OUTDOOR EDUCATION & RECREATION TASK FORCE

REPORT

7/1/2020

INTRODUCTION

A task force was established to study the Tennessee Outdoor Education and Recreation Grant Program, as outlined by Public Chapter No. 172, Senate Bill No. 58: "There is established a task force regarding the creation of the Tennessee Outdoor Education and Recreation Grant Program, which will include promoting opportunities for students with limited access to outdoor education and recreation, including environmental, ecological, agricultural, wildlife, and natural resource-based opportunities."

The Tennessee Outdoor Education and Recreation Grant program task force shall be composed of the following members: (1) The commissioner of environment and conservation, or the commissioner's designee; (2) The commissioner of education, or the commissioner's designee; (3) The executive director of the Tennessee wildlife resources agency, or the executive directors designee; (4) The commissioner of health, or the commissioner's designee; (5) The commissioner of economic and community development, or the commissioner's designee; and (6) The commissioner of agriculture, or the commissioner's designee. (c) The commissioner of environment and conservation, or the commissioner's designee, shall serve as the chair of the task force and shall call the first meeting.

TASK FORCE MEMBERS:

Chair–Anne Marshall, Department of Environment and Conservation, Senior Advisor
Department of Health–Leslie Meehan, Director of the Office of Primary Prevention
Department of Economic and Community Development- Jody Sliger, Community Development Director
Department of Education–Heather M. Piergies, Physical Ed/Physical Activity Director
Department of Agriculture–Tim Phelps, Communications and Outreach Unit Leader/PIO
Tennessee Wildlife Resources Agency- Chris Richardson, Assistant Director & Jenifer Wisniewski, Communications and Outreach Chief (alternate attendee)

The task force held several meetings between November 2019 and February 2020 and also conducted research and formulated the report and recommendations through virtual means, through the end of June, 2020.

Our report is presented in the following format:

FINDINGS AND RECOMMENDATIONS 1: Studies and reports regarding the potential benefits of outdoor education and recreation, including increased academic success and improved mental and physical health.

FINDINGS AND RECOMMENDATIONS 2: Inventory of any existing grant programs and other existing programs offered to provide access to outdoor education and recreation.

FINDINGS AND RECOMMENDATIONS 3: Identification of barriers that prevent students with limited access to outdoor education and recreation from benefitting fully from currently available opportunities; and

(a) The manner in which creation of the Tennessee Outdoor Education and Recreation Grant Program could address the identified barriers or otherwise broaden opportunities for students with limited access to outdoor education and recreation;

(b) and the priorities and criteria that would enable the program to most successfully target those students including, but not limited to, utilization of: (A) State parks and wildlife management areas; (B) Public-private partnerships; (C) Veteran participation; and (D) Quantitative measurement of participation and results.

The hope of the task force is that this report and the subsequent findings and research will serve to form the basis for a new grant program that will address re-connecting children to nature and the outdoors. An excerpt from the report, "America's Great Outdoors: A Promise to Future Generations, February 2011" states that, ***"This disconnection from nature and the outdoors is a serious threat facing America's great outdoors–and it is costing us. Americans' increasing disconnection from the outdoors is one factor in the skyrocketing obesity rates across the nation, which has tripled among our children over the past 30 years."*** (Kuo, Frances. 2010. Parks and Other Green Environments: Essential Components of a Healthy Human Habitat).

We live in a state where outdoor recreation, parks and healthy programs are some of the best in the nation. We have become increasingly aware of our assets and our ability to launch programs and develop infrastructure that meets or exceeds conservation and health standards. Our award-winning state park system receives over 35 million visitors and offers over 30,000 programs annually.

Programs and initiatives developed by our state agencies are increasing and we are proud of our state's current efforts to connect more and more children and families with nature and the outdoors. Successful healthy active living initiatives through the Department of Health, kids' outdoor educational programming and boot camps provided by the Tennessee Wildlife Resources Agency, and the Division of Forestry's urban nature programs that highlight trees and green space have all made a difference in the lives of Tennesseans.

The Department of Education offers afterschool programs (LEAPS) with the goal of enhancing academic opportunities for students and the Department of Economic and Community Development has put a focus on distressed and rural counties in Tennessee so we can all work together to provide economic vitality to those communities struggling to have a minimum quality of life. Making those connections through our state agencies and the programs we provide and will provide in the future– will provide children free access to parks and green space, outdoor recreation, healthy choices, and environmental education.

But we can do a better job. This report will present proven studies and research that support why we need to focus on our children and the barriers that prevent access to programs and facilities for outdoor recreation.

Our recommendations will communicate to the Tennessee General Assembly and communities statewide the importance of connecting children to nature and the outdoors–whether through parks and schools, in urban or rural settings and utilizing multiple agency partnerships.

FINDINGS AND RECOMMENDATIONS 1—STUDIES AND REPORTS REGARDING THE POTENTIAL BENEFITS OF OUTDOOR EDUCATION AND RECREATION, INCLUDING INCREASED ACADEMIC SUCCESS AND IMPROVED MENTAL AND PHYSICAL HEALTH.

The benefits of outdoor recreation and education are numerous. Many studies, both international and here at home, have proven that outdoor recreation and play improves physical development.

Our research has proven that there are a diverse number of studies and reports that have been written regarding outdoor recreation and education and the positive impacts participation in such programs provide to young people in their formative years. We have cited here the most critical ones that support the overall intent of this grant program. The studies have been categorized according to the main purpose or topic of the study. The full compilation of the group's research is presented in **APPENDIX A**.

> Physical skills are important for growth, physical coordination and the movement of the body. When children play ***outdoors*** they increase their ability to balance, jump, climb, throw, run and skip.
>
> More friends mean improved social development. Outdoor play provides children with the opportunity to gain social skills by interacting, collaborating and negotiating with others.
>
> Increased Imagination–Being outdoors gives children the opportunity to pretend to be anything they want, for example, to be a bear in the wild or a chef in the kitchen.
>
> Gain knowledge and appreciation for the natural world–Children learn about the natural elements and their surroundings when they are outside. For example, they learn about the weather, the change in seasons, and different animals that are found outside.–(himama.com–Early Childhood Education Blog)

A. THE BENEFITS OF OUTDOOR RECREATION

Outdoor recreation isn't just fluff–it is integral to an economic development strategy.

- Outdoor Industry Association Data Link–https://outdoorindustry.org/advocacy/ (can look at all states individually)
- Outdoor Industry Association–Tennessee overall https://outdoorindustry.org/state/tennessee/
- Outdoor Industry Association–Tennessee First Congressional District https://drive.google.com/open?id=1_oScxy3k0BL-UFV3aVUvqMnR8R9iLi--
- Outdoor Industry Association–National Report https://drive.google.com/open?id=1Y_eucECzJvIljtHTex9BHtHkyVv-ziDI
- Bureau of Economic Analysis–https://www.bea.gov/data/special-topics/outdoor-recreation
- Headwaters Economics–https://headwaterseconomics.org/economic-development/trends-performance/outdoor-recreation-economy-by-state/
- TVA/UTIA Reservoir Economic Impact–https://ag.tennessee.edu/news/Pages/NR-2017-05-EconomicimpactsTVArecreation.aspx
- National Recreation & Park Assoc (NRPA)–https://www.nrpa.org/uploadedFiles/nrpa.org/Advocacy/Resources/Parks-Recreation-Essential-Public-Services-January-2010.pdf
- Univ. of Delaware–Complete Communities Toolbox–https://www.completecommunitiesde.org/planning/healthy-and-livable/benefits-parks-rec/

- Richard Louv books–Last Child in the Woods; The Nature Principle
    - Children and Nature Network–https://www.childrenandnature.org/
    - Tools, resources, Facebook, Twitter, research, enewsletter
    - America's Great Outdoors: A Promise to Future Generations
      https://www.npca.org/resources/2140-america-s-great-outdoors-a-promise-to-future-generations

B. RECREATION AND THE OUTDOORS—LINK TO ACADEMIC SUCCESS

1. FORDHAM URBAN LAW JOURNAL–http://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?article=2194&context=ulj
• Healthy Children, Healthy Communities: Schools, Parks, Recreation and Sustainable Regional Planning

The following Articles were accessed from Active Living Research using search keys 'outdoors' and 'children K-12'
https://activelivingresearch.org/search/site/outdoors?page=4&f%5B0%5D=im_taxonomy_vocabulary_7%3A265

2. ASSOCIATION OF AFTER-SCHOOL PROGRAMS CONTEXTUAL CHARACTERISTICS AND CHILDREN'S MODERATE-TO-VIGOROUS PHYSICAL ACTIVITY AND TIME SPENT SEDENTARY

DESCRIPTION:
Presentation at the 2014 Active Living Research Annual Conference.

BACKGROUND AND PURPOSE
Nationwide, a majority of youth fail to meet current physical activity (PA) recommendations, making physical inactivity among youth an important public health concern (1). While past research has identified several settings (i.e. schools, home, neighborhood, etc.) that impact youth PA levels (2-3), the afterschool environment has recently emerged as an influential setting with the potential to substantially impact youth PA levels (4). With an estimated 8 million youth (age 5-18 years old) attending ASP in the United States, these programs represent an ideal setting to promote PA among a diverse group of children (5). However, very little is known about ASPs characteristics associated with children's MVPA and time spent sedentary. The purpose of the current study was to examine the relationship between ASP contextual factors, specifically size of indoor and outdoor play space, type of activity (free play vs. organized PA), program length, and MVPA and time spent sedentary among children attending a diverse sample of ASPs.

OBJECTIVES
To examine the association of the ASP contextual characteristics and their relationship with MVPA and time spent sedentary while attending an ASP.

METHODS
Twenty ASPs across the South Carolina were selected to evaluate the impact of program contextual factors on children's PA levels. A total of 1,302 children (5-12yrs, 53% boys) wore accelerometers for 4 non-consecutive days while attending the ASPs. The physical size of the indoor and outdoor play space ASP used each day were measured via a measuring wheel (indoor) and GIS (outdoor), and inventoried via direct observation. The type of activity was evaluated via direct observation using the System for Observing Staff Promotion of Activity and Nutrition and classified as a ratio of free-play (e.g., children released to play on playground and open green spaces) to organized (e.g., adult-led structured games) activity offerings based on the percentage of observational scans during physical activity time either indoors or outdoors. Time allocated for PA opportunities was determined from each ASPs' daily schedule. PA and sedentary behavior were measured using accelerometers (ActiGraph GT3X models) (6-7). Time (min/d) spent in MVPA and sedentary indoors and outdoors was estimated using built-in light sensors (Lux values) (8). The analysis was conducted only on children attending the ASP for at least 60 minutes on a given day. Children's MVPA and time spent sedentary (min/d) during indoor and outdoor opportunities were evaluated separately in relation to size of the play space, type of activity provided, and amount of time allocated for PA using mixed model regressions.

RESULTS
Girls and boys accumulated an average of 18.1 and 24.2min of MVPA/d. When comparing indoor and outdoor MVPA, approximately equal portions of activity were accumulated in each activity location. Girls obtained 9.0min of indoor MVPA/d (49.7%) and 9.1mins of outdoor MVPA/d (51.3%), while boys accumulated 12.4min of indoor MVPA/d (51.3%) and 11.8min of outdoor MVPA/d (49.7%). Regarding outdoor MVPA, each additional acre of play space was associated with a 2.8 and 1.5 min/d increase in outdoor MVPA for boys and girls, respectively, and a 2.1 min/d increase in outdoor sedentary behavior for boys. A higher free-play to organized activities ratio was associated with a 3.5 and 3.0 min/d increase in outdoor MVPA for boys and girls, respectively. Examining indoor activity levels, a higher ratio of free-play to organized activities was associated with a 2.4 min/d increase in indoor MVPA for boys. Time spent sedentary indoors increased by 0.5 and 0.7 min/d with each additional increase in 1,000ft2 of indoor activity space for boys and girls, respectively, while a higher free-play to organized activities ratio was associated with a 5.5 and 8.3 min/d increase in indoor sedentary behavior for girls. Length of time allocated for PA during the ASP was unrelated to MVPA and time spent sedentary.

CONCLUSIONS
These findings suggest limited influence of the physical size of play space on children's MVPA and sedentary behaviors during an ASP and that modifiable programmatic structure, in the form of the type of activity opportunities provided (free-play vs. organized games) was related to both MVPA and time spent sedentary. These are important findings, in that increasing physical play space is not a feasible or realistic strategy for ASPs. Conversely, more children were physically active indoors with the presence of more organized activities, yet this was related to a decrease in MVPA. Thus, future studies should develop effective strategies to increase PA levels by taking into account indoor and outdoor play opportunities.

IMPLICATIONS FOR PRACTICE AND POLICY
While the ASP play space was associated with children's PA, the impact of this was minimal. Additional contextual factors impacting ASP youth PA, such as programming high quality PA experiences, are likely to lead to greater improvements in MVPA and reductions in sedentary behaviors. Policies, therefore, should target the PA programming to ensure children are afforded opportunities to be physically active while attending after school programs.

3. PHYSICAL AND SOCIAL CONTEXTUAL INFLUENCES ON CHILDREN'S LEISURE-TIME PHYSICAL ACTIVITY: AN ECOLOGICAL MOMENTARY ASSESSMENT STUDY

DESCRIPTION
Dunton, G.F., Liao, Y., Intille, S., Wolch, J., & Pentz, M. (2011). Physical and Social Contextual Influences on Children's Leisure-Time Physical Activity: An Ecological Momentary Assessment Study. Journal of Physical Activity and Health, 8(Suppl 1), S103-S108.

BACKGROUND
This study used real-time electronic surveys delivered through mobile phones, known as Ecological Momentary Assessment (EMA), to determine whether level and experience of leisure-time physical activity differ across children's physical and social contexts.

METHODS
Children (N = 121; ages 9 to 13 years; 52% male, 32% Hispanic/Latino) participated in 4 days (Fri.–Mon.) of EMA during nonschool time. Electronic surveys (20 total) assessed primary activity (eg, active play/sports/exercise), physical location (eg, home, outdoors), social context (eg, friends, alone), current mood (positive and negative affect), and enjoyment. Responses were time-matched to the number of steps and minutes of moderate-to-vigorous physical activity (MVPA; measured by accelerometer) in the 30 minutes before each survey.

RESULTS
Mean steps and MVPA were greater outdoors than at home or at someone else's house (all $P < .05$). Steps were greater with multiple categories of company (eg, friends and family together) than with family members only or alone (all $P < .05$). Enjoyment was greater outdoors than at home or someone else's house (all $P < .05$). Negative affect was greater when alone and with family only than friends only (all $P < .05$).

CONCLUSION
Results describing the value of outdoor and social settings could inform context-specific interventions in this age group.

4. SCHOOL GARDENS AND PHYSICAL ACTIVITY:
A RANDOMIZED CONTROLLED TRIAL OF LOW-INCOME ELEMENTARY SCHOOLS

DESCRIPTION
Presentation at the 2014 Active Living Research Annual Conference.nn

BACKGROUND AND PURPOSE
Recently, school gardens have begun to move from niche to norm as a strategy to promote public health (Severson, 2010; Otterman, 2010). However, despite growing interest, few studies have examined the effects of gardens on children's health or health behaviors. Evidence suggests that gardens may positively influence children's diet-related outcomes such as vegetable consumption, vegetable knowledge (Morris, Briggs & Zidenberg-Cherr, 2002), willingness to taste vegetables (Morris, Neustadter & Zidenberg-Cherr, 2001; Morris, Briggs & Zidenberg-Cherr, 2002) but studies of gardens' effects on children's physical activity (PA) are virtually nonexistent.

Despite the dearth of research examining school gardens and PA, the influence of school gardens on children's PA merits study for four reasons. First, preliminary evidence suggests that school gardens have the potential to influence PA (Hermann et al., 2006) and gardening has been linked to PA among adults (Twiss et al., 2003). Second, we know that time spent outdoors is a positive and consistent predictor of PA among children (Ferreira, van der Horst, Wendel-Vox, van Lenthe & Brug, 2006; Sallis, Prochaska & Taylor, 2000). Thus, one strategy to increase PA is to increase time outdoors, enhance children's desire to be outdoors, and thereby compete with the "draw" of indoor activities such as TV and computers. A third argument for gardening as a means to increase PA is that there may be carry-over effects from one context to another – in this case, from school to home. After participating in a community gardening program in San Bernardino, California, the number of students who gardened at home increased by 20% (Twiss et al., 2003). A fourth argument for gardening as a strategy to increase youth PA concerns the initiation of long-term health-related habits. Children and youth in this country are not achieving recommended levels of PA (Pate, Freedson, Sallis et al. 2002). Among children ages 6-11, only 42% achieve the recommended 1 hour of PA per day (Troiano et al, 2007). Consistent with the life course perspective, empirical evidence suggests that life-long habits, including those related to food and PA (DiNubile, 1993), are established early (Elder 1998; Wethington, 2005). Introducing children to gardening may help to shift them from a life course trajectory of sedentary activities toward a positive trajectory of gardening and healthy habits.

OBJECTIVES
The objectives of this study are to examine:

1. the effects of school gardens on children's time spent outdoors and physical activity levels during the school day
2. the effects of school gardens on children's general activity and sedentary behavior patterns over time
3. among children in the intervention group, differences in activity and movement patterns while participating in an outdoor, garden-based lesson compared to while participating in an indoor, classroom lesson.

METHODS

In a randomized controlled trial, this 2-year study examined the effects of a school garden intervention on elementary school children's time spent outdoors and physical activity. Eight low-income New York State schools were randomly assigned to receive school gardens or to serve as wait-list control schools that received gardens at the end of the data collection period. Physical activity was operationalized with three measures. Actigraph GT3X+ accelerometers worn during the school day for three days at each of four waves of data collection indicated children's levels of vigorous, moderate, and light physical activity as well as sedentary activity. Lux measures from the accelerometers provided a measure of children's time spent outdoors. The GEMS Activity Questionnaire (GAQ) (Treuth et al., 2003) documented changes in overall physical activity behaviors over the 2-year period. Lastly, the PARAGON direct observation measure (Myers & Wells, under review) was used to characterize the postures and movement associated with indoor versus outdoor learning.

RESULTS

Lux readings from the accelerometers indicate that children in the garden intervention group showed an increase in the amount of time spent outdoors during the school day. In addition, accelerometry results indicate the intervention group increased proportion of time spent in moderate physical activity (MPA) and moderate to vigorous physical activity (MVPA) compared to pre-garden baseline and to the non-garden control group. Results from the GAQ suggest that over time, children in the garden intervention are less sedentary in their overall activities than the control group children. Lastly, direct observation data suggest that while participating in a garden-based outdoor lesson, children engage in less sitting and in more walking and standing than while participating in an indoor lesson in the classroom.

CONCLUSIONS

School gardens appear to be a potent intervention to increase children's time spent outdoors as well as the proportion of time spent in MVPA during the school day. Gardens may also contribute to reduction of overall sedentary activities. Lessons delivered in the garden are associated with more movement than are indoor lessons.

IMPLICATIONS FOR PRACTICE AND POLICY

This study provides evidence that school gardens should move from niche to norm in schools throughout the United States, as another strategy in our toolkit to increase physical activity.

5. ASSESSING THE SOCIAL AND PHYSICAL CONTEXTS OF CHILDREN'S LEISURE-TIME PHYSICAL ACTIVITY: AN ECOLOGICAL MOMENTARY ASSESSMENT STUDY

DESCRIPTION

Dunton, G.F., Kawabata, K., Intille, S., Wolch, J., & Pentz, M.A. (2012). Assessing the Social and Physical Contexts of Children's Leisure-Time Physical Activity: An Ecological Momentary Assessment Study. American Journal of Health Promotion, 26(3), 135-142.

PURPOSE

To use Ecological Momentary Assessment with mobile phones to describe where and with whom children's leisure-time physical activity occurs.

DESIGN

Repeated assessments across 4 days (Friday–Monday) during nonschool time (20 total).

SETTING

Chino, California, and surrounding communities.

SUBJECTS
Primarily low to middle income children (N = 121; aged 9–13 years; $\bar{x}$ = 11.0 years, SD = 1.2 years; 52% male, 38% Hispanic/Latino).

MEASURES
Electronic surveys measured current activity (e.g., active play/sports/exercise, watching TV/movies), social company (e.g., family, friends, alone), physical location (e.g., home, outdoors, school), and other perceived contextual features (e.g., safety, traffic, vegetation, distance from home).

ANALYSIS
Multilevel linear and multinomial logistic regression.

RESULTS
Most of children's physical activity occurred outdoors (away from home) (42%), followed by at home (indoors) (30%), front/backyard (at home) (8%), someone else's house (8%), at a gym/recreation center (3%), and other locations (9%). Children's physical activity took place most often with multiple categories of people together (e.g., friends and family) (39%), followed by family members only (32%), alone (15%), and with friends only (13%). Age, weight status, income, and racial/ethnic differences in physical activity contexts were observed.

CONCLUSIONS
The most frequently reported contexts for children's leisure time physical activity were outdoors and with family members and friends together.

3. HEALTH BENEFITS TO CHILDREN FROM CONTACT WITH THE OUTDOORS & NATURE

- NRPA–Parks and Healthy Kids
  https://www.nrpa.org/our-work/Three-Pillars/health-wellness/ParksandHealth/fact-sheets/parks-healthy-kids/

- Active Living Research
  https://activelivingresearch.org/sites/activelivingresearch.org/files/ALR.Resources.Summary_Parks_06.26.15.pdf

- Parks, Trails & Recreation Programs to Prevent Obesity and Improve Health

4. URBAN AND LOW-INCOME CHILDREN AND FAMILIES

The following Articles were accessed from Active Living Research using search keys 'outdoors' and 'children K-12'
https://activelivingresearch.org/search/site/outdoors?page=4&f%5B0%5D=im_taxonomy_vocabulary_7%3A265

1. PATHWAYS TO OUTDOOR RECREATION, PHYSICAL ACTIVITY, AND DELINQUENCY AMONG URBAN LATINO ADOLESCENTS

THE CHALLENGE
Residents of underserved urban neighborhoods often face serious challenges related to crime, violence, and incivilities that make it difficult for them to be physically active outdoors.

MAKE AN IMPACT
Understanding the relationship between outdoor recreation and perception of crime and violence can inform interventions aimed at encouraging physical activity.

WHAT THE FINDINGS ARE ABOUT
This study examined whether fear, victimization, and perceived incivilities are associated with physical activity and outdoor recreation among Latino youth and whether involvement in physical activity is associated with delinquency.

