description (Volume 4)

Children in greener neighborhoods have lower body weight changes

Bell and colleagues examined the medical records of 4,000 three- to sixteen-year-old children that lived in Marion County, Indiana, received care from a particular clinic network between 1996 and 2002, had height and weight measurements for two consecutive years, and lived at the same

playground near their homes. While this study may be limited due to its relatively small sample size, reliance on parental report, and focus on availability as opposed to actual use of park space, this study provides valuable insight into the potential importance of children's proximity to specific park facilities as opposed to park space in general.

eleven- to thirteen-year-old children in London, Ontario completed a questionnaire regarding their physical activity levels on the preceding day. In addition, parents completed a questionnaire evaluating their child's home environment and researchers used a Geographic Information System to analyze each child's neighborhood environment. In analyzing the data, Tucker and colleagues found that, on average, children engaged in about 160 minutes of physical activity a day. In addition, researchers found that neighborhood recreational opportunities significantly and positively influenced children's physical activity levels. For example, Tucker and colleagues found that children with two or more recreation facilities in their neighborhood engaged in almost 17 more minutes of physical activity after school as compared to children with less than 2 recreation facilities and were almost 2 times as likely to be in the upper quartile for after school physical activity. Importantly, researchers controlled for a number of other factors in their analyses, including season and demographic factors. Tucker and colleagues also found that land use mix and percentage of park coverage did not significantly influence children's physical activity levels. While this study is cross-sectional in nature, relied on self-report, and focused on quantity and not quality of recreation facilities, it provides valuable insight into how neighborhood recreation opportunities may influence children's physical activity levels.

Author Affiliation: Tucker, Irwin, Gilliland, and Larsen are with the University of Western Ontario in Canada.

Tucker, P., Irwin, J. D., Gilliland, J., & He, M. (2008). Adolescents' perspectives of home, school and neighborhood environmental influences on physical activity and dietary behaviors. *Children, Youth and Environments, 18*(2), 12-35. This article is available online at: http://www.colorado.edu/journals/cye/index_issues.htm. (Volume 4)

Spending time outdoors, among other factors, is associated with higher levels of physical activity in preschool children

Physical activity provides important health benefits to children. Unfortunately, not much is known about the prevalence of preschool children's physi

authors estimate that an increase in tree density of 343 trees per square kilometer would be associated with a 29% lower prevalence of early childhood asthma. It is important to note that this analysis does not demonstrate that trees cause or prevent asthma for an individual child. While the results of this study are encouraging, additional research is needed to better understand the effects of trees on the prevalence of childhood asthma.

Lovasi, G. S., Quinn, J. W., Neckerman, K. M., Perzanowski, M. S., & Rundle, A. (2008). "Children living in areas with more street trees have lower prevalence of asthma." *Journal of Epidemiology and Community Health*, 62(7), 647-649. This study may be available in a library near you or can be purchased online at: <http://jech.bmj.com/> (Volume 3)

Spending time outdoors helps prevent myopia in 12-year-olds

In recent decades, myopia or nearsightedness has become increasingly common in young children. While the cause(s) of myopia remain unknown, environmental factors, such as reading that requires children to focus at a close distance, are thought to play an important role. Using data from the Sydney, Australia Myopia study, K. A. Rose and colleagues investigate the relationship between near work, midworking distance, and outdoor activities with the prevalence of myopia in 6- and 12-year-old children. Between 2003 and 2005, 1,765 6-year-olds and 2,367 12-year-olds received a comprehensive eye exam and completed questionnaires about their activities during weekdays and weekends (parents completed the questionnaires for the 6-year-old children). The authors grouped children's activities into near work (e.g., drawin

eliminating or minimizing physical risk. The authors review the difference between “hazard” and “risk” and emphasize the importance of considering risk within the larger context of children’s development, as well as the need to focus on identifying and fostering a risk balance that is appropriate for each individual child. In concluding their article, Little and Wyver articulate a model they developed that illustrates possible pathways from specific factors (e.g., poor outdoor environments or fear of litigation) to minimization of risk-taking and developmental outcomes, and emphasize the need to examine early childhood education policy and practice.

Author Affiliation: The authors are with Macquarie University in Australia.

Little, H., & Wyver, S. (2008). Outdoor play - does avoiding the risks reduce the benefits? *Australian Journal of Early Childhood*, 33(2), 33-40. This study may be available in a library near you or can be purchased online through the publisher at: http://www.earlychildhoodaustralia.org.au/australian_journal_of_early_childhood/about_ajec.html (Volume 4)

Outdoor experience for teens has self-reported life-changing results

A classic 1998 study by Dr. Stephen R. Kellert of Yale University, with assistance from Victoria Derr, remains the most comprehensive research to date to examine the effects on teenage youth of participation in outdoor education, specifically wilderness-based programs. Subjects were participants in programs offered through three old and well-respected organizations: the Student Conservation Association (SCA), the National Outdoor Leadership School (NOLS), and Outward Bound. The researchers used quantitative and qualitative research techniques, and parallel use of both retrospective and longitudinal study techniques. Results indicate that the majority of respondents found this outdoor experience to be “one of the best in their life.” Participants report positive effects on their personal, intellectual and, in some cases, spiritual development. Pronounced results were found in enhanced self-esteem, self-confidence, independence, autonomy and initiative. These impacts occurred among both the retrospective and longitudinal respondents in this study, which means, in part, that these results persisted through many years.

Kellert, Stephen R.; with the assistance of Victoria Derr. “A National Study of Outdoor Wilderness Experience.” New Haven: Yale University, 1998.

<http://www.nols.edu/resources/research/pdfs/kellert.complete.text.pdf> (Volume 1)

Access to nature nurtures self-discipline

This study focuses on the positive benefits to inner city youth, particularly girls, from access to green spaces for play. Even a view of green settings enhances peace, self-control, and self-discipline. While the results are most notable for girls, the evidence is not limited to the positive impact on girls. (Original Research)

Taylor, Andrea Faber; Frances E. Kuo; and William C. Sullivan. “Views of Nature and Self-Discipline: Evidence from Inner City Children.” In the *Journal of Environmental Psychology*, 21, 2001. © 2001 Academic Press. Available on the Web site of the University of Illinois Urbana-Champaign.

<http://www.lhhl.uiuc.edu/> (Volume 1)