KEY FINDINGS AND RECOMMENDATIONS
Youth who were more fearful of crime were less physically active and engaged in less outdoor recreation, but being the victim of or witnessing crime was not related to either physical activity or outdoor recreation.

Youth who were more acculturated to the US were less likely to engage in outdoor recreation.
Girls may be more sensitive to neighborhood aesthetics than boys, while boys are more likely to be victims of violent crime or to be recruited into gangs, thus making crime a greater barrier to boys' physical activity.

Read the full article: Pathways to Outdoor Recreation, Physical Activity, and Delinquency among Urban Latino Adolescents

Suggested Citations:
Roman, C.G., et al. (2013). Pathways to Outdoor Recreation, Physical Activity, and Delinquency among Urban Latino Adolescents. Annals of Behavioral Medicine, 45(1Suppl): S151-S161

2. ENVIRONMENTAL BARRIERS TO CHILDREN'S OUTDOOR SUMMER PLAY

BACKGROUND
Childhood obesity rates have risen markedly in the U.S. over the last 25 years. Apart from the nutritional considerations that are well-documented, child overweight is associated with low levels of physical activity (PA). Although a number of studies address the environmental barriers to adult PA, research on children is limited. The purpose of this study was to explore the barriers to outdoor play in the summertime as perceived by children themselves.

METHODS
In the summer of 2012, 281 children ages 6-14 years were surveyed as to things that would keep them from playing outdoors. RESULTS: The top three factors named by boys were bad weather, fear of gangs/crime, and preferring indoor activities like video games. Girls also named bad weather most often, followed by it being too hot outdoors, and fear of gangs/crime.

CONCLUSION
Children view unsafe neighborhoods and bad weather as the primary barriers to outdoor play. Allowing access to unused school gymnasiums may be a useful strategy for facilitating children's PA in the summer months.

Worobey, J., Lelah, L., & Gaugler, R. (2013). Environmental Barriers to Children's Outdoor Summer Play. Journal of Behavioral Health, 2(4), 362-365.

3. YOUNG CHILDREN IN URBAN AREAS:
LINKS AMONG NEIGHBORHOOD CHARACTERISTICS, WEIGHT STATUS, OUTDOOR PLAY, AND TELEVISION WATCHING

Kimbro, R.T., Brooks-Gunn, J., & McLanahan, S. (2011). Young Children in Urban Areas: Links Among Neighborhood Characteristics, Weight Status, Outdoor Play, and Television Watching. Social Science & Medicine, 72(5), 668-676.

Although research consistently demonstrates a link between residential context and physical activity for adults and adolescents, less is known about young children's physical activity. Using data from the U.S. Fragile Families and Child Wellbeing Study (N = 1822, 51% male), we explored whether outdoor play and television watching were associated with children's body mass indexes (BMIs) at age five using OLS regression models, controlling for a wide array of potential confounders, including maternal BMI. We also tested whether subjective and objective neighborhood measures–socioeconomic status (from U.S. Census tract data), type of dwelling, perceived collective efficacy, and interviewer-assessed physical disorder of the immediate environment outside the home–were associated with children's activities, using negative binomial regression models.

Overall, 19% of the sample were overweight (between the 85th and 95th percentiles), and 16% were obese (>=95th percentile). Hours of outdoor play were negatively associated with BMI, and hours of television were positively associated with BMI. Moreover, a ratio of outdoor play to television time was a significant predictor of BMI. Higher maternal perceptions of neighborhood collective efficacy were associated with more hours of outdoor play, fewer hours of television viewing, and more trips to a park or playground. In addition, we found that neighborhood physical disorder was associated with both more

outdoor play and more television watching.

Finally, contrary to expectations, we found that children living in public housing had significantly more hours of outdoor play and watched more television, than other children. We hypothesize that poorer children may have more unstructured time, which they fill with television time but also with outdoor play time; and that children in public housing may be likely to have access to play areas on the grounds of their housing facilities.

4. NEIGHBORHOOD DESIGN AND CHILDREN'S OUTDOOR PLAY: EVIDENCE FROM NORTHERN CALIFORNIA

DESCRIPTION

Handy, S., Cao, X., & Mokhtarian, P. L. (2008). Neighborhood Design and Children's Outdoor Play: Evidence from Northern California. Children, Youth and Environments, 18(2), 160-179.

Today's children are spending less of their free time outdoors in the neighborhood, with negative consequences for health. Neighborhood design has attracted attention for both its contribution to the problem and its potential as a solution. However, relatively few studies have examined the causal relationship between neighborhood design and children's outdoor play.

This study uses data from a 2003 survey of a random sample of households from eight Northern California neighborhoods. Using a quasi-longitudinal design, we apply ordered probit models to examine the effect of neighborhood characteristics on children's outdoor play while controlling for neighborhood preferences. The results provide support for a causal relationship between neighborhood design and outdoor play and point to cul-de-sacs, larger front yards, lower crime, and increased interaction among neighbors as key characteristics that influence outdoor play by increasing parents' perceptions of safety.

FINDINGS AND RECOMMENDATIONS 2—INVENTORY OF ANY EXISTING GRANT PROGRAMS AND OTHER EXISTING PROGRAMS OFFERED TO PROVIDE ACCESS TO OUTDOOR EDUCATION AND RECREATION.

GRANTS AND FUNDING PROGRAMS

Powerful and effective partnerships exist that raise awareness of many of our state programs and help make that connection between outdoor recreation and education and public health. These opportunities should be sought after and should continue for increased effectiveness of any new program. A partial inventory illustrating a few highlights of state agency programs and funding sources is listed here. A statewide search resulted in a more comprehensive list that is provided in **APPENDIX B.**

A community may have great ideas that would improve the health of the people living, working, studying and visiting there. Project funding can come from a wide variety of sources including the federal, state and local governments, non-profit organizations, foundations, private business sponsors, health care providers and insurers and others. Transportation, Planning, and Economic and Community Development have traditionally been good funders of placemaking projects. Some funding is guaranteed and some is highly competitive. Some funding opportunities require advanced planning and some come around every year. This information can help navigate to sources of funding.https://www.tn.gov/health/cedep/environmental/healthy-places/healthy-places/tools-and-resources/tr/funding-opportunities.html

State agency grant funding information can also be found here: https://www.tn.gov/generalservices/procurement/central-procurement-office--cpo-/library-/grant-funding-information.html

Other Tennessee funding and opportunities can be found here:
https://www.ruralhealthinfo.org/states/tennessee/funding

A. STATE AGENCY HIGHLIGHTS—GRANTS AND FUNDING SOURCES BY STATE AGENCY:

DEPARTMENT OF AGRICULTURE

- Tennessee Forestry Camp
- FFA Forestry Contest
- Project Learning Tree–TN Forestry Association
- Division of Forestry's overview of programs is included in **APPENDIX B**.

DEPARTMENT OF CHILDREN'S SERVICES

- Building Strong Brains Tennessee initiative–this initiative is a partnership between state government and the private sector that promotes policies, programs and practices to prevent and reduce adverse childhood experiences (ACEs) in children, youth and young adults.

DEPARTMENT OF ECONOMIC AND COMMUNITY DEVELOPMENT

- Three-Star Grant Program
- Community Development Block Grant
- Tennessee Main Street Program
- ARC Grants–Appalachian Regional Commission–to help build recreation businesses
- Incentives and Grants: https://tnecd.com/advantages/incentives-grants/

DEPARTMENT OF EDUCATION

- The department administers funding for two different extended learning programs: 21st Century Community Learning Centers (21st CCLCs) and Lottery for Education Afterschool Programs (LEAPS) both with the goal of enhancing academic opportunities for students.

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

- Recreational Trails Grant–trails and greenway funding
- Local Parks and Recreation Fund (LPRF) Grants–parks infrastructure and land acquisition
  - Planning Grants through the Recreation Educational Services Division to rural and distressed counties/ cities to develop a parks and recreation master plan
- "The TN 2020 Plan–Parks, People and Landscapes" and currently in development–"TN 2030–Tennessee's Outdoor Recreation Future (2021)"
- Green Development Grants
- Green Star Partnership
- Tennessee State Parks Run Clubs
- Partnership for Environmental Literacy in Tennessee (PELT)–interagency working group
- Healthy Parks, Healthy Person–Henry Horton State Park; (program overview PowerPoint provided in **APPENDIX B**.
- Tennessee State Parks' **ACE Resiliency Project at Frozen Head State Park**–to increase understanding of the benefits to outdoor learning and direct experience with nature to support ACE resilience.
- Tennessee State Parks Junior Range Program–offers children, ages 6-4, a fresh look at the world around them! Inspiring a love of nature and the outdoors, camps open the door to a lifetime of fun and adventure.

  These summer sessions provide hands-on opportunities for exploring and learning about the natural world through an array of fun and creative activities. Sessions are led by our dedicated and professional rangers, seasonal interpretive recreators and naturalists.

  Topics and activities vary from camp to camp but may include: Outdoor Safety, Astronomy, Reptiles and Amphibians, Aquatics, Map and Compass Navigation, Birds of Prey, Insects and Spiders, Primitive Weapons, Track Making and Identification, Outdoor Skills, Ecology, Canoeing, Hiking and much more.

- Tennessee State Parks–Special Summer Programs

  Summer is prime time to enjoy all the great programs and family activities offered in Tennessee State Parks!

  State Parks has a talented team of trained seasonal interpreters to help make your visit to the park memorable. State park interpreters help coordinate and lead many of the fun, interactive and educational programs for which Tennessee State Parks are known.

  Program offerings celebrate the natural, historical or cultural resources of each park and may include guided hikes, canoe floats, museum tours, owl prowls, slideshows, campfires, living history programs, Junior Ranger camps, nature craft workshops and outdoor skills demonstrations.

DEPARTMENT OF HEALTH

- Healthy Built Environments
- Project Diabetes
- Greenways and Trails Inventory–in progress (inter-agency effort)
- Tennessee Livability Collaborative

DEPARTMENT OF TRANSPORTATION

- Congestion Mitigation and Air Quality Improvement (CMAQ) Grant
- Transportation Alternatives Program (TAP) Grant

TENNESSEE WILDLIFE RESOURCES AGENCY

- Youth Hunting and Education
- Youth Fishing and Kids Free Fishing Events
- National Archery in the Schools Program
- Scholastic Clay Target Program
- Tennessee Outdoor Youth Summit (TOYS)

OTHER GOVERNMENT AGENCIES AND/OR NON-PROFITS:

- Environmental Justice Collaborative Problem-Solving Grants (Environmental Protection Agency)
- PeopleForBikes Spring 2018 Community Grant Program (PeopleforBikes nonprofit)
- Project WILD–TN Wildlife Federation
- Project WET–The Center of Excellence for Field Biology of Austin Peay State University

B. ADDITIONAL FUNDING OPPORTUNITIES CAN BE FOUND ON TN'S HEALTHY PLACES WEBSITE: https://www.tn.gov/health/cedep/environmental/healthy-places/healthy-places/tools-and-resources/tr/funding-opportunities.html

C. HEALTHY BUILT ENVIRONMENT FUNDING SOURCES—SEE APPENDIX B.

D. OUTDOOR ACTIVITIES FOR KIDS SPREADSHEET—SEE APPENDIX B.

FINDINGS AND RECOMMENDATIONS 3 — IDENTIFICATION OF BARRIERS THAT PREVENT STUDENTS WITH LIMITED ACCESS TO OUTDOOR EDUCATION AND RECREATION FROM BENEFITING FULLY FROM CURRENTLY AVAILABLE OPPORTUNITIES

SPECIFIC ISSUES/BARRIERS THAT THE TASK FORCE IDENTIFIED INCLUDE:

- Awareness of current programs especially the health benefits that they would receive. Either parents are not involved or do not know, or the proper social support mechanisms are not in place. If it involves a culture change–how and who approaches that problem? The bottom line is that families need to know and be aware and they have to want to participate and see the benefits–not just the young people. Opportunities for more family cohesiveness may have increased with the recent pandemic that hit our nation as we were in the process of formulating this report.

- Costs–associated with recreational equipment; and costs/expenses associated with traveling to parks for activities –they are mobile but don't have excess dollars to spend on leisure programs and facilities. Currently, Tennessee has several programs that allow local governments to build parks and recreation facilities, trails and recreation centers; however, there is no funding to purchase needed equipment.

- Access–related to transportation–they are not mobile and do not have the means to travel to parks or to programs within the community, schools, etc. They are aware but cannot get there.

- Lack of facilities and parks' infrastructure–hits two vulnerable areas: in urban neighborhoods and in rural communities. TDEC has the grant funding for these facilities, but the program requires a 50% match from the local government and sometimes they cannot afford the match dollars that are required.

- Capacity–most agencies do not have enough staff, or the necessary professional staff, to conduct more outreach and programs to all sectors of a community. This can be more of an issue than funding in most cases. Communities and non-profits need boots on the ground.

- There is a hesitancy to be outside due to bugs, ticks, humidity, etc.; also, adventure is sometimes seen as "danger"–there is a knowledge barrier that greater educational awareness can address.

- Understanding the outdoor recreation terminology–when approached with the invitation to "go outside for a walk" instead of "let's go hiking" more people may consider recreating outdoors (nature of americans.org)

- We need more virtual tours, hikes, etc. so people can see what they would experience. Since the task force identified this barrier, this has increased due to COVID-19 in all state parks, national parks and local parks and recreation departments.

- We need more EDUCATION–it is a critical piece. The current programs offered by state departments don't have adequate funding and are not available in all schools.

- The task force identified water sports, such as kayaking and canoeing, as the biggest trends in outdoor recreation at the present time. However, access is an issue for low income families due to the cost of equipment. Also, more programs should be available that can teach these skills to students in schools and to veterans and other special populations.

- Liability issues when participating in camps and off-site programs or residence programs. Filling slots in the FFA camp with Dept of Agriculture, for example, has seen a decline in recent years due to fear factors of participating in these activities.

- Greater awareness is needed–of connecting the idea that health is related to being outdoors; being outside promotes brain development and helps with all facets of health–mental, physical, etc. We need more information on proven successful outcomes and methods/places to share that information.

- Children do not get adequate recess time in schools–not as much as they once did. Some educators see recess as wasted time or transition time. The current requirement provides for only 130 minutes per elementary student per week, while some national programs promote 60 minutes per day; for middle and high school students the requirement allows for only 90 minutes cumulative. There is currently a bill in the Tennessee GA to change the physical education time and to increase it.

RECOMMENDATIONS TO ADDRESS BARRIERS OR BROADEN OPPORTUNITIES FOR STUDENTS WITH LIMITED ACCESS TO OUTDOOR EDUCATION AND RECREATION

SUGGESTED PRIORITIES AND CRITERIA FOR A SUCCESSFUL PROGRAM

The task force focused on potential priorities and criteria that could be used in targeting those students seeking the utilization of: state parks and wildlife management areas, Public-private partnerships and Veteran participation, as per the statue.

CONCLUSION & RECOMMENDATIONS

In Tennessee, there must be a multi-agency effort to lay the foundation and manage the Outdoor Education and Grant Program so that grant applications and the administration of the overall program considers all the components that should be in place to realize successful outcomes:

1. **WE HAVE A MULTI-FACETED COMMUNICATIONS PLAN THAT:**

a. Includes messaging to all government agencies, non-governmental agencies, family and children services agencies, veterans' organizations and schools. Awareness is a barrier and needs our focus.
b. Provides access to the evidence that shows access to, and interaction with, nature is essential to human health and well-being; access to adequate and appropriate information is lacking–improve signage, outdated websites, and provide availability of broad band connections to share information more widely.
c. Will provide improved access to nature and parks in order to improve and maintain human health and well-being;
d. Strives to reduce health care costs by maintaining physical and mental health at an early age and in turn, this can influence the family as a whole;
e. Highlights parks and other agencies and the services and programs that provide benefits in the areas of Social, Individual, Environmental and Health/Wellness–all targeted at enabling our young people to become empowered over their own health and well-being.

2. **A COLLABORATIVE EDUCATION PROCESS CAN TAKE PLACE THAT FOCUSES ON:**

a. Parks, forests and green spaces need recognition for the essential role they play in preserving, maintaining, and promoting the health of humans, as well as that of their environment. These public lands are a catalyst to influence collaboration and serve as the focal point in a community.
b. Tennessee State Parks and the Department of Health, through the Healthy Parks Healthy Person program have made great strides in parks/health promotion among all ages. This program can be applied with more of a focus in schools (K-12) for improved health and well-being for school-age children. It needs continued, regular funding to be successful.
c. How to incorporate this knowledge into public health policy and health promotion, as well as environmental literacy plans with the Department of Education;
d. Upgrading and improving funding and access to current programs offered to the schools through TWRA and Department of Education:
    i. Project Learning Tree (thriving nationally but not in TN) AG tag funding goes towards this program
    ii. Teacher conservation workshops through Dept. of Agriculture
    iii. Project WET
    iv. Project WILD
    v. Growing up WILD
e. Cooperation through a partnerships approach is required between government departments, park management agencies, health professionals, and researchers to successfully integrate parks and nature in public health.
    i. Look at what we are already doing and enhance current agency plans and funding programs to target more out door recreation programs and initiatives.
    ii. There is a need to leverage the education components more–through field trips, literacy plans, etc. Standards can align more with outdoor recreation/education activities.
f. Collaboration in the pursuit of common goals, by continuing the Outdoor Recreation and Education Task Force as the granting advisory body overseeing the dissemination and approval of the grants to agencies and organizations; this body shall also in the future, be known as the Outdoor Education and Recreation Advisory Committee (OERAC).

3. **FOCUS ON THE MAJOR BARRIERS THAT PREVENT OR LIMIT PARTICIPATION IN OUTDOOR RECREATION:**

a. Funding for transportation and infrastructure to outdoor recreation and educational programs, parks and schools.

b. Capacity–programs could be expanded if we had more staff. We support the growth and development of the Tennessee Recreation Initiative Program through TDEC, which funds parks and recreation staff and operations for rural/distressed counties and cities in Tennessee. Currently, there is an amendment to the TCA which will expand the funding to this program.

4. **ADHERENCE TO THE GOALS AND PRIORITIES IN THE 2030 STATEWIDE RECREATION PLAN**, being developed by the Tennessee Department of Environment and Conservation (with multi-agency input) in order to continue facilitating the engagement of communities and multiple state agencies in embracing the importance of outdoor recreation and environmental and outdoor education.

5. **A FOCUS ON PHYSICAL ACCESS TO PUBLIC TRANSPORTATION, ROADS, AND TRAILS.** The lack of information or access to information about recreational opportunities on public lands may be a problem.

6. **FOR ANY GRANT PROGRAM ESTABLISHED FOR THIS PURPOSE, THE STATE SHOULD ENSURE THE QUANTITATIVE MEASUREMENT OF PARTICIPATION AND RESULTS.**

a. Reports and audits of grantees must be part of the required grant process

b. Applications must request and include measurables/metrics

7. **THE TENNESSEE GENERAL ASSEMBLY SHOULD PASS A BILL REQUIRING THE USE OF SHARED USE GUIDES/ RESOURCES/FACILITIES, UTILIZING THE DEPARTMENT OF HEALTH'S GUIDE:**

Department of Health
https://www.tn.gov/content/dam/tn/health/program-areas/primary-prevention/Joint%20Use%20Guide_Final_2019.pdf

The members of the Outdoor Education and Recreation Task Force would like to thank their Commissioners for the support and confidence they gave to all of us in the completion of this important project:

David W. Salyers, P.E., Commissioner, Department of Environment and Conservation
Penny Schwinn, Commissioner, Department of Education
Ed Carter, former Executive Director, Tennessee Wildlife Resources Agency
Lisa Piercey, Commissioner, Department of Health
Bob Rolfe, Commissioner, Department of Economic and Community Development
Charlie Hatcher, D.V.M., Commissioner, Department of Agriculture

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Art Direction: Heather Lose

APPENDIX A

STUDIES & RESEARCH

Department of Agriculture | Forestry

Studies/Reports Connecting Nature with Improved Mental & Physical Health

2/19/2020

Prepared for the Governor's Outdoor Education and Recreation Task Force

- Akers, A., Barton, J., Cossey, R., Gainsford, P., Griffin, M., Mikleright, D. (2012). Visual Color Perception in Green Exercise: Positive Effects on Mood and Perceived Exertion. *Environmental Science and Technology*. 46(16):8661-8666.

  Abstract

  Positive effects of green exercise on physical and psychological wellbeing have been found, yet little is known about the underlying cognitive mechanisms responsible for such effects. The purpose of this visual sensation study was to establish the extent to which the color green, as a primitive visual feature of many natural environments, contributes to the green exercise effect. Fourteen participants performed three moderate-intensity 5-min cycling tasks (50% peak power output) while watching video footage of a rural cycling course that simulated cycling through a real natural environment. The three randomly counter-balanced video conditions were unedited (V(GREEN)), achromatic (V(GRAY)) or red filter (V(RED)). Lower total mood disturbance and ratings of perceived exertion were found during the V(GREEN) compared to V(GRAY) and V(RED). Feelings of anger were higher after V(RED) compared to the other conditions. Feelings of tension, depression, fatigue, vigor, and confusion did not differ among conditions. This is the first study to show that the color green, as a primitive feature of visual sensation, has a contributory effect toward positive green exercise outcomes.

- Aspinall, P., Mavros, P., Coyne, R., Roe, J. (2012). The urban brain: analyzing outdoor physical activity with mobile EEG. *British Journal of Sports Medicine*.

  Abstract

  BACKGROUND:

  Researchers in environmental psychology, health studies and urban design are

interested in the relationship between the environment, behaviour settings and emotions. In particular, happiness, or the presence of positive emotional mindsets, broadens an individual's thought-action repertoire with positive benefits to physical and intellectual activities, and to social and psychological resources. This occurs through play, exploration or similar activities. In addition, a body of restorative literature focuses on the potential benefits to emotional recovery from stress offered by green space and 'soft fascination'. However, access to the cortical correlates of emotional states of a person actively engaged within an environment has not been possible until recently. This study investigates the use of mobile electroencephalography (EEG) as a method to record and analyse the emotional experience of a group of walkers in three types of urban environment including a green space setting.

METHODS:

Using Emotiv EPOC, a low-cost mobile EEG recorder, participants took part in a 25 min walk through three different areas of Edinburgh. The areas (of approximately equal length) were labelled zone 1 (urban shopping street), zone 2 (path through green space) and zone 3 (street in a busy commercial district). The equipment provided continuous recordings from five channels, labelled excitement (short-term), frustration, engagement, long-term excitement (or arousal) and meditation.

RESULTS:

A new form of high-dimensional correlated component logistic regression analysis showed evidence of lower frustration, engagement and arousal, and higher meditation when moving into the green space zone; and higher engagement when moving out of it.

CONCLUSIONS:

Systematic differences in EEG recordings were found between three urban areas in line with restoration theory. This has implications for promoting urban green space as a mood-enhancing environment for walking or for other forms of physical or reflective activity.

- Barton, J., Pretty, J. (2010). What is the Best Dose of Nature and Green Exercise for Improving Mental Health? A Multi-Study Analysis. *Environmental Science and Technology*. 44: 3947-3955.

Abstract

Green exercise is activity in the presence of nature. Evidence shows it leads to positive short and long-term health outcomes. This multistudy analysis assessed the best regime of dose(s) of acute exposure to green exercise required to improve self-esteem and mood (indicators of mental health). The research used meta-analysis methodology to analyze 10 UK studies involving 1252 participants. Outcomes were identified through a priori subgroup analyses, and dose-responses were assessed for exercise intensity and exposure duration. Other subgroup analyses included gender, age group, starting health status, and type of habitat. The overall effect size for improved self-esteem was d = 0.46 (CI 0.34-0.59, p < 0.00001) and for mood d = 0.54 (CI 0.38-0.69, p < 0.00001). Dose responses for both intensity and duration showed large benefits from short engagements in green exercise, and then diminishing but still positive returns. Every green environment improved both self-esteem and mood; the presence of water generated greater effects. Both men and women had similar improvements in self-esteem after green exercise, though men showed a difference for mood. Age groups: for self-esteem, the greatest change was in the youngest, with diminishing effects with age; for mood, the least change was in the young and old. The mentally ill had one of the greatest self-esteem improvements. This study confirms that the environment provides an important health service.

- Berman, M. G., Jonides, J., Kaplan, Stephen. (2008). The Cognitive Benefits of Interacting With Nature. *Psychological Science*. 19: 1207-1212.

Abstract

We compare the restorative effects on cognitive functioning of interactions with natural versus urban environments. Attention restoration theory (ART) provides an analysis of the kinds of environments that lead to improvements in directed-attention abilities. Nature, which is filled with intriguing stimuli, modestly grabs attention in a bottom-up fashion, allowing top-down directed-attention abilities a chance to replenish. Unlike natural environments, urban environments are filled with stimulation that captures attention dramatically and additionally

requires directed attention (e.g., to avoid being hit by a car), making them less restorative. We present two experiments that show that walking in nature or viewing pictures of nature can improve directed-attention abilities as measured with a backwards digit-span task and the Attention Network Task, thus validating attention restoration theory.

- Children and Nature Network. (2012). Health Benefits to Children from contact with the Outdoor & Nature. 46 pages. http://www.childrenandnature.org/
  - A great list of annotated bibliographies of research and studies. Attached as appendix.
- Donovan, G. Butry, D. Michael, Y., Prestemon, J., Liebhold,A., Gatziolis, D., Mao, M. (2013). The Relationship Between Trees and Human Health: Evidence from the Spread of the EAB. *American Journal of Preventive Medicine*. 44(2):139-45.

  Background: Several recent studies have identified a relationship between the natural environment and improved health outcomes. However, for practical reasons, most have been observational, cross-sectional studies.

  Purpose: A natural experiment, which provides stronger evidence of causality, was used to test whether a major change to the natural environment—the loss of 100 million trees to the emerald ash borer, an invasive forest pest—has influenced mortality related to cardiovascular and lower-respiratory diseases.

  - U.S. Department of Agriculture, Forest Service. 2018. Urban nature for human health and well-being: a research summary for communicating the health benefits of urban trees and green space. FS-1096. Washington, DC. 24 p.

    A research summary for communicating the health benefits of urban trees and green space. See appendix.

    Conclusion

    People are dependent on nature for food, water, security, health, and well-being—we are connected with the natural world for our very survival. Green spaces also make us happier and healthier. The evidence of the link between nature, health, and preventive medicine will hopefully spur

more direct collaboration between the health, urban planning, education, and natural resource communities. With the growing pressures of modern life, these are critical connections to pursue; the answers to some of the biggest challenges facing these groups lie in the recognition of shared interests, goals, and objectives. This area of research will continue to grow in the coming years and decades, illuminating the essential role that nature plays in the health and well-being of our minds, bodies, and spirit.

- Gies, E. (2006). *The Health Benefits of Parks.* The Trust for Public Land.

  Intended for park advocates and professionals, The Health Benefits of Parks: How Parks Help Keep Americans and Their Communities Fit and Healthy makes a powerful case for the ways that parks support and promote healthy lifestyles, particularly in cities. The booklet demonstrates that parks are a wise community investment. Topics include:

  - Parks, greenways, and trails enable and encourage people to exercise.
  - Exposure to nature improves psychological and social health.
  - Play is critical for child development.
  - Parks help build healthy, stable communities.

- Hanson, P., Matt, F., Bowyer, J.,Bratkovich, S., Fernholz, K., owe, J., Groot, H., Pepke, E. (2016). The Human Health and Social Benefits of Urban Forests.

  Recent research suggests that urban forests can improve human mental and physical health, improve academic performance where school settings and classrooms integrate trees and forest views, increase social cohesion, and, in some cases, contribute to a reduction in crime. While urban forests provide an array of social benefits to people living and working in cities and visiting them, these benefits are often unevenly distributed. Uneven distribution of tree related benefits frequently correlates with socioeconomic status, race, and ethnicity, and education level, as open space and urban tree cover are frequently less common in lower income neighborhoods.

  At a time when more and more people around the world live within cities, it is

increasingly important to take advantage of the many benefits that urban forests offer. Robust and equitable urban forest management policies and incentives are needed in order to enable widespread access to the many benefits urban forests provide.

- Kaplan, R., Kaplan, S. (1989). *The experience of nature: A psychological perspective*. New York: Cambridge University Press.

- Kuo, F. E., Taylor, A. F. (2004). A Potential Natural Treatment for Attention-Deficit /Hyperactivity Disorder: Evidence From a National Study. *American Journal of Public Health*. 94(9): 1580-1586.

  Abstract

  Objectives. We examined the impact of relatively "green" or natural settings on attention-deficit/hyperactivity disorder (ADHD) symptoms across diverse subpopulations of children.

  Methods. Parents nationwide rated the aftereffects of 49 common after-school and weekend activities on children's symptoms. Aftereffects were compared for activities conducted in green outdoor settings versus those conducted in both built outdoor and indoor settings.

  Results. In this national, nonprobability sample, green outdoor activities reduced symptoms significantly more than did activities conducted in other settings, even when activities were matched across settings. Findings were consistent across age, gender, and income groups; community types; geographic regions; and diagnoses.

  Conclusions. Green outdoor settings appear to reduce ADHD symptoms in children across a wide range of individual, residential, and case characteristics.

- Lee, J., Park, B.-J., Tsunetsugu, Y., Kagawa, T., Miyazaki, Y. (2009). Restorative effects of viewing real forest landscapes, based on a comparison with urban landscapes. *Scandinavian Journal of Forest Research*. 24(3): 227-234.

  Abstract

  Growing attention has been paid to the health-enhancing or therapeutic effects of natural environments, such as forests, and the requirement for an evidence-

based approach has been pressing. However, there is a lack of evidence-based research in this field. In this study, the restorative effects of viewing real forest landscapes were examined through field experiments by comparing the effects of urban landscapes. Twelve Japanese male subjects in their twenties participated in a 3 day field experiment. The subjects were instructed to visit forest and urban environments randomly and to view each real landscape. Physiological and psychological data on each subject were collected four times a day. Significant differences between the responses of the subjects in forest compared with those in the urban environment were found. Forest environments had significantly lower values than urban environments after viewing in (1) salivary cortisol concentration (an index of stress response), (2) diastolic blood pressure, and (3) pulse rate. Further, subjects felt more comfortable, soothed and refreshed when viewing a forest landscape than an urban one. These findings support the idea that real forest landscapes may ameliorate stress, aid autonomic nervous system relaxation and increase positive emotion, and provide important scientific evidence of forest-guided health benefits.

- Lee, J., Park, B.-J., Tsunetsugu, Y., Ohra, T., Kagawa, T., Miyazaki, Y. (2011). Effect of forest bathing on physiological and psychological responses in young Japanese male subjects. *Public Health*. 125(2): 93-100.

  Summary

  Objective

  To provide scientific evidence supporting the efficacy of forest bathing as a natural therapy by investigating its physiological benefits using biological indicators in outdoor settings.

  Study design

  Within-group comparisons were used to examine psychological and physiological responses to exposure to real forest and urban environments.

  Methods

  Young Japanese male adults participated in a 3-day, 2-night field experiment. Physiological responses as well as self-reported psychological responses to

forest and urban environmental stimuli were measured in real settings. The results of each indicator were compared against each environmental stimulus.

Results

Heart rate variability analysis indicated that the forest environment significantly increased parasympathetic nervous activity and significantly suppressed sympathetic activity of participants compared with the urban environment. Salivary cortisol level and pulse rate decreased markedly in the forest setting compared with the urban setting. In psychological tests, forest bathing significantly increased scores of positive feelings and significantly decreased scores of negative feelings after stimuli compared with the urban stimuli.

Conclusion

Physiological data from this field experiment provide important scientific evidence on the health benefits of forest bathing. The results support the concept that forest bathing has positive effects on physical and mental health, indicating that it can be effective for health promotion. Despite the small sample size in this study, a very clear tendency towards positive physiological and psychological outcomes in forests was observed.

- Li, Q. (2010). Effect of forest bathing trips on human immune function. *Environmental Health and Preventative Medicine.* 15(1): 9-17.

Abstract

In Japan, a forest bathing trip, called "Shinrinyoku" in Japanese, is a short, leisurely visit to a forest; it is regarded as being similar to natural aromatherapy. This review focuses on the effects of forest bathing trips on human immune function. Beginning in 2005, adult Japanese individuals, both male and female, participated in a series of studies aimed at investigating the effect of forest bathing trips on human immune function. The subjects experienced a 3-day/2-night trip to forest areas, and blood and urine were sampled on days 2 (the first sampling during each trip) and 3 (the second sampling during each trip), and on days 7 and 30 after the trips. Natural killer (NK) activity, the numbers of NK, granulysin-, perforin-, and granzymes A/B-expressing lymphocytes in the blood, and the concentration of urinary adrenaline were measured. The same measurements were made before the trips on a normal working day as a

control. The mean values of NK activity and the numbers of NK, granulysin-, perforin-, and granzymes A/B-expressing cells on forest bathing days were significantly higher than those on the control days, whereas the mean values of the concentration of urinary adrenaline on forest bathing days were significantly lower than that on the control days in both male and female subjects. The increased NK activity lasted for more than 30 days after the trip, suggesting that a forest bathing trip once a month would enable individuals to maintain a higher level of NK activity. In contrast, a visit to the city as a tourist did not increase NK activity, the numbers of NK cells, or the level of intracellular granulysin, perforin, and granzymes A/B. These findings indicate that forest bathing trips resulted in an increase in NK activity, which was mediated by increases in the number of NK cells and the levels of intracellular granulysin, perforin, and granzymes A/B.

- Li, Q., Kawada, T. (undated but probably 2010). Healthy forest parks make healthy people: Forest environments enhance human immune function. Department of Hygiene and Public Health, Nippon Medical School, Tokyo, Japan.

  Abstract

  Humans have enjoyed forest environments for a long time because of the quiet atmosphere, beautiful scenery, mild climate, and fresh, clean air. In the present study, we found that visiting forest parks enhanced human natural killer cell (NK) activity, increased anti-cancer proteins, and reduced stress. This effect lasted for more than 30 days. Phytoncides released from trees and the decreased production of stress hormones may partially contribute to the increased NK activity. Because NK cells can kill tumor cells by releasing anti-cancer proteins, and visiting forest parks increases NK activity and the amount of anti-cancer proteins, therefore the above findings suggest that visiting forest parks may have a preventive effect on cancer generation and progression.

- Li Q, Kobayashi M, Wakayama Y,Inagaki H, Katsumata M, Hirata Y, Hirata K, Shimizu T, Kawada T, Park BJ, Ohira T, Kagawa T, Miyazaki Y. (2009). Effect of phytoncide from trees on human natural killer cell function. *International Journal of Immunopathology and Pharmacology.* 22(4):951-959.

  Abstract

  We previously reported that the forest environment enhanced human natural killer (NK) cell activity, the number of NK cells, and intracellular anti-cancer proteins in lymphocytes, and that the increased NK activity lasted for more than

7 days after trips to forests both in male and female subjects. To explore the factors in the forest environment that activated human NK cells, in the present study we investigate the effect of essential oils from trees on human immune function in twelve healthy male subjects, age 37-60 years, who stayed at an urban hotel for 3 nights from 7.00 p.m. to 8.00 a.m. Aromatic volatile substances (phytoncides) were produced by vaporizing Chamaecyparis obtusa (hinoki cypress) stem oil with a humidifier in the hotel room during the night stay. Blood samples were taken on the last day and urine samples were analysed every day during the stay. NK activity, the percentages of NK and T cells, and granulysin, perforin, granzyme A/B-expressing lymphocytes in blood, and the concentrations of adrenaline and noradrenaline in urine were measured. Similar control measurements were made before the stay on a normal working day. The concentrations of phytoncides in the hotel room air were measured. Phytoncide exposure significantly increased NK activity and the percentages of NK, perforin, granulysin, and granzyme A/B-expressing cells, and significantly decreased the percentage of T cells, and the concentrations of adrenaline and noradrenaline in urine. Phytoncides, such as alpha-pinene and beta-pinene, were detected in the hotel room air. These findings indicate that phytoncide exposure and decreased stress hormone levels may partially contribute to increased NK activity.

- Li, Q., Nakadai, A., Matsushima, H., Miyazaki, Y., Krensky, A., Kawada, T., Morimoto, K. (2006). Phytoncides (Wood Essential Oils) Induce Human Natural Killer Cell Activity. *Immunopharmacology and Immunotoxicology*, 28:319-333.

- Maas, J., Verheij, R., Groenewegen, P., de Vries, S., Spreeuwenberg, P. (2006). Greenspace, urbanity, and health: how strong is the relation? *Journal of Epidemiology and Community Health.* 60(7): 587-592.

  Abstract

  Study objectives

  To investigate the strength of the relation between the amount of green space in people's living environment and their perceived general health. This relation is analysed for different age and socioeconomic groups. Furthermore, it is analysed separately for urban and more rural areas, because the strength of the relation was expected to vary with urbanity.

  Design

The study includes 250 782 people registered with 104 general practices who filled in a self administered form on sociodemographic background and perceived general health. The percentage of green space (urban green space, agricultural space, natural green space) within a one kilometre and three kilometre radius around the postal code coordinates was calculated for each household.

Methods

Multilevel logistic regression analyses were performed at three levels—that is, individual level, family level, and practice level—controlled for sociodemographic characteristics.

Main results

The percentage of green space inside a one kilometre and a three kilometre radius had a significant relation to perceived general health. The relation was generally present at all degrees of urbanity. The overall relation is somewhat stronger for lower socioeconomic groups. Elderly, youth, and secondary educated people in large cities seem to benefit more from presence of green areas in their living environment than other groups in large cities.

Conclusions

This research shows that the percentage of green space in people's living environment has a positive association with the perceived general health of residents. Green space seems to be more than just a luxury and consequently the development of green space should be allocated a more central position in spatial planning policy.

- Maller, C., Henderson-Wilson, C., Pryor, A., Prosser, L., Moore, M. (2008). Healthy parks, healthy people: The health benefits of contact with nature in a park context. A review of relevant literature. 2nd edition. Parks Victoria.

- Mao G.X., Cao, Y.B., Lan, X.G., He, Z.H., Chen, Z.M., Wang, Y.Z., Hu, X.L., Lv, Y.D., Wang, G.F., Yan, J. (2012). Therapeutic effect of forest bathing on human hypertension in the elderly. *Journal of Cardiology*. 60:495-502.

- Ohtsuka, Y., Yabunaka, N., Takayama, S. (1998). Shinrin-yoku (forest-air bathing and walking) effectively decreases blood glucose levels in diabetic patients. *International*

Journal of Biometeorology. 41(3):125-7.

- Park, B.-J., Furuya, K., Kasetani, T., Takayama, N., Kagawa, T., Miyazaki, Y. (2011). Relationship between psychological responses and physical environments in forest settings. *Landscape and Urban Planning*. 102(1): 24-32.

Abstract

The present study aimed to clarify the relationship between psychological responses to forest and urban environmental settings and the physical variables that characterize these environments, by examining the psychological responses of 168 subjects to their physical environment. Field experiments were conducted in 14 forests and 14 urban areas across Japan. The semantic differential (SD) method was employed in which a questionnaire was administered to subjects prior to their walks in the forests and urban areas. In addition, the profile of mood states (POMS) questionnaire was administered before and after the walks, as well as before and after they sat and viewed the forest and urban landscapes. The environmental variables measured were air temperature, relative humidity, radiant heat, wind velocity, and two indices of thermal comfort [predicted mean vote (PMV) and predicted percentage dissatisfied (PPD)]. Responses to the SD questionnaire indicated that compared to urban settings, forest settings are perceived as being significantly more enjoyable, friendly, natural, and sacred. The POMS measures of tension and anxiety (T-A), depression and dejection (D), anger and hostility (A-H), vigor (V), confusion (C), fatigue (F), and total mood disturbance (TMD) showed significant differences between the forests and urban areas. These results strongly support the suggestion that forest settings have attention restoration effects. The psychological responses to physical environments were also significantly related to air temperature, relative humidity, radiant heat, wind velocity, PMV, and PPD. The results of this study might be useful in designing restoration environments in urban areas.

Highlights

► In forest areas, the incidence of positive emotions is significantly higher than urban areas. ► In forest areas, thermal conditions are more comfortable than urban areas. ► Positive emotions are correlated with thermal comfort.

- Park, B.-J., Tsunetsugu, Y., Kasetani, T., Kagawa, T., Miyazaki, Y. (2010). The

physiological effects of Shinrin-yoku (taking in the forest atmosphere or forest bathing): evidence from field experiments in 24 forests across Japan. *Environmental Health and Preventative Medicine*. 15(1):18-26.

- Taylor, A. F., Kuo, F. E. (2009). Children with attention deficits concentrate better after a walk in the park. *Journal of Attention Disorders*. 12(5): 402-409.

Abstract

Objective: In the general population, attention is reliably enhanced after exposure to certain physical environments, particularly natural environments. This study examined the impacts of environments on attention in children with ADHD.

Method: In this within subjects design, each participant experienced each of three treatments (environments) in single blind controlled trials. Seventeen children 7 to12 years old professionally diagnosed with ADHD experienced each of three environments—a city park and two other well-kept urban settings—via individually guided 20-minute walks. Environments were experienced 1 week apart, with randomized assignment to treatment order. After each walk, concentration was measured using Digit Span Backwards.

Results: Children with ADHD concentrated better after the walk in the park than after the downtown walk (p = .0229) or the neighborhood walk (p = .0072). Effect sizes were substantial (Cohen's d =.52 and .77, respectively) and comparable to those reported for recent formulations of methylphenidate.

Conclusion: Twenty minutes in a park setting was sufficient to elevate attention performance relative to the same amount of time in other settings. These findings indicate that environments can enhance attention not only in the general population but also in ADHD populations. “Doses of nature” might serve as a safe, inexpensive, widely accessible new tool in the tool kit for managing ADHD symptoms. (*J. of Att. Dis. 2009; 12(5) 402-409)*

- Thompson, C. W., Roe, J., Aspinall, P., Mitchell, R., Clow, A., Miller, D. (2012). More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. *Landscape and Urban Planning*. 105(3): 221-229.

Abstract

Green space has been associated with a wide range of health benefits, including stress reduction, but much pertinent evidence has relied on self-reported health indicators or experiments in artificially controlled environmental conditions. Little research has been reported using ecologically valid objective measures with participants in their everyday, residential settings. This paper describes the results of an exploratory study (n = 25) to establish whether salivary cortisol can act as a biomarker for variation in stress levels which may be associated with varying levels of exposure to green spaces, and whether recruitment and adherence to the required, unsupervised, salivary cortisol sampling protocol within the domestic setting could be achieved in a highly deprived urban population. Self-reported measures of stress and general wellbeing were also captured, allowing exploration of relationships between cortisol, wellbeing and exposure to green space close to home. Results indicate significant relationships between self-reported stress (P < 0.01), diurnal patterns of cortisol secretion (P < 0.05), and quantity of green space in the living environment. Regression analysis indicates percentage of green space in the living environment is a significant (P < 0.05) and independent predictor of the circadian cortisol cycle, in addition to self-reported physical activity (P < 0.02). Results also show that compliance with the study protocol was good. We conclude that salivary cortisol measurement offers considerable potential for exploring relationships between wellbeing and green space and discuss how this ecologically valid methodology can be developed to confirm and extend findings in deprived city areas to illuminate why provision of green space close to home might enhance health.

Highlights

► The biological impact of exposure to green space encountered by a deprived population in their home environment is shown. ► Diurnal patterns of participants' salivary cortisol, self-report stress and objective measures of green space were recorded. ► Using a small, UK, urban sample, a significant positive correlation between cortisol slope and % green space was found. ► There was a significant negative correlation between self-reported stress and % green space. ► Ecologically valid and objective measures provide evidence for a salutogenic environment-body interaction.

- Townsend, M. (2008). Healthy parks, healthy people: The health benefits of contact with nature in a park context. A review of relevant literature. Deakin University.Burwood, Melbourne, Australia.

- See appendix

- Tsunetsugu, Y., Lee, L., Park, B.-J., Tyrväinen, L., Kagawa,T., Miyazaki, Y. (2013). Physiological and psychological effects of viewing urban forest landscapes assessed by multiple measurements. *Landscape and Urban Planning.* 113: 90-93.

- Tsunetsugu, Y., Park, B., Miyazaki, Y. (2010). Trends in research related to "Shinrin-yoku" (taking in the forest atmosphere or forest bathing) in Japan. *Environmental Health and Preventative Medicine.* 15(1): 27-37.

- Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science*. 224:420-422.

  Abstract

  Records on recovery after cholecystectomy of patients in a suburban Pennsylvania hospital between 1972 and 1981 were examined to determine whether assignment to a room with a window view of a natural setting might have restorative influences. Twenty-three surgical patients assigned to rooms with windows looking out on a natural scene had shorter postoperative hospital stays, received fewer negative evaluative comments in nurses' notes, and took fewer potent analgesics than 23 matched patients in similar rooms with windows facing a brick building wall.

- Ulrich, R. S. (1999). Effects of gardens on health outcomes: Theory and research. In C. Cooper-Marcus & M. Barnes (Eds.), Healing Gardens: Therapeutic Benefits and Design Recommendations. New York: John Wiley, pp. 27-86.

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.

Focus: Literature Reviews & Overview Documents

These articles summarize literature related to outdoor and nature contact and children's health and well-being.

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 children's use of the outdoors and relationships to their health. Specific topics Muñoz examines include research linking children's time spent outdoors to increased physical activity, healthy development, and overall well-being. She also examines research related to the design of children's

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

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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

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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 residential neighborhood layouts with specific national and international case studies, including clustered housing and shared outdoor space, cul-de-sacs and greenways, alleys, and home zones. Moore and Marcus conclude by providing a number of key recommendations to help ensure children's access to nature in residential environments.

Moore, R. C., & Cooper Marcus, C. (2008). "Healthy planet, healthy children: Designing nature into the daily spaces of childhood." In S. Kellert, J. Heerwagen & M. Mador (Eds.), *Biophilic design: Theory, science and practice*. Hoboken, NJ: John Wiley & Sons, Inc. This book chapter is available online at:
http://www.naturalearning.org/docs/MooreCooperMarcus_Healthy.pdf **(Volume 3)**

Direct experience in nature is critical and diminishing

Nature is important to children's development in every major way — intellectually, emotionally, socially, spiritually, and physically. In one of his newest books, *Building for Life: Designing and Understanding the Human-Nature Connection* (Island Press, 2005), Dr. Stephen R. Kellert of Yale University devotes a chapter to the subject of "Nature and Childhood Development." Combining his original research with well-documented references to the research of others, this chapter is a powerful synthesis of what we know, and what we do not know, about the importance of nature to children's healthy development. Kellert states, "Play in nature, particularly during the critical period of middle childhood, appears to be an especially important time for developing the capacities for creativity, problem-solving, and emotional and intellectual development." He includes research to indicate optimal learning opportunities at age-appropriate times and differentiates between indirect, vicarious, and direct experiences with nature — with the latter less and less available to children. He urges designers, developers, educators, political leaders and citizens throughout society to make changes in our modern built environments to provide children with positive contact with nature — where children live, play, and learn. (Original Research and Synthesis)

Kellert, Stephen R. "Nature and Childhood Development." In *Building for Life: Designing and Understanding the Human-Nature Connection*. Washington, D.C.: Island Press, 2005. Full book available via Amazon.com

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)**

Focus: Mental Health

These articles examine relationships between children's contact with the outdoors and/or nature and their psychological and cognitive performance and functioning.

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 reduce symptoms of attention deficit disorder in children as young as five. Here is another important study that supports this finding. In addition to access to reports of the primary research, the scholars provide a Power Point presentation that may

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 and Behavior. Vol. 35:3, 311-330. This study is not available online without purchase; http://www.sagepub.co.uk/journals/details/j0163.html **(Volume 1)**

Nearby nature boosts children's cognitive functioning

A precursor to Nancy Wells' study reported above, this research, reported in 2000, shows that proximity to, views of, and daily exposure to natural settings increases children's ability to focus and therefore enhances cognitive abilities. (Original Research)

Wells, N.M. "At Home with Nature: Effects of 'Greenness' on Children's Cognitive Functioning." Environment and Behavior. Vol. 32, No. 6, 775-795. This study is not available online without purchase; http://eab.sagepub.com/cgi/content/abstract/32/6/775 **(Volume 1)**

Focus: Physical Health

These articles examine linkages between the design of children's environments, children's outdoor-related behavior and their physical health, including physical activity, development, and functioning.

Older children who spend more time outside tend to be more physically active and are less likely to be overweight

Cleland and colleagues investigated whether the amount of time children spend outdoors is related to their physical activity levels and being overweight. About 200 five- to six-year-old and 350 ten- to twelve-year-old children from 19 randomly selected elementary schools in Melbourne, Australia participated in this study. In 2001 and 2004, parents reported the amount of time their children spent outdoors and researchers recorded children's physical activity levels using an accelerometer and measured children's weight and height. In their paper, Cleland and colleagues report many findings, some of which are discussed below. The researchers found, for example, that children spent significantly more time outdoors during warmer months as compared to cooler months; boys had significantly higher levels of moderate and vigorous physical activity (MVPA) on weekdays than

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*****(11), 1685-1693.** This study may be available in a library near you or can be purchased online through the publisher at: http://www.nature.com/ijo/index.htm **(Volume 4)**

Green school grounds improve quantity and quality of elementary school children's physical activity

In recent years, there has been increasing interest in greening school grounds to diversify children's play experiences, such as through the planting of trees, building of ponds, and development of vegetable gardens. Dyment and Bell investigated how green school grounds affect the physical activity of elementary school children by sending questionnaires to a diversity of Canadian schools that had greened their school grounds. Questionnaires were completed by 105 individuals from 59 schools who had been involved in their school's greening project. In analyzing the study data, Dyment and Bell found that green areas were an important place for physical activity: respondents reported that 66% of students use green areas for active play. Interestingly, the researchers found that green areas tended to support more moderate and light activity as opposed to the more vigorous activity that generally takes place in traditional turf and asphalt areas. Dyment and Bell found that nearly 50% of the respondents reported that their school ground promotes more vigorous activity after greening, while about 70% reported more moderate and/or light physical activity taking place after greening. In addition, the researchers found that 90% of respondents reported that their school ground appeals to a wider variety of student interests after greening; 85% reported that their school ground now supports a wider variety of play activities; and 84% reported that since greening, their school ground encourages more exploration of the natural world. While this study may be limited due to its reliance on retrospective self-report, it provides important insight into the benefits of green school grounds and their potentially significant role in

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

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

Dyment, 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 residential address for at least two years. The majority of participants in this study were non-Hispanic black and enrolled in Medicaid (an indicator of socioeconomic status). Bell and colleagues geocoded each participant's address using a Geographic Information System and measured greenness at these locations using satellite images and a vegetation index. The researchers speculated

that neighborhood greenness might serve as an indicator of children's access to spaces that promote physical activity or increased time outside. In analyzing the study data, Bell and colleagues found that the amount of vegetation in a child's neighborhood was inversely correlated with their Body Mass Index (BMI) score at the year two measurement. That is, in general, the more vegetation a child had in their neighborhood, the lower their body weight changes. The researchers also found that children in more vegetated settings were less likely to have a higher BMI over 2 years as compared to children in less vegetated settings. Importantly, Bell and colleagues controlled for a number of other factors in their analyses, such as residential density. While the study is observational and thus cannot causally link neighborhood greenness and body weight changes, this research highlights the role that neighborhood vegetation could play in policies and programs aimed at preventing childhood obesity.

Author Affiliation: Bell is with the University of Washington. Wilson is with Indiana University-Purdue University. Liu is with Indiana University.

Bell, J. F., Wilson, J. S., & Liu, G. C. (2008). Neighborhood greenness and 2-year changes in Body Mass Index of children and youth. *American Journal of Preventive Medicine, 35*(6), 547-553. This study may be available in a library near you or can be purchased online through the publisher at: http://www.ajpm-online.net/ **(Volume 4)**

Community design can promote and support children's physical activity

This article is a policy statement by the American Academy of Pediatrics' Committee on Environmental Health regarding the influence that community design has on children's opportunities to be physically active. The Committee highlights the role of neighborhood design in promoting recreational and incidental or "utilitarian" physical activity, such as the availability of parks and recreational facilities, as well as children's ability to walk to school. The Committee also highlights important factors influencing children's physical activity, including traffic danger, the presence of sidewalks, and perception and fear of crime. Finally, the Committee provides a number of specific recommendations for pediatricians and government to promote children's physical activity in the built environment and support more active lifestyles.

Binns, H. J., Forman, J. A., Karr, C. J., Osterhoudt, K., Paulson, J. A., Roberts, J. R., et al. (2009). The built environment: designing communities to promote physical activity in children. *Pediatrics, 123*(6), 1591-1598. This study may be available in a library near you or can be purchased online through the publisher at: http://www.jpeds.com/ **(Volume 4)**

Children with a park playground near their home are more likely to be of a healthy weight

Physical activity is thought to play an important role in childhood obesity. While research results to date are somewhat mixed, parks can provide important opportunities for children to be physically active. In this study, Potwarka and colleagues examine whether children's weight is related to park space and the availability of specific park facilities within 1km of children's homes. Researchers collected information on 108 two- to seventeen-year-old children from four neighborhoods in a mid-sized city in Ontario, Canada. Parents reported their child's height and weight, while researchers used a Geographic Information System to assess park space for each child and a database and trained observers to assess park facilities. In analyzing the study data, Potwarka and colleagues found that proximity to park space was not significantly related to children's weight status. The researchers did find, however, that when examining park facilities, children with a park playground within 1 km of their homes were five times more likely to be of a healthy weight than children without a park

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.

Author Affiliation: The authors are with the University of Waterloo in Canada.

Potwarka, L. R., Kaczynski, A. T., & Flack, A. L. (2008). Places to play: association of park space and facilities with healthy weight status among children. *Journal of Community Health, 33*(5), 344-350. This study may be available in a library near you or can be purchased online through the publisher at: http://www.springer.com/public+health/health+promotion+&+disease+prevention/journal/10900 **(Volume 4)**

Public open space features may influence children's physical activity

Public open spaces may be important places for children to play and be physically active. Timperio and colleagues investigated relationships between the specific features of public open spaces and children's physical activity by examining data collected as part of a neighborhood study in Melbourne, Australia. Participants in this study included 163 eight- to nine-year-old children and 334 thirteen- to fifteen-year-old children. Participants wore an accelerometer for one week to measure their physical activity and researchers used a Geographic Information System and trained observer to identify and analyze the closest public open space to each child's home. In analyzing the data, Timperio and colleagues found that younger children spent significantly more time engaged in moderate to vigorous physical activity (MVPA) on weekdays and weekends as compared to adolescents. While there were no gender differences among younger children, among adolescents researchers found that boys spent significantly more time engaged in MVPA on weekdays and weekends as compared to girls. With regard to public open space, Timperio and colleagues found that participants, on average, lived about 300 meters from their closest public open space. When examining relationships between features of children's closest public open space and physical activity, researchers obtained somewhat mixed and inconsistent results. For example, researchers found that playgrounds were positively associated with younger boys' weekend physical activity, the number of recreational facilities was inversely associated with younger girls' physical activity after school and on the weekend, and the presence of trees and signage regarding dogs were positively associated with adolescent girls' physical activity after school. While this study provides one of the few examinations of public open space features and children's physical activity, additional research is needed to better understand children's actual use of public open space and the quantity and quality of public open space features.

Author Affiliation: Timperio, Crawford, Andrianopoulos, Ball, Salmon, and Hume are with Deakin University in Australia. Giles-Corti is with the University of Western Australia.

Timperio, A., Giles-Corti, B., Crawford, D., Andrianopoulos, N., Ball, K., Salmon, J., et al. (2008). Features of public open spaces and physical activity among children: findings from the CLAN study. *Preventive Medicine, 47*(5), 514-518. This study may be available in a library near you or can be purchased online through the publisher at: www.elsevier.com/locate/amepre **(Volume 4)**

Neighborhood recreation facilities positively influence children's physical activity levels

Tucker and colleagues examined children's physical activity levels in relation to several neighborhood environmental factors and parents' perceptions of recreation opportunities. Over 800

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. He is with Brescia University College and Middlesex London Health Unit. Hess is with the University of Toronto in Canada.

Tucker, P., Irwin, J. D., Gilliland, J., He, M., Larsen, K., & Hess, P. (2009). Environmental influences on physical activity levels in youth. *Health & Place, 15*(1), 357-363. 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/30519/description#description **(Volume 4)**

Adolescents' local environments influence their physical activity and food consumption

Eating well and being physically active are important to good health and well-being. In this article, Tucker and colleagues review the impact of home, school, and neighborhood environments on adolescents' food behavior and physical activity, and investigate adolescents' perceptions of these environments. As part of this study, researchers interviewed 60 twelve- to fourteen-year-old adolescents in focus groups in London, Ontario, Canada. Tucker and colleagues analyzed the content of information discussed in each focus group to understand influences on participants' food consumption and physical activity. Researchers found that schools, nearby parks, and recreation facilities, as well as other structural opportunities around homes (e.g., yards and other kids) influenced adolescents' physical activity and served as both a facilitator and barrier to their physical activity. For example, the majority of adolescents reported using parks often, however, some participants commented on the small size of local parks, amount of garbage, and the lack of opportunities for older children. Tucker and colleagues also found that adolescents identified the availability of fast-food restaurants, convenience stores, and other restaurants as impacting their food consumption and that a number of participants identified the lack of healthy foods in their schools and neighborhoods. While this study may be limited due to its small sample size and reliance on volunteers, it offers important insight into the local environment's influence on adolescents' physical activity and food consumption.

Author Affiliation: Tucker is with the Middlesex-London Health Unit in Canada. Irwin and Gilliland are with the University of Western Ontario in Canada. He is with the University of Texas at San Antonio.

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 physical activity levels and the factors that most influence physical activity in this age group. In this paper, T. Hinkley and colleagues review 24 studies published between 1980 and 2007 that investigated factors related to physical activity levels in preschool children. The authors examined a total of 39 different variables, such as gender and time spent outdoors, and coded the results to identify consistency/inconsistency across studies. In the end, Hinkley and colleagues found support for the following findings: 1) boys are more active than girls, 2) a child's age and body mass index are not related to physical activity, 3) children who have parents that participate in physical activity with them are more active than children who have parents that do not participate with them in physical activity, and 4) children who spend more time outdoors are more active than children who spend less time outdoors. The authors also found that psychological, cognitive, emotional, and behavioral variables have not been studied enough to yield conclusive results with regard to their association to physical activity levels in preschool children. Hinkley and colleagues review the strengths and weaknesses of studies to date, compare their results to those found for older children and adolescents, and highlight future research needs in order to better understand the many factors that influence preschool children's physical activity.

Hinkley, T., Crawford, D., Salmon, J., Okely, A. D., & Hesketh, K. (2008). "Preschool children and physical activity - A review of correlates." *American Journal of Preventive Medicine, 34*(5), 435-441. This study may be available in a library near you or can be purchased online through the publisher at: http://www.elsevier.com **(Volume 3)**

Readers may also be interested in a 2000 review by Sallis and colleagues that summarizes research on correlates of physical activity behaviors in children and adolescents.

Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). "A review of correlates of physical activity of children and adolescents." *Medicine and Science in Sports and Exercise, 32*(5), 963-975. This study may be available in a library near you or can be purchased online through the publisher at: http://www.ms-se.com/

Neighborhood parks play an important role in promoting physical activity in children

Although the American Academy of Pediatrics has recommended that children be physically active for at least 60 minutes a day and limit sedentary activity to less than 2 hours a day, many children do not meet these recommendations. In this article, Victoria Floriani and Christine Kennedy review the latest research findings with regard to the promotion of physical activity in children. For example, the authors discuss a number of studies which have found that access to a neighborhood park or playground is associated with higher levels of physical activity in children and that specific park amenities, such as lighting after dark, may be important in facilitating park use. Floriani and Kennedy also summarize research on sedentary behavior and how evidence, while often inconclusive, indicates that the less time children spend in sedentary behaviors, the more physically active they may be. In addition, the authors highlight recent research exploring the relationship

between mental health and physical activity. While there is still much to be learned about this relationship, preliminary research has found a positive relationship between higher levels of physical activity and positive mental health outcomes, such as increased feelings of self-efficacy and confidence. Floriani and Kennedy conclude the article by encouraging pediatric health care providers to discuss physical activity with their patients and strategize with them on ways to incorporate activity into their daily lives.

Floriani, V., & Kennedy, C. (2008). "Promotion of physical activity in children." ***Current Opinion in Pediatrics, 20*****(1), 90-95.** This article is available online at: **http://www.parks.sfgov.org/wcm_recpark/SPTF/Floriani.pdf (Volume 4)**

Readers may also be interested in the following recent articles that investigate specific factors related to physical activity in children and adolescents.

Babey, S. H., Hastert, T. A., Yu, H. J., & Brown, E. R. (2008). Physical activity among adolescents – "When do parks matter?" ***American Journal of Preventive Medicine, 34*****(4), 345-348.** This study may be available in a library near you or can be purchased online through the publisher at: http://www.elsevier.com

de Vries, S. I., Bakker, I., van Mechelen, W., & Hopman-Rock, M. (2007). "Determinants of activity-friendly neighborhoods for children: Results from the SPACE study." ***American Journal of Health Promotion, 21*****(4), 312-316.** This study may be available in a library near you or can be purchased online through the publisher at: http://www.healthpromotionjournal.com/

Roemmich, J. N., Epstein, L. H., Raja, S., & Yin, L. (2007). "The neighborhood and home environments: Disparate relationships with physical activity and sedentary behaviors in youth." ***Annals of Behavioral Medicine, 33*****(1), 29-38.** This study may be available in a library near you or can be purchased online through the publisher at: http://www.springer.com/psychology/health+and+behavior/journal/12160

Many U.S. children are vitamin D deficient and this deficiency is associated with cardiovascular risk factors

Vitamin D is primarily produced in the skin after exposure to sunlight and is essential for calcium absorption and may be important to numerous other body processes. In this study, Kumar and colleagues investigated the prevalence of vitamin D deficiency among U.S. children and whether vitamin D deficiency is associated with cardiovascular risk factors. The researchers analyzed data for nearly 10,000 children from the 2001-2004 National Health and Nutrition Examination Survey (NHANES), a nationally representative survey of the U.S. population where participants were interviewed and given physical examinations. In analyzing the data, Kumar and colleagues found that 9% of 1- to 21-year-old children were vitamin D deficient, representing 7.6 million U.S. children, and 61% were vitamin D insufficient, representing 50.8 million U.S. children. In examining factors associated with vitamin D deficiency, researchers found that children who were older, female, non-Hispanic black or Mexican American, obese, drank milk less than once a week, did not take vitamin D supplements, and were engaged in more than 4 hours of screen time a day, were more likely to be vitamin D deficient. In addition, Kumar and colleagues found that vitamin D deficiency was associated with a number of cardiovascular risk factors, including higher systolic blood pressure and higher lipoprotein cholesterol, when compared to children without vitamin D deficiency. While this study may be limited due to its cross-sectional design, Kumar and colleagues' work using a large, nationally representative sample provides valuable information on an understudied topic.

Author Affiliation: Kumar, Kaskel, and Melamed are with the Albert Einstein College of Medicine in New York. Muntner is with the Mount Sinai School of Medicine in New York. Hailpern is with the Centers for Disease Control and Prevention.

Kumar, J., Muntner, P., Kaskel, F. J., Hailpern, S. M., & Melamed, M. L. (2009). Prevalence and associations of 25-Hydroxyvitamin D deficiency in US children: NHANES 2001-2004. *Pediatrics*(August 3). This study may be available in a library near you or can be purchased online through the publisher at: http://www.jpeds.com/ **(Volume 4)**

Readers may also be interested in the following related articles:
Reis, J. P., von Muhlen, D., Miller, E. R., Michos, E. D., & Appel, L. J. (2003). Vitamin D status and cardiometabolic risk factors in the United States adolescent population. *Pediatrics*(August 3).

Misra, M., Pacaud, D., Petryk, A., Collett-Solberg, P. F., & Kappy, M. (2008). Vitamin D deficiency in children and its management: Review of current knowledge and recommendations. *Pediatrics, 122*(2), 398-417.

Many children and adolescents are vitamin D deficient

Worldwide, there is a high prevalence of vitamin D deficiency among infants, children, and adolescents. Vitamin D deficiency is a risk factor for rickets and may be a risk factor for development of a number of chronic diseases, such as cardiovascular diseases and cancer. In this paper, S.Y. Huh and C.M. Gordon review the sources of vitamin D, which includes endogenous synthesis (the first step of which is the absorption of ultraviolet B radiation), how vitamin D deficiency is defined and measured, and the prevalence of and risk factors for vitamin D deficiency, which includes reduced sun exposure. In addition, the authors review the health effects of vitamin D deficiency and its prevention and treatment. Huh and Gorden stress the importance of additional research to determine the optimum concentration of vitamin D for children of different ages and to compare different regimens designed to prevent and treat vitamin D deficiency as well as to better understand short and long-term impacts on critical health outcomes.

Huh, S. Y., & Gordon, C. M. (2008). "Vitamin D deficiency in children and adolescents: Epidemiology, impact and treatment." *Reviews in Endocrine & Metabolic Disorders, 9*(2), 161-170. This study may be available in a library near you or can be purchased online through the publisher at:
http://www.springer.com/medicine/internal/journal/11154

Street trees may help prevent early childhood asthma

The prevalence of childhood asthma in the U.S. has increased dramatically in the past 20 years and is particularly high in poor urban communities. While the exact cause for this increase remains unknown, environment and lifestyle changes are believed to be possible contributors. Trees may help prevent asthma by changing local air quality or by encouraging children to play outdoors, exposing them to a variety of microbes. In this study, G.S. Lovasi and colleagues investigate whether there is an association between street trees and childhood asthma by examining data, grouped by specific hospital geographic areas, on the prevalence of asthma for 4-year-old and 5-year-old children, hospitalizations as a result of asthma for children younger than 15, number of street trees, census data, and proximity to pollution sources. In analyzing the data, the authors found that higher street density was associated with a lower prevalence of childhood asthma, but that there was not a significant association between street trees and hospitalizations. In their analysis, Lovasi and colleagues controlled for a number of other factors that may have influenced the results, such as proximity to pollution sources and sociodemographic characteristics. Based on these findings, the

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., drawing and reading), midworking distance (e.g., watching television and using the computer), and outdoor activities (e.g., bicycle riding and outdoor sport). After adjusting for a number of potentially confounding factors (e.g., parental myopia and ethnicity), Rose and colleagues found that while there was no association between the prevalence of myopia and activity among 6-year-olds that higher levels of total time spent outdoors were associated with a lower prevalence of myopia among 12-year-olds. The authors found that 12-year-olds with the highest levels of near work activity and lowest levels of outdoor activity were two to three times more likely than their peers to develop myopia, whereas 12-year-olds with the lowest levels of near work activity and highest levels of outdoor activity were less likely than their peers to develop myopia. The authors also found that participation in sports did not seem to be a significant factor in explaining this protective effect. Rose and colleagues suggest that light intensity may be an important factor in explaining the impact of outdoor activity on the development of myopia and that additional research is needed to help understand this relationship.

Rose, K. A., Morgan, I. G., Ip, J., Kifley, A., Huynh, S., Smith, W., et al. (2008). Outdoor activity reduces the prevalence of myopia in children. ***Ophthalmology, 115*****(8), 1279-1285.** This study may be available in a library near you or can be purchased online at: http://www.ajo.com/. **(Volume 3)**

Play in natural environments improves kindergarten children's motor abilities

Fjortoft examined the impact of kindergarten children's play environment on their motor development in Telemark, Norway. As part of this study, one kindergarten group, consisting of 46 children, was provided opportunities to play in a nearby 19 acre forest for one to two hours a day, while the other kindergarten group, consisting of 29 children from two kindergartens, continued to play on traditional playgrounds for one to two hours a day. Fjortoft conducted a pre-test of all children's motor fitness, followed by a 9 month observational period and post-test. With regard to children's motor abilities, she found that play in the natural environment improved all motor abilities except flexibility. In the comparison group, however, children's motor fitness improved in only 3 of

the 9 motor tests. When examining differences between the two groups, Fjortoft found the experimental group to be significantly better than the comparison group in terms of balance and coordination.

Fjortoft, I. (2004). Landscape as playscape: the effects of natural environments on children's play and motor development. *Children, Youth and Environments, 14*(2), 21-44. This article is available online at: http://www.colorado.edu/journals/cye/index_issues.htm.

Focus: Other Health Benefits

These articles highlight other health benefits from children's contact with the outdoors and/or nature, as well as benefits to children's development of life assets, such as attitudes and behaviors towards the environment.

Green School Gyms improve children's health

BTCV is a charitable organization in the United Kingdom that created Green Gyms to improve people's health and the environment. As part of Green Gyms, individuals participate in a range of conservation and gardening projects outdoors, such as planting trees and constructing footpaths. From 2007 to 2009, BTCV implemented Green Gyms in 9 primary schools. As part of these School Green Gyms, a weekly 1 to 1.5 hour session was provided for 10 weeks for groups of about 10 children at each school. During these sessions, children participated in environmental activities on their school grounds or nearby open spaces. BTCV commissioned a university to evaluate the School Green Gyms. As part of this evaluation, children completed a questionnaire before and after participation in the program. In analyzing the data, researchers found that children's psychosocial health and overall health significantly improved after the Green Gyms program. In addition, they found that children's weekend physical activity levels significantly increased after the program and that children felt very positive about the program. While the study data is based on self-reported information and it is difficult to separate the impact of the program activities from the outdoor context, this evaluation provides valuable information about the impact of an innovative program on children's health.

BTCV. (2009). Evaluation findings: health and social outcomes 2009. BTCV. This report is available online at: http://www2.btcv.org.uk/display/greengym_research **(Volume 4)**

Children benefit from appropriate risk-taking during outdoor play

Play is critical to children's healthy development. Little and Wyver examine outdoor play with a focus on early childhood education and urban Western culture. The authors review a number of social and environmental factors that have influenced children's outdoor play experiences in recent years (e.g., traffic, lack of space, other time demands, and parental fears). Little and Wyver discuss the importance of children's experience with risk to healthy development, including children's ability to develop and refine their motor skills and enjoy and gain confidence in being physically active. The authors also review literature related to the impacts of not providing children with opportunities to engage in challenging and risk-related experiences, including children's engagement in inappropriate risk-taking and underdevelopment of decision-making skills related to making sound risk judgments. Little and Wyver discuss the inability of many early childhood educators to provide challenging and stimulating outdoor experiences to children due to restrictive regulations and a cultural emphasis on

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)**

USDA
United States Department of Agriculture

URBAN NATURE FOR HUMAN HEALTH AND WELL-BEING

A research summary for communicating the health benefits of urban trees and green space

Forest Service FS-1096 February 2018

Introduction

Writers, philosophers, and naturalists have praised the benefits of nature for human health, happiness, and well-being for centuries, but only relatively recently have researchers begun studying and quantifying the complex relationship between human health and nature.

In 1984, Roger Ulrich, professor and director of the Center for Health Systems and Design at Texas A&M University, published the results of a pioneering study that looked at the recovery rates of gall bladder surgery patients in relation to the views from their rooms in a Texas hospital. Some of the patients looked out over a garden and grove of trees, while others had a view of a brick wall. Ulrich found that patients with a natural view spent fewer days in the hospital and used fewer pain medications (Ulrich 1984).

Ulrich's study helped open the door to a new field of inquiry focused on illuminating the ways that nature influences our physical, mental, and social lives. More than three decades later, a broad and diverse body of scientific literature describes the human health value of nature, confirming that trees, parks, gardens, and other natural settings are as essential to livable and sustainable cities as the other critical systems that keep their residents moving and working.

Findings from the current literature indicate the wide range of effects.

CONTENTS

For instance, studies show that–

- People living near parks and green space have less mental distress, are more physically active, and have extended life spans.
- Exposure to nature may impact human mortality from chronic disease.
- When people exercise outdoors in natural environments, they do so for longer periods of time and at greater intensities.
- Positive health effects are enhanced when green space includes the presence of water, or blue space.

There is also strong evidence that time spent in nature can improve the attention capacity of children with attention deficit disorders. Similarly, some research shows that inner-city children who grow up in public housing buildings with a view of nature have greater impulse control and are able to concentrate better and delay gratification longer.

This report summarizes some of the most prominent research related to nature and public health to help urban natural resource professionals, urban planners, architects, educators, health professionals, and community groups effectively communicate the health benefits of urban nature to their constituents.

Photo by: baona, iStockphoto.com

Hospital patients with nature views from their rooms spent fewer days in the hospital and used fewer pain medications.

Some may argue that the observational nature of much of the existing research limits its utility to influence practice and policy–that randomized clinical trials, the gold standard for evaluating health outcomes, are needed to prove a causal link between nature and certain health effects (see Box 1).

We provide this overview of the current literature to describe what we *do* know; which, taken as a whole, offers a compelling case for maintaining and expanding nature-based outdoor environments in cities and bringing people closer to nature. We describe limitations of this research, and we maintain that there are many opportunities to use this scientific knowledge to help improve individual and community health. The pace of nature-health research is expanding dramatically, and increased funding is supporting further study and new approaches to experimental design that will provide even more tangible evidence for the connection between the natural environment and human well-being.

Defining Nature and Health Research

Nature and health research is highly diverse in terms of the human populations studied, types of nature (e.g., tree canopy, parks, or green streets), landscape scales, and health outcomes. This report is organized into reviews of research conducted in five general health categories:

1. Pollution and physical health
2. Active living
3. Mental health
4. Stress reduction
5. Social health, cohesion, and resilience

Engaging with nature can bring about multiple health effects that occur simultaneously and across short or long periods of time. When people exercise in a natural setting, for example, they experience the physical health benefits of active living, while also reducing stress and perhaps alleviating anxiety. They might exercise with family or interact with neighbors along the way, receiving the added health benefits of social connection. They might have a partly negative experience if their asthma or allergy symptoms are exacerbated while out on a day with a particularly high pollen count. In most cases, researchers recognize the multiple connections or associations and acknowledge the difficulty of establishing definitive causal relationships between nature and health. In this report, we categorize each study according to its primary theme to help the nontechnical reader use the information to communicate key findings.

Studies and publications within the nature and health literature contain a range of terminology–nature, parks, gardens, green space, open space, green infrastructure, urban forests, urban ecosystems, metro nature, nearby nature, and other terms–related to the different features and processes that compose the natural environment. In

BOX 1. Studying Health and Nature: Scientific Approaches

Investigative approaches to understanding the connections between human health and nature have evolved over time and are continually being updated, in part due to a desire to move from observational studies to experiments that quantitatively measures relationships between nature and health outcomes—how nature directly and measurably improves public health.

Much of the prevailing social science research has been descriptive, or qualitative, because personal connections to nature are not readily expressed numerically. Early research described responses from people about nature preferences, perceptions, mood, satisfaction with place or neighborhood, and potential behavior. More recent quantitative or measured "nature and health" findings are largely correlational. They confirm a relationship between nature experience and measured health outcomes, but they don't answer a key question—*why do we see such responses*?

Understanding underlying causal mechanisms requires experimental studies where we have a control group (not exposed to nature) and an experimental group (exposed to nature) living under similar conditions and then monitoring health responses over a long period of time. As you can imagine, this can bring up many complex issues such as exposing individuals purposefully to potential unhealthy situations. Setting up a large-scale study and controlling for the variability in human populations can be difficult and costly. Nonetheless, the limited number of quantitative studies that have been conducted have demonstrated significant effects on human health and well-being (Faber Taylor and Kuo 2009, Faber Taylor and others 2001b, Li and Sullivan 2016).

New interdisciplinary research collaborations among the environmental, medical, and public health fields are providing opportunities for experimental science. In Louisville, KY, for example, the Nature Conservancy has teamed with the University of Louisville School of Medicine, Division of Cardiology to conduct the Louisville Green Heart Study. The Conservancy will work with communities to plant trees and other vegetation while university researchers will conduct a longitudinal study to determine the health effects of the neighborhood greening (The Nature Conservancy 2016).

Similarly, advances in technology and the availability of open data sources have enabled correlation or relationships analysis that combines vegetation data layers, urban land use maps, and large-scale health data sets—such as county-level health records or large population health surveys—to examine how changes in vegetation may influence human health.

What's next? Some of the most interesting contemporary research is probing neuroscience, endocrine, and physiological responses to nature exposure. A significant set of questions that are now queued up by the science community concern dosage—how much nature, how often, what kind; and does any of this vary for people across the human lifecycle?

Most of the research reported here explores health outcomes from visual stimulus; scientific investigations are now exploring the influence of other sensory inputs—sound, smell, ambient temperature, and body sensation—on health response. And while less prominent across the decades, qualitative studies of place, meaning, and social interactions continue to reveal human's need to connect with nature for our health and wellness.

Photo by: Dawel5957, iStockphoto.com

The interdisciplinary Green Heart Study in Louisville, KY, is looking at the effects of neighborhood greening.

most cases, the location and scale of the research study defines the terminology used. Some studies may use remote sensing data to provide measures of natural land cover and human land use features over cities, regions, or countries. Others focus on proximity to a park, the presence of trees lining streets, or even potted plants in office environments. Throughout this publication, we try to maintain the terminology used by the researchers in the referenced study.

There are limitations to the research presented here. A large number of studies described in this review have been replicated multiple times with consistent findings. Other studies are singular, showing interesting results that should not be generalized beyond the specific population, location, and scale of the study. It is important to interpret research findings within their original scope and context.

Pollution and Physical Health

Urban trees and other natural systems provide a range of physical health benefits. Trees can improve air and water quality, mitigate the heat island effect, and help alleviate noise (Nowak and others 2010). Trees can shield people from ultraviolet (UV) radiation, the cause or contributing factor for three types of skin cancer (Nowak and Heisler 2010). Urban ecosystems are increasingly recommended by national and State environmental protection agencies to mitigate the harmful impacts of air and water pollutants, harmful emissions, and the negative effects of urban heat and noise (Wolf and Robbins 2015).

Air Quality

Particulate matter, sulphur dioxide, ground-level ozone, nitrogen dioxide, and carbon monoxide are common air pollutants. Excess air pollution can lead to airway inflammation and reduced lung function. Pollution can also worsen health problems such as asthma, chronic obstructive pulmonary disease, and cardiovascular disease (Shah and Balkhair 2011). Trees and vegetation in parks can help reduce air pollution directly by removing pollutants and reducing air temperature, both of which contribute to smog, and indirectly by reducing energy needs for cooling in surrounding buildings and associated pollutant emissions from power plants (Nowak and Heisler 2010).

The effect of vegetation on urban air quality depends on the vegetation itself, its position on the site, and overall landscape design, as well as the level of air pollution in the area. Since pollution is more concentrated at the source, vegetation should be planted close to the source. A recent review determined that vegetation should preferably be low and/or close to roads to reduce sediment and dust, for example (Janhäll 2015). The review also found that vegetation should be dense but allow airflow to pass through to increase deposition of coarse and ultra-fine particles on leaves; vegetation with "hairy" leaves and a large leaf area were ideal (Janhäll 2015). In a study conducted in Norway and Poland, species such as Scotch pine (*Pinus sylvestris*), Yew (*Taxus media*) and Silver birch (*Betula pendula*) were efficient species in capturing ultrafine particulate matter (Saebo and others 2012).

Vegetation can also *increase* pollutants by emitting volatile organic compounds (VOCs) that can contribute to ozone and carbon monoxide formation. VOC emissions are temperature dependent. Because trees generally lower air temperatures, increased tree cover can lower overall VOC emissions and subsequent ozone levels in urban areas (Nowak 2002). VOC emissions vary by species. Researchers with the U.S. Department of Agriculture, Forest Service have identified nine genera that have the highest emission rates: beefwood (*Casuarina* spp.), *Eucalyptus* spp., sweetgum (*Liquidambar* spp.), black gum (*Nyssa* spp.), sycamore (*Platanus* spp.), poplar (*Populus* spp.), oak (*Quercus* spp.), black locust (*Robinia* spp.), and willow (*Salix* spp.) (Nowak 2002). However, due to the high degree of uncertainty in atmospheric modeling, it is not clear whether ozone formation from VOC emissions for these species is greater than ozone removal or prevention.

Street trees in particular can trap pollutants beneath their canopies or act as a barrier to the natural flow of air through the built environment of cities (Whitlow and others 2011). A number of researchers from Cornell University are developing models to guide the design and layout of tree plantings in urban settings. A recent paper published by the researchers recommends planting trees near solid barriers to reduce downwind pollutant concentrations and using wide vegetation barriers with trees of high leaf area density (Tong and others 2016).

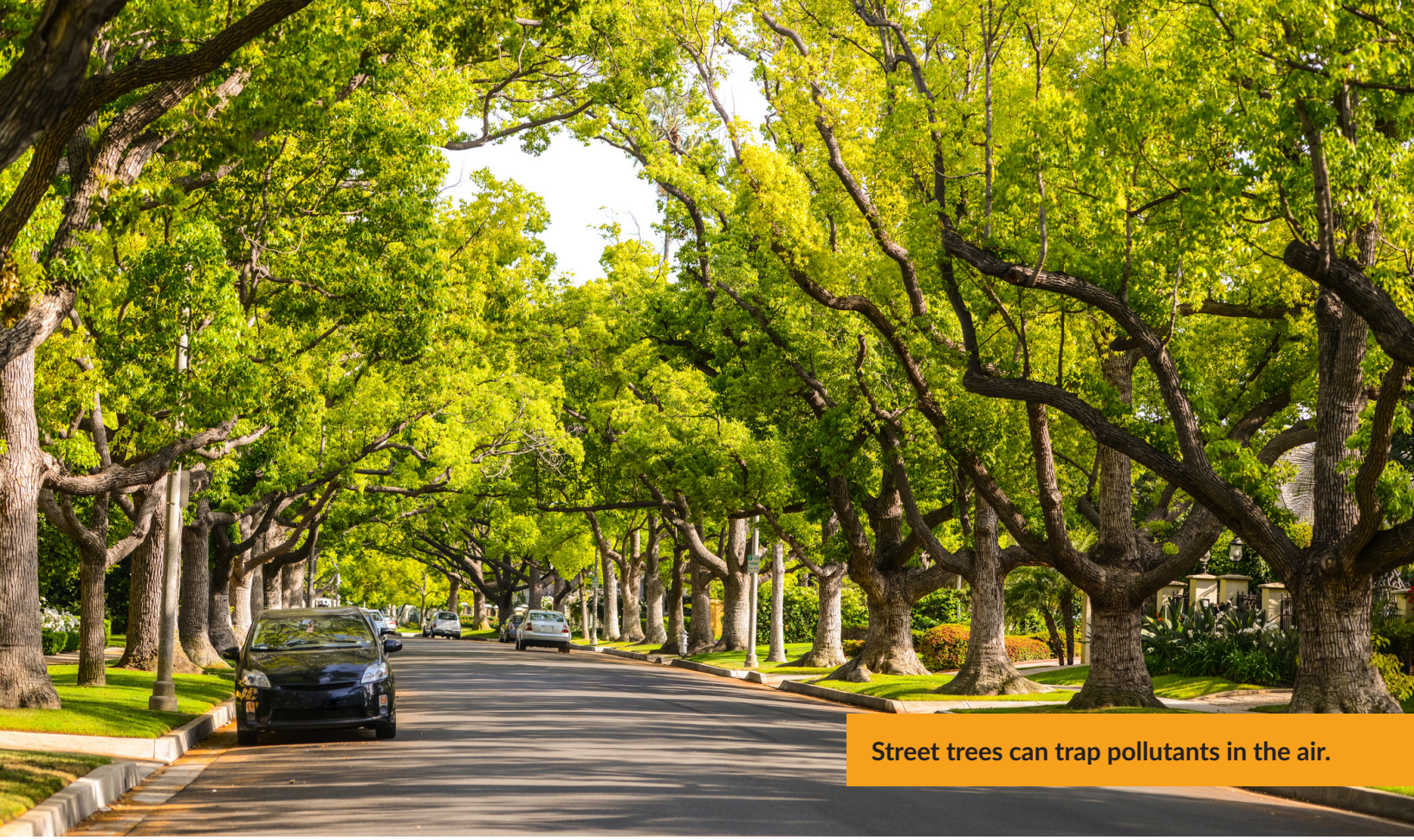
Air quality benefits provided by green space are particularly relevant for human health due to the relationship between air pollution and respiratory illnesses. Nowak and others (2014) found that in 2010, trees removed 17.4 million tons of air pollution across the United States, which prevented 850 human deaths and 670,000 cases of acute respiratory symptoms.

An important issue in urban forestry is the selection and distribution of trees for low allergy impact. Male pollen-producing trees are often planted to minimize unwanted fruit fall. Tree diversity in an urban area is often desired, as concentrations of one species can create heavy pollen source areas (Cariñanos and Casares-Porcel 2011).

Urban Heat

While the relationship between urban green space and air pollution is complex and less certain (Tong and others 2016, Whitlow and others 2011), the cooling effects of green space are more direct and easily measured.

Cities are generally warmer than surrounding agricultural and forested areas due to the dominance of impervious surfaces and energy-absorbing materials, a phenomenon often described as the urban heat island effect. Heat has direct effects on human health, with consistent associations found between increased daily



Street trees can trap pollutants in the air.

Photo by: anouchka, iStockphoto.com

temperatures and increased heat-related deaths, illnesses, and hospitalizations, particularly during extreme heat periods in summer (Vutcovici and others 2014). Children and the elderly are particularly vulnerable. Heat-related illnesses range from mild symptoms of fatigue and heat-stroke to the worsening of preexisting illnesses, hypotension, and death (Harlan and others 2006).

In Phoenix, AZ, heat regularly reaches dangerous levels, making the cooling effects of green space a valuable service. In addition, researchers found that lower socioeconomic and ethnic minority groups in Phoenix were more likely to live in warmer neighborhoods with greater exposure to heat stress (Harlan and others 2006). High settlement density, sparse vegetation, and a lack of green space were significantly correlated with higher temperatures (Harlan and others 2006).

Urban trees are particularly vital for reducing heat stress and decreasing the size and effect of the urban heat island (Zupancic and others 2015). Trees have the unique ability to provide micro-cooling through evapotranspiration, as well as relief from heat stress through shade. Both small and large areas of green space can provide cool islands within cities. Geographic location and the type of available vegetation can also influence the extent that green spaces mitigate the urban heat island effect. For example, green spaces that are connected and closely spaced can improve the flow of cool air through the city (Zupancic and others 2015).

Additional studies have found that urban forests and green roofs can help reduce urban heat island effects (Takebayashi and Moriyama 2007). A recent review (Zupancic and others 2015) examined various types and scales of green space and found that green space can provide cooler air at the park, neighborhood, and city level. Every 10 percent increase in overall urban tree canopy generates a 2 °F (0.6 °C) reduction in ambient heat (Wolf 2008a).

A study of air temperature across the city of Baltimore, MD, looked at air temperature differences in relation to parks and other green space (Heisler and others 2007). When researchers compared temperature points, they found that the center of the city was consistently the warmest, while parks were generally cooler than surrounding areas. Patapsco Valley State Park, which is heavily forested (68 percent tree cover), was the "coolest" of the Baltimore parks, 13 °F (7.2 °C) cooler in the evening and about 5 °F (2.8 °C) cooler in daytime relative to the warm inner city.

Studies show that park temperatures are strongly influenced by the park's vegetation and surrounding land cover,

but also that parks can influence nearby temperatures, sometimes for a distance as great as the diameter of the park (Nowak and Heisler 2010).

Human Mortality

The research community is studying the connection between nature and human mortality, but it is still difficult to draw a causal link. A number of studies describe lack of access to nature and associations with disease, such as cardiovascular disease, and high mortality rates.

A relationship between trees and human health is demonstrated dramatically by the loss of ash trees, many formerly lining city streets, to emerald ash borer. The emerald ash borer, an exotic beetle, was first detected in 2002 in Canton, MI, and then rapidly spread across the Midwest and into Canada. The pest then began to appear in more distant locations as infested trees were unknowingly shipped as firewood. Within 4 years of detection, over 100 million ash trees died. Their disappearance meant that many parks and neighborhoods, once tree-lined, were now bare.

This widespread tree mortality served as a natural experiment. Researchers looking at human health statistics for counties affected by the emerald ash borer found increased human mortality rates, with a large spike in people dying of cardiovascular and lower respiratory tract illness (Donovan and others 2013). Even after controlling for many socioeconomic factors, such as income and education, the analysis showed the same pattern across counties with very different demographic makeups. While the researchers were not able to explain the cause of the association, they demonstrated that the relationship between trees and human health was undeniably strong.

Active Living

While super-sized sodas, junk food, and all-you-can-eat buffets are often blamed for the obesity epidemic in the United States, another key culprit is a steep decline in the level of physical activity. People in the United States are consuming the same level of daily calories as they did in the late 1980s, but are burning fewer calories in exercise, work, or play. Between 1988 and 2010, the percentage of women who reported not engaging in regular physical activity rose from 19 percent to 52 percent. For men, the number increased from 11 percent to 43 percent (Ladabaum and others 2014).

Fewer people walk or bike to work. Many jobs themselves have become increasingly sedentary. Jobs demanding moderate physical activity, which accounted for 50 percent of all jobs in 1960, have plummeted to just 20 percent (Church and others 2011). Kids are playing outdoors less, and fewer are signing up for team sports (Physical Activity Council 2016). Kids and adults are both spending a great deal of time sitting at school and work and at home in front of screens—televisions, computers, and mobile devices (Rideout and others 2010).

Photo by: DeanDrobot, iStockphoto.com

Fewer people bike to work than in the past.

One result of inactivity is a marked increase in obesity. Rates of childhood obesity have tripled (12–19 years old) or quadrupled (6–11 years old) since the early 1970s, and those of adults have more than doubled (USDA 2010). Obesity places people at increased risk of multiple chronic diseases and conditions: high blood pressure, high cholesterol, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, cancer, and mental illness. The rise in long-term chronic diseases related to obesity results in billions of dollars per year in medical costs and lost productivity (Center for Disease Control and Prevention 2016).

The shift to a sedentary lifestyle has been rapid and costly. Though it's been shown that changes in diet can help, daily moderate activity is key to controlling weight gain. Even 30 minutes of brisk walking 5 days a week can significantly reduce health risks (U.S. Department of Health and Human Services 2008). However, 51 percent of U.S. adults are not meeting the minimum guidelines for aerobic physical activity, and 26 percent are not active at all (Center for Disease Control and Prevention 2015).

The availabity of nearby parks can encourage physical activity.

Photo by: BraunS, iStockphoto.com

Research confirms that the availability of parks, trails, and nature can positively affect attitudes toward being active and encourage physical activity (Wolf 2008b), and shows that when people exercise in natural environments, they do so for longer and at greater intensities (Kerr and others 2012). The following sections provide more information about the beneficial relationships between nature and active living and the features of outdoor environments that promote activity.

Benefits of Physical Activity

While it's widely accepted that physical activity is good for physiological and psychological well-being, different environments influence levels and duration of physical activity differently. People who use parks and open spaces are three times more likely to achieve recommended levels of physical activity than non-users (Giles-Corti and others 2005), and people who exercise outdoors tend to do so for longer periods and more energetically than those who solely exercise indoors (Ceci and Hassmen 1991, Focht 2009).

In one study, a 15-minute stroll through the woods increased participants' attention, positive emotions, "connectedness" to nature, and ability to reflect on a life problem more constructively than a walk through an urban setting did for other participants (Mayer and others 2009).

In a similar study, participants with serious depression received significant cognitive benefits and improvements in mood after a 50-minute walk in a natural setting relative to one in an urban setting (Berman and others 2012).

One of the primary symptoms of depression is rumination, or repetitive thoughts focused on negative features of the self (Bratman and others 2015). Participants who took a 90-minute nature walk reported having less rumination and exhibited decreased neural activity in a part of the brain linked with sadness and self-reflection. These findings led the researchers to recommend investment in access to natural environments in order to improve the "mental capital" of cities and nations (Bratman and others 2015).

Researchers have also started addressing the question of nature "dosage" (Barton and Pretty 2010, Shanahan and others 2015). What types and amounts of nature exposure provide the most benefits? How much is enough? Shanahan and others (2015) have proposed that the nature–health research community consider measuring the quality and quantity (i.e., the intensity) and the frequency and duration of the nature experience, and determine how each of these aspects of the nature dose are likely to be linked to different health outcomes. They propose that future research generate quantifiable nature-based health recommendations.

Features that Promote Physical Activity

We assume that physical activity in outdoor environments is good for physical and psychological health, but that assumption raises a number of other questions. Does the mere presence of nature or green space encourage people to be active? Are there particular features or nature designs that prompt outdoor play or that are better suited to active users? Fortunately, researchers are beginning to address these questions.

Transportation systems in most contemporary cities and towns focus on efficiently moving automobiles, with little consideration of pedestrians, bicyclists, or public transportation. Today, less than 3 percent (2.8 percent) of the U.S. population commutes to work by walking, as opposed to 9.9 percent in 1960, and less than 1 percent (0.5 percent) arrives at work on a bicycle (McKenzie 2014). These trends are directly related to the obesity epidemic and lack of physical activity in the United States (Wells and others 2007).

While it may seem intuitive that the availability of green space promotes "active transport" (walking and/or biking as a means of transportation) by making routes to destinations more attractive, the evidence is actually mixed. When it comes to commuting, distance to destination, availability of suitable infrastructure (e.g., sidewalks, bicycle lanes), and safety are more important factors than green space (Heinen and others 2010).

For example, bicycle commuters in Belgium prefer paths that are separated from traffic by vegetation barriers, bioswales, or a shoulder (Ghekiere and others 2014). The same study concluded that parents were more likely to allow children to commute to school by bicycle if the path was separated from the road.

Does the mere availability of parks and green space promote physical activity? Again, the results are mixed. While a number of studies have linked higher levels of physical activity with green space access (Sugiyama and others 2008), other studies have failed to find a significant relationship (Foster and others 2009, Mytton and others 2012). It is difficult to establish a direct link between levels of physical activity and the mere availability of green space (Lee and Maheswaran 2011). It is not a simple case of "build it and they will come."

Other factors may be more important in people's decisions regarding whether to use a given park, trail, or green space for physical activity, such as the presence of infrastructure and amenities, attractiveness, organized park programming (such as group hikes or exercise classes) and maintenance of the grounds, accessibility, and safety (Cohen and others 2009, Owen 2004) (see table 1).

A survey of 1,148 adults living in the U.S. South found that the number of adults who met physical activity guidelines was 15 percent higher in neighborhoods with sidewalks (Reed and others 2006). Similarly, an Atlanta study combining a Geographic Information System land-use study with digital motion trackers found that 37 percent of adults living in high walkability neighborhoods were likely to meet physical activity guidelines, compared to 18 percent of those living in low walkability neighborhoods (Frank and others 2005).

Table 1. Positive Factors for Physical Activity

Physical Environment
Higher population density (city core rather than suburbs); higher housing density
Mix of land uses (such as residential and retail)
Street design with more connectivity
Accessible public transit
Walking and biking infrastructure (such as sidewalks and bike lanes)
Psycho-Social Environment
Safety from crime
Safety from traffic
Absence of social disorder
Aesthetics (including trees and landscape)
Educational campaigns (such as Walk-to-School programs)
Incentive programs (such as workplace reimbursement for transit use)
Park programming (such as exercise classes, group hikes)

Source: Wolf (2008b), Cohen and others (2009).

Perceived safety is an important characteristic and precondition for the use of green space for physical activity (Jansson and others 2013). For children, the safety of the environment as perceived by their parents is a crucial factor in use of a given park or facility (Ferdinand and others 2012).

One component of safety is crime. Research on the relationship between crime and the presence of vegetation indicates that the presence of trees and grass around residences results in less crime than in more barren residential areas (Donovan and Prestemon 2012; Kuo and Sullivan

Residents of easily walkable neighborhoods are more likely to meet physical activity guidelines.

Photo by: jhorrock, iStockphoto.com

2001a, 2001b; Troy and others 2016). In a study covering a rural-urban gradient in and around Baltimore, Troy and others (2011) found that a 10-percent increase in tree canopy was associated with a roughly 12-percent decrease in crime. Kondo and others (2015) examined Philadelphia crime statistics relative to roadside gray areas that had been upgraded with vegetation for mitigating stormwater runoff. They found a significant reduction (18–27 percent) in reports of narcotics possession in areas around the green improvements, compared to an increase of 65 percent across the city during the same period.

Despite the evidence from research, there is a public perception that vegetation provides a screen for criminals to hide behind or conceal their activities. A series of studies on a university campus in the 1990s concluded that areas with more places for concealment or hiding, such as those with more vegetation, elicited more fear and stress responses, and less feelings of safety (Nasar and Jones 1997, Nasar and others 1993). Thus, while the data may generally show less crime in greener areas, the perception of a lack of safety may counteract the actual situation, and undermine the attractiveness of a park or trail for physical activity (Maas and others 2009a).

Crime Prevention through Environmental Design best practices can include urban greening to create more defensible, safer outdoor spaces (Cisneros 1995). Visibility is a key factor in how users rate green space safety (Kaplan and Talbot 1988). Areas with larger trees and more open space are generally deemed safer than areas with dense vegetation, small trees, and large shrubs (Koskela and Pain 2000). Greater openness is perceived as less dangerous. Managers may want to consider public safety perceptions when designing and maintaining urban parks, green space, and trails in order to create more welcoming, well-used spaces that deter crime and create safer and more active communities. A recent study on neighborhood crime in Baltimore supports intentional landscape design and maintenance and provides preliminary best practices for deterring criminals. The presence of yard trees, garden hoses, and well-maintained lawns, for example, as well as pruned shrubs and vegetation, are “cues to care” that can reduce crime (Troy and others 2016).

Mental Health

Frederick Law Olmsted, the designer of New York City's Central Park, wrote extensively about the mental health benefits of contact with nature. As early as 1865, he declared that time in nature provided "relief from ordinary cares, change of air and change of habits" and "increases the subsequent capacity for happiness and the means of securing happiness" (Olmstead 1865 [1952]). While Olmstead's claims were based on personal observation and intuition, research is now proving the statement highly insightful.

Researchers are finding that time spent in nature provides a wealth of mental benefits, from increased cognitive performance and well-being (being at your best) to alleviation of mental health illnesses such as depression, attention deficit disorders, and Alzheimer's. In this section we describe some of this research and how green space and parks can be designed and utilized for mental health.

General Mental Health and Happiness

Researchers at the University of Exeter surveyed 10,000 urban residents in the United Kingdom, asking them how satisfied they were with their lives and whether they had signs of depression, anxiety, or other psychological disorders. After controlling for other factors known to significantly influence well-being such as income, employment, marital status, health, and housing, they found that as green space increased within a 2.5-mile radius of residents' homes, overall well-being received a boost as well (White and others 2013). One of the researchers explained the relationship this way: "We know that getting married, for example, decreases depression and increases life satisfaction. And also getting a job when you are unemployed decreases stress and increases life satisfaction. How big were our effects relative to that? Moving from an area of little green space to an area of quite a lot of green space was about a third of the effect of getting married and about a tenth of the effect of moving from unemployed to employed" (University of Exeter 2016).

In an analysis of a public health survey of 11,200 adults, Danish researchers found a 42-percent increase in self-reported stress levels among individuals living more than 1 kilometer (km) away from green space (or blue space at lakes and beaches), and those residing beyond the 1-km range also had the worst scores on other dimensions of general health, vitality, mental health, and bodily pain (Stigsdotter and others 2010).

Cognitive Function and Mental Fatigue

The demands of modern life can often be mentally exhausting. Focusing attention on flows of information and tasks, screening out distractions, and responding to the constant stimuli of commuting, work, school, and family leaves many people feeling drained, with memory loss and reduced capacity for sustained attention (Berto and others 2010). Rachel and Stephen Kaplan's Attention Restoration Theory (ART) suggests that we can use nature to restore depleted cognitive functions and maintain performance (Kaplan 1993, 1995).

ART proposes that our brains switch between two different attention systems, directed and involuntary. Directed attention is what people use at the workplace to solve problems and focus on tasks, all the while negotiating the surrounding distractions that typify many offices or workplace environments. Directed attention also leads to mental fatigue, which is that "drained" feeling that affects our cognitive performance.

Involuntary attention, also called soft fascination, is what our brain uses when our attention is captured by something stimulating or intriguing. Involuntary attention does not require intense focus and involves effortless reflection. ART proposes that this is the type of attention people use in natural environments, which serve as places for mental restoration, as they enable the directed attention system to recover from fatigue.

Photo by: dolphinphoto, iStockphoto.com

The designer of New York City's Central Park (shown here), Frederick Olmstead, wrote extensively about the benefits of regular contact with nature.

ART has been subjected to a number of experiments that appear to support its basic principles (Berman and others 2008, Li and Sullivan 2016, Pilotti and others 2015). In one study, researchers gave participants a tough memory and

attention test. Participants were then assigned to take a 50- to 55-minute walk through either the Ann Arbor Arboretum or downtown Ann Arbor, MI. When the participants returned to the lab and took the test again, the arboretum group scored significantly higher (Berman and others 2008). According to the authors, the results demonstrate the valuable mental benefits provided by time in nature: "Simple and brief interactions with nature can produce marked increases in cognitive control. To consider the availability of nature as merely an amenity fails to recognize the vital importance of nature in effective cognitive functioning."

Photo by: Halfpoint, iStockphoto.com

Walks in nature can improve cognitive brain function.

Most people may not have time to go for a 50-minute walk during the middle of their workday, or have access to a world-class park such as the Ann Arbor Arboretum. However, less immersive contact with nature can provide some of the same benefits. Even brief "nature breaks" can improve brain performance by providing a cognitive reprieve from the complex demands of modern life (Bratman and others 2015, Mantler and Logan 2015, Shibata and Suzuki 2002).

In another study, environmental psychologists in Australia gave test subjects an attention and memory task. In the middle of the test, participants got a 40-second break, during which they looked at simulated external views: some looked at a simulated view of a concrete roof, while others looked at a "green roof" that resembled a flowering meadow (Lee and others 2015). The participants who looked at the green roof performed significantly better on the second half of the test than the others. In a study in Norway, participants who sat at a desk with plants performed better on a memory and attention test than those who sat at an empty desk with no natural stimuli (Raanaas and others 2011). In the case of offices and schools, the addition of natural features could significantly improve attention and content retention rates.

Mental Illness

Contact with nature can also provide relief, and perhaps healing, for those who suffer from short-term and chronic mental illness (Berman and others 2012), including depression, anxiety, and mood disorders.

Public health researchers from the University of Canterbury in New Zealand compared neighborhood green space across Auckland with the New Zealand Ministry of Health Tracker database for treatment of anxiety and mood disorders in the area. Socioeconomic differences between neighborhoods were addressed using a measure of "socioeconomic deprivation" from the New Zealand census (Nutsford and others 2013). The connections were clear. Every 1-percent increase in the proportion of usable or total green space resulted in a 4-percent lower rate of anxiety/mood disorder treatment, and a 3-percent lower treatment rate for every 100-meter decrease in distance to the nearest usable green space.

A population-level study (2,479 individuals) along a rural to urban gradient in Wisconsin compared mental health outcomes with a vegetation index and percentage of tree canopy coverage (Beyer and others 2014). After controlling for a wide variety of socioeconomic factors, the authors identified a strong association between better mental health among both urban and rural residents in areas with more green space. Higher levels of neighborhood green space were associated with significantly lower levels of symptoms for depression, anxiety, and stress. The researchers suggested that, "greening could be a mental health improvement strategy in the United States."

In a series of Dutch studies, researchers found a connection between neighborhood greenness (typically within 1–3 km from a residence), self-reported general health, and a lowered risk of physician-diagnosed diseases. Individuals with small amounts of green space (10 percent) within 1 km of their home had a 25-percent greater risk of depression and a 30-percent greater risk of anxiety disorders in comparison to those with large amounts of green space (90 percent) close to their home (Maas and others 2006, Maas and others 2009c). Interestingly, the relation was stronger for children and people with a lower socioeconomic status, defined according to education level and work status (the researchers did not have access to data on income).

Children and Mental Health

In recent decades, the growing popularity of digital media and technology has changed the relationship between people and nature. For children, more time interacting with digital devices means less time outdoors, less time spent in free play, and less real, first-hand experiences with nature. Books such as *Last Child in the Woods* by Richard Louv have increased awareness of this issue (Louv 2005). Research concludes that our growing disconnect with nature has real and lasting effects; however, it also shows the restorative effects of even limited contact with nature for both children and adults in attention restoration and managing symptoms of attention deficit disorders (Berman and others 2008).

The ability to harness self-discipline, delay gratification, and control impulses has been linked to a range of positive outcomes for kids, including academic success and physical and psychological health. Teenagers who lack impulse control and self-discipline may be at greater risk for delinquency, pregnancy, and drug use (Faber Taylor and others 2001a). Some studies show that contact with nature can help increase self-discipline. Researchers from the Human-Environment Research Laboratory at the University of Illinois, Urbana-Champaign, studied 169 boys and girls who lived in identical, high-rise buildings in an inner city with varying levels of nature nearby. They found that the more natural the view from a participant's home, the higher the participant scored on tests of concentration, impulse inhibition, and delayed gratification (Faber Taylor and others 2001b). The researchers provided this compelling thought: "Perhaps when housing managers and city officials decide to cut budgets for landscaping in inner city areas, they deprive children of more than just an attractive view."

Additional studies from the Human-Environment Research Laboratory at the University of Illinois, Urbana-Champaign, conducted over the past decade revealed strong evidence of nature's benefits for children affected by Attention Deficit Disorder (ADD) and Attention Deficit Hyperactivity Disorder (ADHD) (Faber Taylor and Kuo 2009, Kuo and Faber Taylor 2004). Of note is a study they did that engaged children with ADHD in walks in several different environments. The children who walked in a park showed more improvements in attention after walking in a park than those who took walks in downtown or neighborhood settings. The effect was comparable to those reported for common pharmaceutical therapies for ADHD (Faber Taylor and Kuo 2009). "'Doses of nature' might serve as a safe, inexpensive, widely accessible new tool in the tool kit for managing ADHD symptoms," the researchers concluded.

Photo by: mkovalevskaya, iStockphoto.com

Children are increasingly disconnected with the outdoors.

Children and Academic Success

Nature may also play a role in academic success. Researchers linked remote sensing measures of vegetation cover around 905 elementary schools in Massachusetts with the results of standardized tests. They found that the presence of more trees and vegetation was associated with higher scores on standardized tests (Wu and others 2014). Adjusting their analysis to account for income, researchers found higher scores of children from both low- and high-income areas were correlated with increased vegetation cover.

Another study in Michigan found, after controlling for student socioeconomic status and racial/ethnic makeup, building age, and size of school enrollment, that views from cafeterias and classroom windows with greater quantities of trees and shrub cover were positively associated with elevated standardized test scores, graduation rates, and percentages of students planning to attend a 4-year college, as well as fewer occurrences of criminal behavior (Matsuoka 2010). Li and Sullivan (2016) found classroom views of green landscapes were related to significantly better performance on tests of attention and led to students' more rapid recovery from stressful experiences.

Landscape Design for Mental Health

The "savannah hypothesis" argues that people prefer open landscapes with scattered trees, similar to the African landscapes in which humans evolved (Heerwagen and Orians 1993). New work supports the idea that the psychological benefits of green space are linked to plant species diversity (Williams and Cary 2002). For example, people who spent time in a park with greater plant species

richness scored higher on various measures of psychological well-being than participants who spent time in less biodiverse parks (Fuller and others 2007). The authors suggest that parks and green space should provide a mosaic of habitat patches to support both biodiversity and the well-being of human populations.

Stress Reduction

Stress has become a constant in people's everyday lives—work demands, financial strains, and family pressures. The cumulative effect of chronic stress can have serious health consequences over time, including depression, anxiety, heart disease, high blood pressure, chronic pain, and type 2 diabetes (Collingwood 2013). Researchers in Japan are discovering that surrounding oneself with nature can be one of the most powerful stress relievers available. In fact the practice of "forest bathing" has become a popular way to unwind in Japan and elsewhere (see Box 2).

Getting outside typically involves at least a little exercise, and exercise is a proven mood booster (Aspinall and others 2013, Barton and Pretty 2010). Also, being outside means people are more likely to encounter neighbors and friends, and social contact is another way to reduce stress (Heinrichs and others 2003). Views of natural scenes can effectively reduce stress (Kahn and others 2008), and this is particularly true if initial stress levels are high (Roe and others 2013).

BOX 2. Forest Bathing

Shinrin-yoku is the name given to the Japanese art of "forest bathing." Forest bathing typically involves meditative walks through the woods with the objective of reconnecting with nature, decreasing stress, elevating natural moods, and strengthening the immune system. Forest bathing is rooted in Shinto and Buddhist practices that promote the experience of nature through all five senses. Forest bathers spend time touching and smelling leaves, bark, and flowers. Some even bring essential oils along to enhance smells. Meditation is often part of the experience as well. The practice originated in Japan in the early 1980s when it was endorsed by the Forest Agency of Japan and has since been gaining ground in the United States and other locations around the world.

Since 2004, Yoshifumi Miyazaki, director of the Centre for Environment Health and Field Sciences at Chiba University in Japan, has taken more than 600 research subjects into the woods for monitored forest bathing trips. He and his colleagues have found that forest walks, compared with urban walks, yield a 12.4-percent decrease in the stress hormone cortisol, a 7-percent decrease in sympathetic nerve activity, a 1.4-percent decrease in blood pressure, and a 5.8-percent decrease in heart rate (Lee and others 2009, 2011). On subjective tests, study participants also report better moods and lower anxiety. The lower concentrations of cortisol are a direct indicator of less stress. Overexposure to cortisol and other stress hormones has been linked to increased anxiety, depression, heart disease, weight gain, and focus and concentration difficulties. Overall, forest bathing appears to have significant stress-reduction benefits.

Photo by: Smileu, iStockphoto.com

Forest bathing can help decrease stress, blood pressure, and heart rate.

Stress recovery theory (SRT) is based on empirical studies that demonstrated immediate positive and physical responses to natural settings or even views of nature (Ulrich 1983). When a person is stressed, views of nature can reduce blood pressure, muscle tension, and pulse rate within minutes. SRT suggests that this is an evolutionary reflex associated with the limbic system—one of the oldest parts of the brain and the seat of the emotions—in response to settings that signal safety and an abundance of food. According to SRT, evolution conserved this functional response because more rapid recovery from stress helped early humans to quickly move from one survival task to another. Certain types of settings, such as places with abundant vegetation, calm or slow-moving water, savannah-like locations, and unthreatening wildlife, are more likely to be restorative.

Photo by: shankekala, iStockphoto.com

Natural features near workplaces can provide a place to reduce stress during the workday.

In one of the earliest and most cited studies about stress, Ulrich and others (1991) presented a graphic, 10-minute work accident film to 120 students. Before and after the film, viewers' stress levels were evaluated using measures of blood pressure, muscle tension, and heart rate, along with a self-rating of stress. Next, students watched a 10-minute video of either pristine nature (a peaceful river and forest) or of a congested urban scene filled with traffic and pedestrians. Recovery was faster and more complete for the subjects who were exposed to the nature video. In some cases, participants who viewed nature scenes were even more relaxed than before viewing the accident film.

The stress-reducing quality of nature has also been shown in investigations of cortisol, a hormone released by the adrenal glands in response to stress. In one study, scientists measured the levels of cortisol in 25 socioeconomically disadvantaged adults in Scotland and asked them to fill out questionnaires about what stressed them out at home and at work (Ward Thompson and others 2012). The data were then compared to the number of parks, woodlands, and other natural environments in each participant's zip code. The researchers found that those who lived in areas with the highest amount of green space had lower levels of cortisol, and their self-reported feelings of stress were lower than those who spent more time in urban settings without green space. The authors recognized the limitation of the small sample size, which was used to assess the feasibility of the study protocol.

In an interview with the BBC, Catherine Ward Thompson, the lead researcher on the study, said: "Our whole neuroendocrine system has evolved over millennia to respond positively to environments that are seen as providing what we need to live and thrive. There is something about the natural environment that is biologically part of our system. In a way, we are hard-wired to respond to it . . . and this may be turning our bodies back into something we have evolved biologically to respond positively to" (Kinver 2012).

Research has further clarified how natural areas in urban environments can help buffer people from stress factors. For example, green space between residences and high-traffic roads can reduce nuisance noise levels (Gidlöf-Gunnarsson and Öhrström 2007, Nilsson and Berglund 2006) and vegetation can increase privacy and conceal aesthetically displeasing structures (Smardon 1988). Just the presence of natural features near homes, schools, hospitals, and workplaces appears to be beneficial (see Box 3). Residents of public housing with nearby vegetation may more effectively cope with stress compared to those with homes surrounded by concrete (Kuo 2001).

Medical studies have shown that exposure to stress, especially for prolonged periods, can reduce immune response in humans. Recently, Kuo (2015) proposed enhanced immune functioning as a "central pathway" between nature and health. The author points out that natural environments have physiological and psychological effects related to immune functioning and that the natural world includes chemical and biological agents that boost immune functions (Kuo 2015).

BOX 3. Healing Gardens

Hospital settings are inherently stressful. Stress, anxiety, depression, and post-traumatic stress disorder (PTSD) are documented in many clinical studies on patient and family stress in relation to hospitalization. Even when medical procedures are routine, patients describe stressful feelings. For hospitalized patients requiring more complex treatments for cancer therapies, transplant surgery, stroke rehabilitation, palliative care and more, patients and their families often note high levels of stress.

Legacy Health, a nonprofit operating hospitals in Oregon and SW Washington, has embraced the installation of healing gardens at all of their locations as a way for patients and staff to relax, recover, and rejuvenate. Their first therapeutic garden was built in 1991; there are now 12 gardens at their 8 hospitals.

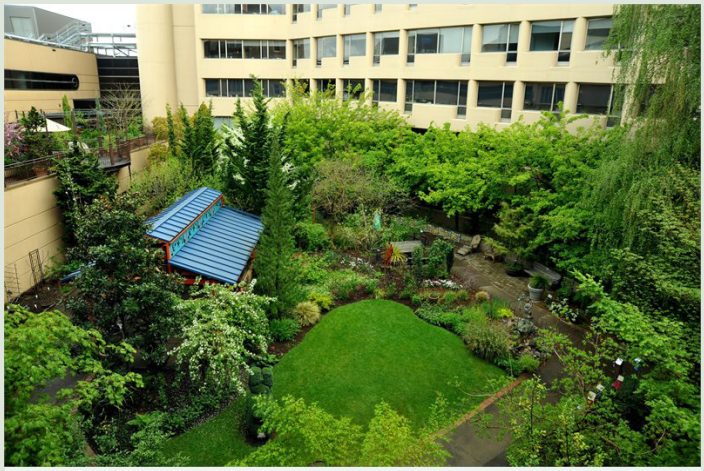


Photo by: Legacy Health

Healing gardens provide a place for patients to reduce stress during hospital stays.

Physicians, nurses, and therapists from a range of practices—psychiatry, physical rehabilitation, pediatrics, trauma, cancer, burn, and family birth centers—prescribe use of the gardens to their patients. Visitors and employees are also encouraged to use the gardens. Behavioral health patients participate in horticulture therapy treatments, and patients from the Children's Hospital engage in weekly nature stations.

Patients and staff report that using the Legacy hospital gardens helps them to relax and rejuvenate, and families of patients say that time spent in restoration in the gardens allows them to be able to better help their loved ones.

Therapeutic gardens:

- **Encourage activity and movement**
- **Help reduce stress**
- **Help build social and emotional support**
- **Provide a wealth of sensory and natural benefits from the sun, wind, rain, breezes, smell of soil, birdsong, trees, shrubs, flowers, butterflies, water sound, hummingbirds, moonlight, and more**

Social Health, Cohesion, and Resilience

Humans are naturally social, but the nature of modern life has decreased the quantity and quality of our social ties. Most people no longer live within extended families, and many live far away from even their closest family members. As Robert Putnam's *Bowling Alone: The Collapse and Revival of American Community* documented, Americans are increasingly isolated and disengaged from traditional institutions and networks such as churches, labor unions, and civic organizations that used to form the basis for their social lives (Putnam 2000).

Americans are far more socially isolated today than they were two decades ago, and a sharply growing number of people say they have no close friends (McPherson and others 2006). Similar to physical activity, social relationships are important for health and well-being. For example, lack of strong social relationships has been directly linked to the development and progression of cardiovascular disease (Knox and Uvnas-Moberg 1998) and health-threatening behaviors such as smoking, drinking, gang involvement, and drug use (Cubbin and others 2008).

Generally, research has shown a positive relationship between social ties and cohesion and green space (de Vries and others 2013, Francis and others 2012, Maas and others 2009b). Perceptions of social coherence and the extent and depth of local social interactions can be associated with perceptions of the greenness of the neighborhood (Sugiyama and others 2008). Of course, the type of green space matters. A 2013 study found a similar relationship

between green space and perceptions of social cohesion, but the researchers determined that the quality of the green space—measured in terms of variety of plants, maintenance, orderly arrangement, absence of litter, and general impression—mattered more than the quantity of green space in promoting social cohesion in the neighborhood (de Vries and others 2013).

Green, or nature-based, infrastructure builds physical resilience in a community and is key to mitigating natural disasters. Effective urban forestry programs and active environmental stewardship networks can provide the leadership to respond to and recover from natural disasters (Tidball and Krasny 2013). Erika Svendsen and Lindsay Campbell of the Forest Service's New York City Field Station research the relationship between environmental stewardship, healing, and community resilience in the aftermath of disasters (Svendsen and others 2014). They have documented how communities in New York City created "living memorials," or green space dedicated to memorializing the lives lost in the 9/11 attacks (Svendsen and Campbell 2010). The same authors looked at the role of nature in the rebuilding effort that took place in Joplin, MO, after the devastating 2011 tornado that completely destroyed much of the town and killed 161 people (Svendsen and others 2014). They found that as volunteers and community groups become actively involved in the stewardship of natural resources, their communities show increased civic engagement and ecological literacy. Additionally, communities that work together to create green infrastructure designed to be resilient to storms and other disasters can also generate and nurture social connections in these shared places.

Social Cohesion and the Elderly

Walkable green space is associated with greater longevity in older people (Takano and others 2002), and this is likely connected to the increased social interaction that is often associated with outdoor time for elderly individuals. For the elderly, increased social interaction is correlated with lower rates of mortality, depression, and cognitive impairment (Almedom 2005, Lubben 1988, Maas and others 2006). These studies highlight the importance of having accessible parks, gardens, and green space in close proximity to neighborhoods with large numbers of elderly residents as well as care centers.

Community gardens can improve nutrition, increase physical activity, and provide a location to socialize with neighbors. Community gardens can also provide a source of fresh fruits and vegetables often not readily available. Alaimo and others (2008) found that adults were 3.5 times more likely to consume at least five servings of fruit or vegetables a day if someone in their household participated in a community gardening project within the last 12 months. Studies show a range of mental health benefits from gardening as well: reductions in the severity of depression, increased attention (Gonazalez 2010), and prevention of the onset of dementia and negative dementia behaviors and symptoms (Fabrigoule and others 1995, Simmons and others 2006).

Photo by: laflor, iStockphoto.com

Community gardens are a great way for seniors to get physically active outdoors.

Alzheimer's disease is one of a number of cognitive impairments, collectively termed dementia, that primarily affect older individuals. Dementia patients with access to therapeutic or outdoor gardens exhibit fewer disruptive or agitated behaviors (Ellis 1995, Mather and others 1997). Time spent in parks and gardens can improve quality of life and function of dementia patients by reducing negative behaviors up to 19 percent, improving sleep patterns and improving hormone balance (Chalfont and Rodiek 2005, Mooney and Nicell 1992). Gardening appears to be particularly effective, improving mobility and dexterity, increasing confidence, and improving social skills among dementia patients (Rappe 2005, Ulrich 2002).

"Wander gardens" are confined outdoor spaces that enable activity without restraint but prevent departure. Access to these spaces is associated with improvements in the mobility of elderly patients (Detweiler and others 2012). At a dementia facility in Virginia, Detweiler and others

(2009) found that patients with access to a wander garden had about 30 percent fewer falls and a reduction in fall severity. In addition, they found significant reductions in the amount of medications used (a 10.5-percent reduction overall, with a range of 3.4 to 22.2 percent).

Social Equity and Access to Nature

Many people, because of lack of access, transportation, or general familiarity, visit parks and green space rarely or not at all (Blanck and others 2012). Physical activity and frequency of park use depend on demographic, socioeconomic, and regional characteristics and reflect inequalities in park distribution (Sister and others 2010) or in the accessibility of parks and green space (Comber and others 2008).

While we note the mixed findings on access to green space in diverse communities (Troy and others 2007), a number of studies have concluded that the distribution of urban green space is related to measures of socioeconomic status, such as income, education, race/ethnicity, and occupation, and regularly report that neighborhoods with higher socioeconomic status enjoy greater access to nearby green space (Gordon-Larsen and others 2006, Jennings and Johnson Gaither 2015, Martin and others 2004, Wen and others 2013). The lack of recreational facilities and green space in low-income communities is associated with decreased physical activity and increased obesity, both of which place people at higher risk for mortality (Mitchell and Popham 2008). Efforts to address physical inactivity and other health concerns related to inequitable access to green space would benefit from analyzing how green spaces are distributed throughout diverse populations (Jennings and others 2012).

Equal access to nature seems to help remediate some health disparities between low- and high-income neighborhoods. Several studies have found that limited access to green space in low-income neighborhoods can negatively affect cardiovascular health, in comparison to wealthy neighborhoods (Jennings and Johnson Gaither 2015). However, low-income neighborhoods with large amounts of green space have cardiovascular mortality rates similar to those of wealthy neighborhoods (Mitchell and Popham 2008).

Access to green space can also reduce other health conditions such as obesity, psychological health, and heat-related illness (Jennings and Johnson Gaither 2015). For example, higher tree density in urban areas is associated with decreased risk of childhood obesity (Lovasi and others 2013) as well as depression and type 2 diabetes (Astell-Burt and others 2014) among low-income urban families.

Studies also document how green space play a role in reducing stress. By monitoring patterns of salivary cortisol (a biological indicator of stress), a study in low-income areas of Dundee, Scotland, reported healthier daytime salivary cortisol patterns and lower levels of perceived stress for residents with higher proportions (more than 43 percent) of green space (Roe and others 2013).

Low-income communities typically have fewer resources to help them deal with pollution, fewer municipal services to mitigate the effects of pollution, and fewer resources at the household level to buffer families from the effects of pollution. Therefore, poorer communities are at a higher risk of exposure to air pollution and the effects of extreme heat (Huang and others 2011, Jesdale and others 2013). Since chronic health conditions can disproportionately affect low-income communities (Marmot and Allen 2014), limited access to the benefits from green space is a particularly important issue for vulnerable populations.

Photo by: Willard, iStockphoto.com

Rural communities face different barriers to active living than those in urban areas. They often and have limited access to recreation and physical activity opportunities.

While much of the discussion of the connection between green space and health focuses on urban environments, rural children and adults have higher rates

of obesity than their urban counterparts, and the barriers to active living in rural areas are often much different than the challenges of increasing physical activity in urban areas (Yousefian Hansen and Hartley 2015). Rural communities often lack transportation options and have limited access to recreation and physical activity opportunities. Other barriers may include isolation, climate and terrain, cost and safety fears such as high traffic speeds, the threat of loose dogs and wild animals, crime concerns, and lack of sidewalks and lighting (Yousefian Hansen and Hartley 2015).

Conclusion

People are dependent on nature for food, water, security, health, and well-being—we are connected with the natural world for our very survival. Green spaces also make us happier and healthier. The evidence of the link between nature, health, and preventive medicine will hopefully spur more direct collaboration between the health, urban planning, education, and natural resource communities. With the growing pressures of modern life, these are critical connections to pursue; the answers to some of the biggest challenges facing these groups lie in the recognition of shared interests, goals, and objectives. This area of research will continue to grow in the coming years and decades, illuminating the essential role that nature plays in the health and well-being of our minds, bodies, and spirit.

Acknowledgments

The Forest Service's National Urban Forest Technology and Science Delivery Team (NTSD) is comprised of urban program staff and science delivery experts from across our regions and research stations, working collaboratively to deliver quality urban natural resources science, technology, and information to improve the long-term sustainability of urban ecosystems. This publication is part of the team's effort to deliver urban forestry research and information to partners, stakeholders, and customers. NTSD team members Annie Hermansen-Baez (Forest Service Southern Research Station), Beth Larry (Forest Service Research & Development), and Lauren Marshall (Forest Service State & Private Forestry) managed the writing and production of this report. Josh McDaniel helped with the literature review and writing of this report. Zoe Hoyle (retired Forest Service), Louise Wilde and Sonja Beavers (Forest Service Office of Communications) provided editorial and layout reviews. Raghu Consbruck and Tracy Bryant provided the graphic design and layout of this publication.

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The following natural resource professionals, health professionals, and scientists donated their time and expertise by reviewing this document and helping to greatly improve the final report:

- Cindy Blain, California ReLeaf
- Dana Coelho, Forest Service, Rocky Mountain Region, State and Private Forestry
- Patti Erwin, Arkansas Forestry Commission
- Susan Granberry, Georgia Forestry Commission
- Teresia Hazen, Legacy Health
- Viniece Jennings, Forest Service, Southern Research Station
- Michelle Kondo, Forest Service, Northern Research Station
- Kathleen Sheehan, Forest Service, Pacific Northwest and Alaska Regions, and Private Forestry
- David Stephenson, Idaho Department of Lands
- Erika Svendsen, Forest Service, Northern Research Station
- Kathy Wolf, University of Washington/Forest Service

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How to cite this publication

U.S. Department of Agriculture, Forest Service. 2018. Urban nature for human health and well-being: a research summary for communicating the health benefits of urban trees and green space. FS-1096. Washington, DC. 24 p.

Healthy parks healthy people: The health benefits of contact with nature in a park context

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Healthy Parks, Healthy People: The Health Benefits of Contact with Nature in a Park Context

Cecily Maller, Mardie Townsend, Lawrence St Leger, Claire Henderson-Wilson, Anita Pryor, Lauren Prosser, and Megan Moore

Ed. note: With the increasing recognition of the value of nature to human health and well-being, Parks Victoria will host the first International Healthy Parks Healthy People Congress in 2010. The aim of the congress is to raise awareness of recent research, highlight case studies, and facilitate discussion regarding the advantages of, and opportunities for, future collaboration. The congress will be staged in Melbourne, Australia, 11–16 April 2010. See healthyparkshealthypeoplecongress.org for further details.

This paper is an abridgment, made with the authors' permission, of a much longer monograph, "Healthy Parks, Healthy People: The Health Benefits of Contact with Nature in a Park Context—A Review of Relevant Literature (2nd ed., March 2008). The original monograph in its entirety can be found at the congress website, above. This version focuses on the sections of the monograph most directly related to parks.

Introduction

That the natural environment is a key determinant of health is unquestioned. A report published by the World Health Organization (Prüss-Üstün and Corvalán 2006:6) claims that "approximately one-quarter of the global disease burden, and more than one-third of the burden among children, is due to modifiable environmental factors." However, even in its attempt to quantify the environmental burden of disease, WHO has focused on *environmental degradation*—"the amount of death and disease caused by factors such as unsafe drinking-water and sanitation, and indoor and outdoor air pollution" (Prüss-Üstün and Corvalán 2006: 6), paying little if any attention to the impacts of *environmental deprivation*. The same focus is reflected more broadly within "environmental health" as a discipline and a profession.

Despite the prevailing attitude in society that humans are separate from, outside of, or above nature (Suzuki 1990; Martin 1996), as human understanding of the natural environment has developed, and the massive destruction that human activities can have on natural systems has been observed, a more enlightened view has emerged. This view recognizes that plants and animals (including humans) do not exist as independent entities as was once thought, but instead are parts of complex and interconnected ecosystems on which they are entirely dependent, and of which they are fundamentally a part (Driver et al. 1996). In the

foreword to its Millennium Ecosystem Assessment report "Ecosystems and Human Well-being: Health Synthesis," the World Health Organization (2005:iii) stated:

> Nature's goods and services are the ultimate foundations of life and health, even though in modern societies this fundamental dependency may be indirect, displaced in space and time, and therefore poorly recognised.

The human relationship with the natural world is deeply intertwined with the human conscious and subconscious mind and is therefore not easy to access for analysis. Nonetheless, in recent years, there have been concerted attempts, particularly in the disciplines of ecology, biology, environmental psychology, and psychiatry, to empirically examine the human relationship with the natural world.

Many researchers have come to the conclusion that humans are dependent on nature not only for material needs (food, water, shelter, etc) but perhaps more importantly for psychological, emotional, and spiritual needs (Wilson 1984; Katcher and Beck 1987; Friedmann and Thomas 1995; Roszak et al. 1995; Frumkin 2001; Wilson 2001). Just how dependent on nature humans are, and exactly what benefits can be gained from interacting with nature, are issues that have only just begun to be investigated. Findings so far, however, indicate that parks and other natural environments play a vital role in human health and well-being through providing access to nature. This is likely to change the way parks and nature are currently viewed and managed by governments and the wider community.

The idea that contact with nature is good for human health and well-being is the subject of research in diverse disciplines such as environmental psychology, environmental health, psychiatry, biology, ecology, landscape preferences, horticulture, leisure and recreation, wilderness, and of course public health policy and medicine. Driving these divergent streams is the central notion that contact with nature is beneficial, perhaps even essential, to human health and well-being. While the strength of the evidence for this assertion varies, due in part to "methodological limitations of [some of] the research," and the mechanisms by which nature influences health outcomes is generally unknown, nevertheless acceptance of the association of nature with human well-being is increasing (Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning, Nature and Environment 2005:81).

In the last few hundred years, however, there has been an extraordinary disengagement of humans from the natural environment (Katcher and Beck 1987; Axelrod and Suedfeld 1995; Beck and Katcher 1996). This is mostly due to the enormous shift of people away from rural areas into cities (Katcher and Beck 1987). Here, contact with nature is often only available via parks. Never have humans spent so little time in physical contact with animals and plants, and the consequences are unknown (Katcher and Beck 1987). Further to this, modern society, by its very essence, insulates people from outdoor environmental stimuli (Stilgoe 2001) and regular contact with nature (Katcher and Beck 1987). Some researchers believe that too much artificial stimulation and an existence spent in purely human environments may cause exhaustion, or produce a loss of vitality and health (Katcher and Beck 1987; Stilgoe 2001).

A subject that has attracted some concern is the lack of opportunities for nurturing in urban environments. Nurturing living organisms, such as animals and plants, could be an essential part of human development that, if denied, could have adverse effects on the health, and perhaps even the long-term survival, of the human species (Katcher and Beck 1987; Lewis 1992; Wilson 1993; Bustad 1996; Kellert 1997). Katcher and Beck (1987) state that there is a critical need for continued exploration of the emotional and health value of nurturing living things; they believe it will reveal a human health requirement equal in importance to exercise and touch.

The idea that isolation from the natural world may be harmful to health is not limited to scientists and researchers but is also seen in the choices of everyday people. For example, it is estimated that 42% of the American public uses some form of complementary medicine (Clark 2000), and worldwide the use of complementary medicine has doubled in recent decades (New Scientist 2001). A recent Australian review of the literature on the use of complementary and alternative medicines, with a particular focus on their use in treating asthma, found that "20–30% of adults and 50–60% of children with asthma may be using CAM at any one time" (Slader et al. 2006:386). The rise in popularity of complementary medicines may not only be due to disenchantment with modern techniques, but also the expression of a desire to take a more natural approach to health (Clark 2000). In fact, many patients cite "naturalness" as the appeal of complementary medicine, yet others are drawn by spiritualism or the emphasis on holism (New Scientist 2001). Both of these qualities are often assigned to nature. Yet, there is still a lack of understanding in the general populace, governments, and institutions about the significance of the human connectedness with nature, and its relevance to current social problems, particularly in terms of health.

The following is a review of the potential and actual health benefits of contact with nature. Although the primary interest of this review concerns human contact with nature in a park context, we have examined the literature within the broader context of human health and nature. This has meant the inclusion of fields such as environmental psychology, psychology, psychiatry, medicine, environmental economics, biodiversity conservation, ecology, complementary and alternative medicine, landscape design and urban planning, recreation and leisure, environmental health, public health policy and health promotion, adventure and wilderness therapy, and religion and spirituality.

The emphasis on parks in this document is for the simple reason that they are the chief means of maintaining intact natural ecosystems and preserving biodiversity in a world that is becoming increasingly urbanized. Because of this, parks play an essential role in public health, as they are the most readily available (or sometimes the only) source of nature for the majority of people who live in urban areas. This review is the first step toward collating current knowledge on this topic with the aim of undertaking further empirical research in the near future.

Parks, nature, and health: What is the connection?

The context: Parks and people

When parks were first designed in the nineteenth century, city officials had a strong belief in

the possible health advantages that would result from open space (Hamilton-Smith and Mercer 1991; Rohde and Kendle 1997). It was hoped that parks would reduce disease, crime, and social unrest, as well as providing "green lungs" for the city and areas for recreation (Rohde and Kendle 1997). At this time, it was also believed that exposure to nature fostered psychological well-being, reduced the stresses associated with urban living, and promoted physical health (Ulrich 1993). These assumptions were used as justification for providing parks and other natural areas in cities, and preserving wilderness areas outside of cities for public use (Parsons 1991; Ulrich 1993).

Although parks have not entirely lost their connection with health, the modern emphasis is almost exclusively on their use as a venue for leisure and sport (Rohde and Kendle 1997). The importance of physical activity for health is well known, yet physical inactivity contributes significantly to the burden of disease and is on the rise in developed countries (Duncan et al. 2005). A wealth of literature exists, linking parks with varying levels and types of physical activity. For example, Wendel-Vos et al. (2004) used GIS databases to objectively measure the amount of green and recreational space in neighborhoods, and found that there was an association between greater amounts of parks and sports grounds in an area and increased levels of cycling. Similarly, a study by Zlot and Schmid (2005) found that there was a significant correlation between parkland acreage and walking and cycling for transportation. However, other research has shown that it is not only the size but the quality of parkland and public open space (e.g., Giles-Corti et al. 2005), as well as its physical and economic accessibility (e.g., Bengoechea et al. 2005), that influences people's use of such areas. As Lee et al. (2005) note: "Merely building a park in a deprived area may be insufficient for insuring its intended use.... It is critical to provide ongoing support for maintenance and civic improvements." Exploring the role of personal, social and environmental attributes as mediating factors in socioeconomic variations in women's walking behaviors, Ball et al. (2006) found that while all three elements play a part, access to environments conducive to walking is a key factor which needs to be taken into account. Two aspects of parks and open spaces which influence their use are perceptions of safety and aesthetic appeal (Evenson et al. 2006).

Aside from this recent focus on parks as venues for physical activity, parks tend to be viewed as optional amenities rather than as necessary components of urban (as well as rural) infrastructure (Kaplan and Kaplan 1989). Moreover, there is a prevailing lack of awareness about opportunities for enhancing health provided by larger, wilderness parks such as national parks. Why the benefits of parks understood by early landscape designers and park engineers have been overlooked is a mystery. Yet, research on the benefits of nature carried out over the last two decades is indicating that in fact, they may have been right. Amongst other evidence, data so far have shown that "green nature" can reduce crime (Kuo 2001), foster psychological well-being (Kaplan and Kaplan 1989; R. Kaplan 1992), reduce stress (Parsons 1991; Ulrich et al. 1991b), boost immunity (Rohde and Kendle 1994; Parsons et al. 1998) enhance productivity (Tennessen and Cimprich 1995), and promote healing in psychiatric and other patients (Katcher and Beck 1983; Beck et al. 1986), and is most likely essential for human development and long-term health and well-being (Driver et al. 1996).

Despite the prevailing emphasis on sport and leisure, park management agencies have recently focused on the social and environmental values of parks. For example, the Canadian Parks/Recreation Association recently published *The Benefits Catalogue* (1997) documenting the health and well-being benefits of all aspects of recreation, including that carried out in parks. In Australia, the recent repositioning of Parks Victoria's key message to "Healthy Parks, Healthy People" acknowledges the symbiotic relationship between parks and people (de Kievit 2001). However, although the government and much of the community are aware of how people can benefit parks (e.g., by legislation, activism, or friends of parks groups), the benefits that parks can bestow on people (in terms of health and well-being) through contact with nature have, until recently, gone largely unrecognized.

As summarized in this review, the evidence from recent research demonstrates clearly that there are many and varied health effects to be derived from contact with nature, and that, in urban environments in particular, experiencing nature through parks may in fact be a vital component of human health that for too long has been ignored.

Parks, public health, and well-being

The ecosystem is the fundamental capital on which all life is dependent (Suzuki 1990). Because our water quality, air quality, economic vitality, and personal well-being are as dependent on natural resources as they are on transportation, communications, and public safety systems, parks, by providing access to nature and protecting ecosystems, are an essential part of the infrastructure of our cities and communities (Gutowski 1994, cited in Lewis 1996). The threat of climate change has heightened awareness of the ecosystem services provided by parks and other green spaces. Yet, despite a growth in conservation activities over recent years, there still appears to be a lack of acknowledgement and acceptance on the part of planners, decision-makers, and developers of the need for "a healthy and diverse natural environment in the modern city" (Kellert 2004:9).

In addition to their contribution to public health and well-being through ecosystem services, parks also contribute to health and well-being through the provision of settings for community engagement. Baum (1999) states that healthy communities should provide varied opportunities for their citizens to meet and interact in both formal and informal settings. Recent research has shown that parks make a key contribution to meeting this requirement (e.g., Krenichyn 2005). However, it has been asserted that, if not well-maintained and -used, parks which form boundaries between neighborhoods of different cultural, ethnic, and socioeconomic characteristics may become "green walls" dividing communities, rather than places of community interaction (Solecki and Welch 1995).

In the urban environment, the best access that people have to nature (apart from that available in their homes and gardens) is via parkland. Parks vary in size, shape, quality, and character, and hence satisfy the whole spectrum of opportunities for contact with the natural world at various levels. Yet, Wilson's (1984) biophilia hypothesis has prompted many researchers to re-evaluate their understanding that plants and engineered ecosystems, such as parks, please people only on a cultural (Stilgoe 2001) or superficial level (Driver et al.

1996). From an evolutionary perspective, parks are ideal environments in which to reap some of the positive contributions to personal health that are inseparable from our evolutionary history, but which are virtually impossible to obtain in modern society (Furnass 1979). These contributions include the physiological and psychological benefits derived from physical activity over varied terrain, the dramatic change in sensory input, and the spiritual values which can accrue from direct contact with the natural world (Furnass 1979). A common conclusion in the literature is that humans may not be fully adapted to an urban existence (Glendinning 1995; Kellert and Wilson 1993; Kellert 1997; Burns 1998). Hence, they live in an environment so different to that from which they evolved that natural selection has not had time to revise human bodies for coping with many aspects of modern life, including fatty diets, vehicles, drugs, artificial lights, and central heating (Nesse and Williams 1996, cited in Burns 1998). The reasoning for this argument is that humans have spent many thousands of years adapting to natural environments, yet have only inhabited urban ones for relatively few generations (Glendinning 1995; Roszak et al. 1995; Suzuki 1997; Gullone 2000). Moreover, although humans may have all of their physical needs well satisfied by the urban environment of large cities, our internal psyche is profoundly disturbed (Suzuki 1997; Gullone 2000).

Frederick Law Olmsted, the 19th-century American landscape architect, believed in the restorative quality of green nature that "operates by unconscious processes to relax and relieve tensions created by the artificial surroundings of urban life" (Lewis 1992). Olmsted (cited in Lewis 1996) also believed that parks improved health and vigor and extended the life expectancy of citizens. These ideas are now being confirmed by research in psychology and geography, as well as in many other fields. Examples of how parks and nature can contribute to some of the components of health are displayed in Table 1. Although the physical, mental, and social components of health have been identified by health authorities, such as the Victorian Health Promotion Foundation (VicHealth 1999), this review advocates an ecological definition of health by also including the spiritual and environmental components.

Parks and nature have enormous untapped health potential as they provide an opportunity for people to re-establish and maintain their health in a holistic manner. Recent developments in public health and health promotion have recognized the benefits of a holistic approach. For example, it has been stated that the major determinants of health have little to do with the health care system (Hancock 1999), and that public health needs to focus on the environmental and social aspects of health (Chu and Simpson 1994). Parks are in an ideal position to address both these, and other aspects, of human health and well-being.

Repositioning parks

Parks and nature are currently undervalued as a means of improving and maintaining health. Although most people are aware of the health benefits of sport and recreation, the range of other health and well-being benefits arising from contact with nature are virtually unknown. Although further research is required, the findings summarized in this report are sufficient to warrant the repositioning of parks in the minds of both the community and government

Component of health	Contribution of parks
Physical	Provide a variety of settings and infrastructure for various levels of formal and informal sport and recreation, for all skill levels and abilities, e.g., picnicking, walking, dog training, running, cycling, ball games, sailing, surfing, photography, birdwatching, bushwalking, rock climbing, camping
Mental	Make nature available for restoration from mental fatigue; solitude and quiet; artistic inspiration and expression; educational development (e.g., natural and cultural history)
Spiritual	Preserve the natural environment for contemplation, reflection, and inspiration; invoke a sense of place; facilitate feeling a connection to something beyond human concerns
Social	Provide settings for people to enhance their social networks and personal relationships from couples and families, to social clubs and organizations of all sizes, from casual picnicking to events days and festivals
Environmental	Preserve ecosystems and biodiversity, provide clean air and water, maintain ecosystem function, and foster human involvement in the natural environment (friends of parks groups, etc.)

Table 1 A summary of the contribution of parks to human health and well-being.

as a positive health resource. Parks need recognition for the essential role they play in preserving, maintaining, and promoting the health of humans, as well as that of their environment.

Parks, in fact, are an ideal catalyst for the integration of environment, society, and health (which have been demonstrated to be inextricably linked) by promoting an ecological approach to human health and well-being based on contact with nature. The potential exists for parks to gain an expanded role, scope, and influence in society, especially in terms of public health, as well as changing the way park management bodies relate to other organizations and agencies (by advocating an integrated approach to government). This would also bring together several disciplines and/or agencies already moving in this direction as well as value-add to the status of parks in the community.

In order to reposition parks, it is necessary for park management agencies to:

1. *Communicate* to governments and the wider community that:

- A growing body of evidence shows that access to, and interaction with, nature is essential to human health and well-being;
- Through providing access to nature, parks improve and maintain human health and well-being (both at an individual and community level);
- By improving and maintaining human health and well-being, parks have the potential to reduce the burden on the health care system;
- Parks facilitate an holistic/ecological approach to health and well-being that is beneficial (and essential) to individuals, society, and the environment;
- Through providing a holistic/ecological approach to health, parks reinstate people with a sense of empowerment and control over their own health and well-being.

2. *Educate* governments and the wider community:

- As to how the above can be applied for improved health and well-being;
- About how to incorporate this knowledge into public health policy and health promotion;
- About how to collaborate in the pursuit of common goals;
- About the need for broadening the knowledge base in this area (via further research) for future dissemination.

3. *Facilitate* the engagement of the community with nature in order to re-establish the importance of nature in people's lives and the cultivation of a holistic and sustainable attitude towards life and health:

- By communication and education as outlined above;
- By continued exploration of the benefits to individuals and communities to be gained from contact with, and preservation of, nature;
- By fostering park management practices which support community engagement with nature.

To accomplish the above will require the cooperation of multiple government departments and/or other agencies (i.e., those whose portfolios/core business relate to any aspect of society, health, or the environment). This in itself would be ground-breaking since traditionally (as is commonly known) government departments (and other similar entities such as university faculties or research institutes) tend to work in isolation, despite opportunities that may exist for mutual benefit. An interdisciplinary approach would reflect a recent insight in health promotion that modern health issues are usually multifaceted and complex, arising from social and environmental conditions of the individual or community concerned (e.g., socioeconomic status, access to basic health and educational services, family issues, social cohesion, and an unpolluted environment).

Mowen (2003) offers seven hints for park professionals in attempting to align with health agencies, including: (1) infant health partnerships require baby steps, (2) know the lingo of the health profession, (3) integrate health benefits into all communications, (4) use solid evidence to justify the link between park use and health, (5) don't reinvent the health promotion wheel, (6) create partnerships that provide an incentive for physical activity, and (7) attempt collaboration not competition.

To reposition parks in this way will mirror other international attempts, such as those in Canada. The Canadian Parks/Recreation Association state in its *Benefits Catalogue* (1997) that in the future parks will be: recognized as champions of personal and community well-being, central to the quest for human potential, builders of social foundations, catalysts for Canada's green movement, and a cornerstone for economic renewal. This is possible for parks everywhere.

Health benefits of nature: The evidence

The belief that contact with nature fosters psychological well-being and reduces the stress of urban living seems to be as old as urbanization itself (Ulrich and Parsons 1992; Ulrich 1993), and, as mentioned, was the guiding principle behind the first parks. There are many ways that humans come into contact with nature, including viewing natural scenes, being in natural settings, or encountering plants and animals. Some of these occurrences are "everyday" interactions, and others are more specific and affect people at a deeper level. This section briefly examines everyday human–nature interactions, as well as those interactions with landscapes, wilderness, plants, and animals (Frumkin 2001).

Viewing nature

In recent decades, landscape researchers have conducted studies to investigate individuals' preferences for natural scenery (e.g., Talbot and Kaplan 1984, 1986, 1991; Talbot et al. 1987; Kaplan and Talbot 1988; Talbot 1988). From the early work of Talbot and Kaplan (1984) through to more recent work by Kaplan (2001), studies generally indicate that people prefer viewing natural landscapes rather than the built environment. Furthermore, there is now considerable empirical and theoretical evidence for the positive effects that simply viewing natural scenes can have on human health.

The healing effects of a natural view (such as those provided by parks) are increasingly being understood in stressful environments such as hospitals, nursing homes, remote military sites, space ships, and space stations (Lewis 1996). In these environments particularly, as well as for people who work in windowless offices, studies show that seeing nature is important and an effective means of relieving stress and improving well-being (R. Kaplan 1992; Lewis 1996; Leather et al. 1998). Research such as this could have important implications for the placement and planning of parks in urban areas.

One famous study examining recovery rates of patients who underwent gall bladder surgery found that those with a natural view recovered faster, spent less time in hospital, had better evaluation from nurses, required fewer painkillers, and had less postoperative complications compared with those that viewed an urban scene (Ulrich 1984). Similarly, Ulrich and colleagues (1991b) studied the effects of different natural and urban scenes on subjects who had just watched a stressful film (horror genre). Measuring a whole array of physiological measures (including heart rate, skin conductance, muscle tension, and pulse transit time—a non-invasive measure that correlates with systolic blood pressure) they found that recovery was faster and more complete when subjects were exposed to natural rather than urban scenes (Ulrich et al. 1991b). The physiological data measured by this study suggests that natural settings elicit a response that includes a component of the parasympathetic nervous system associated with the restoration of physical energy (Ulrich et al. 1991a).

Similar research conducted in prison environments suggests that cell window views of nature are associated with a lower frequency of stress symptoms in inmates, including diges-

tive illnesses and headaches, and with fewer sick calls overall by prisoners (Moore 1981). Natural views can also result in better performance in attention-demanding tasks (Tennessen and Cimprich 1995). Tennessen and Cimprich (1995) gave university students a test and compared scores of students who had natural views to those that did not. They found that those with a view of nature scored better on the test than those with non-natural views. Furthermore, a study by Heerwagen and Orians (1986, cited in Lewis 1996) compared the preferences of office workers for visual décor (i.e., photographs or posters) in windowed and windowless offices. Findings showed that people who worked in offices without windows were four times more likely to choose photographs or posters of outdoor/natural scenes than those who worked in offices with windows; more than 75% of scenes represented in windowless offices contained no buildings or human-made artifacts at all (Heerwagen and Orians 1986, cited in Lewis 1996).

Further evidence shows that access to nature in the workplace is related to lower levels of perceived job stress and higher levels of job satisfaction (Kaplan and Kaplan 1989). Workers with a view of trees and flowers felt that their jobs were less stressful and were more satisfied with their jobs than others who could only see built environments from their window. In addition, employees with views of nature reported fewer illnesses and headaches (Kaplan and Kaplan 1989). A similar study found that a view of natural elements (trees and other vegetation) buffered the negative impact of job stress (Leather et al. 1998).

Parsons et al. (1998) reviewed the literature on commuter stress in car drivers and the mitigating effects of roadside environments. Driving is known to be a stressful activity, and causes several physiological changes in the body, including activation of the sympathetic nervous system, increased blood pressure, increased heart rate, and an increase in heart rate variability (Parsons et al. 1998). Stress recovery and immunization were measured in subjects exposed to one of four simulated drives (drives with forest/rural scenery, drives along the outside of golf courses, drives through urban scenes, and drives through mixed roadside scenery), immediately following and preceding mildly stressful events. Findings demonstrated that participants who viewed nature-dominated drives experienced quicker recovery from stress and greater immunization to subsequent stress than participants who viewed artifact-dominated drives (Parsons et al. 1998).

Kaplan (2001) found that apartment residents had enhanced well-being and greater neighborhood satisfaction when they could look out onto more natural rather than more built settings. However, satisfaction was far greater when residents could see even a few trees than when their view was of large open spaces (Kaplan 2001). Similarly, results from a study by Kaplan (1985) suggested that urban residents who could see gardens found their neighbors to be friendlier and felt their housing development had a stronger sense of community, thus contributing to their neighborhood satisfaction. Furthermore, Kearney (2006) found that having a view of natural environments (particularly forests and landscaping) increased residents' neighborhood satisfaction and suggested that higher-density living, such as high-rise living, could be more acceptable if residents have a natural view.

The beneficial effects of viewing nature on psychological state, and in particular mood affect, were examined by Ulrich (1979, 1982, cited in Rohde and Kendle 1994). Ulrich (1979, cited in Rohde and Kendle 1994) found that participants who viewed slides of

unspectacular scenes of nature had an increase in positive mood affect, while those who viewed scenes of urban areas experienced a decline in positive mood affect. In this and a later study, Ulrich (1982, in Rohde and Kendle 1994) concluded that scenes of nature, particularly those depicting water, had a beneficial influence on the psychological state of humans. In their review of the literature, Rohde and Kendle (1994) state that the positive psychological response to nature involves feelings of pleasure, sustained attention or interest, "relaxed wakefulness," and diminution of negative emotions, such as anger and anxiety.

Kaplan and Kaplan (1989) point out that observing or viewing nature is an important form of involvement with it. Much of the pleasure that people derive out of nature comes from opportunities to observe, and much of this observation occurs, not when people are in nature itself, but when they are looking out a window (Kaplan and Kaplan 1989). This type of observation lets the mind wander and provides an opportunity for reflection. It can also aid recovery from mental fatigue. "Mental fatigue" is a term coined by Stephen Kaplan (1987b, cited in Kaplan and Kaplan 1989) and arises from an intense period of concentration or directed attention (whether pleasant or unpleasant) that eventually results in a worn-out mental state with symptoms including irritability and a lack of concentration. It has been shown that natural environments are ideal environments to foster recovery from this state. The reason for this is that the act of viewing or observing nature does not require directed or focused attention, but instead requires undirected or effortless attention, which is non-taxing and can restore mental capabilities.

Evidence presented here has demonstrated that just by viewing nature many aspects of human health and development can be markedly improved. Some of these benefits in a park context are summarized in Table 2. Although the benefits are mostly psychological, flow-on effects to physical health have also been documented in the literature. Viewing nature is positive for health, particularly in terms of recovering from stress, improving concentration and productivity, and improving psychological state, particularly of people in confined circumstances such as prisons, hospitals, and high-rise apartments/high density living. From these findings, it is clear that visual access to nature in urban settings should be taken into account and given appropriate priority when planning urban areas. As well as viewing landscapes, however, many therapeutic effects can be gained from *being* in nature.

Being in nature

Being in natural environments, whether hiking in a World Heritage area or sitting in a local urban park, has many psychophysiological beneficial effects on health (i.e., positive psychological effects that translate into positive physiological effects). Although there is much anecdotal evidence documenting the benefits of "being in nature," the exact effects (for example, by using psychophysiological measures) on the human mind, body, and spirit are still largely unknown. It has been suggested that some of the benefits from being in natural settings arise from a mood state of pleasant arousal and relaxation, resulting from returning to a more cyclical and slower sense of time (Furnass 1979; Nettleton 1992).

Nettleton (1992) reviewed some of the literature describing positive emotional states arising out of time spent in natural settings. A study by Russell and Pratt (1980, cited in

Interaction	Health Benefit
Viewing Nature	Improves concentration, remedies mental fatigue, improves psychological health (particularly emotional and cognitive aspects), and positively affects mood state
	Reduces stress and tension and improves self-reports of wellbeing (positively influencing the immune system by reducing production of stress hormones such as cortisol and corticosterone)
	When exposed to scenes of natural environments subjects recover faster and are more resistant to subsequent stress, which also is likely to boost immunity
	Recovery from a stressful event is faster and more complete when subjects are exposed to natural rather than urban scenes, and heart rate and muscle tension decreases (yet it increases when viewing urban scenes)
	Viewing nature improves performance in attention demanding tasks
	Viewing nature aids recovery from mental fatigue (attention restoration) and encourages reflection by requiring involuntary attention
	Views of flowers and trees in the workplace reduce perceived job stress, improve job satisfaction, and reduce the incidence of reported illness and headaches of office workers
	Trees nearby: decrease levels of fear, incivilities, and violence amongst residents; decrease crime rates in public housing; and improve the life satisfaction of residents
Being in Nature	Natural play settings reduce the severity of symptoms of children diagnosed with Attention Deficit Disorder (ADD) and improve concentration
	Viewing nature enhances residents' satisfaction and makes higher density living more acceptable
	Natural surroundings assist cognitive functioning in children
	Wilderness areas provide spiritual inspiration, enable people to gain a fresh perspective on life, and provide an opportunity to 'get away'.
	Therapy in a wilderness setting heals emotional and psychological conditions and can aid those recovering from substance abuse and violence
	Outward Bound and similar programs use wilderness challenges to boost self-confidence and self-esteem
Observing Plants and Gardens, or Gardening	Community gardens increase community cohesion, reduce graffiti and violence and enhance self-image of residents
	Gardening and gardens help people to feel tranquil and at peace
	In habitat restoration people see a metaphor for their own personal transformation and growth, enhancing psychological wellbeing
	Gardens improve psychological wellbeing, provide environmental stimulation, a means of self-expression, physical exercise, and social interaction for residents of retirement communities
	Residents who have nature nearby or regularly pursue nature-related activities (e.g. gardening, bird-watching) have greater neighbourhood satisfaction, overall health and life satisfaction than residents who do not
Observing / Encountering Animals (Pets and Wildlife)	Pets provide companionship, and an opportunity to nurture and express intimacy, as well as facilitating social networks
	The sight of, or touching a pet can reduce stress, decrease blood pressure and heart rate
	Pet owners report fewer minor health problems and have better mental health than non-owners (regardless of overall health, socio-economic status and physical exercise)
	Owning a pet can reduce the risk factors for cardiovascular disease (systolic blood pressure, plasma cholesterol, plasma triglycerides) independent of lifestyle and other health factors
	Observing native animals, having them nearby, or interacting with them improves quality of life

Table 2 Some known health benefits of contact with nature in a park context.

Nettleton 1992) found that parks and gardens were perceived as relaxing and peaceful and were associated with a positive mood state, while supermarkets were perceived as distressing and associated with a negative mood state. A later study conducted at one of the train stations in the Melbourne underground railway system (Parliament Station) found that when asked about what they liked about the station, commuters mentioned a small park (MacArthur Gardens) located just outside the exit of the station that they walked through on their way to the train, whereas the station itself was viewed as sterile, daunting, and stark (Joske et al. 1989, cited in Nettleton 1992).

City life is dominated by mechanical time (punctuality, deadlines, etc.), yet our bodies and minds are dominated by biological time. Conflicts between mechanical and biological time can result in a variety of unpleasant psychosomatic symptoms, including irritability, restlessness, depression, insomnia, tension and headaches, and indigestion (Furnass 1979). If unaddressed, these problems have the potential to eventuate into illnesses that are more serious. The experience of nature in a neurological sense can help strengthen the activities of the right hemisphere of the brain, and restore harmony to the functions of the brain as a whole (Furnass 1979). This is perhaps a technical explanation of the process that occurs when people "clear their heads" by going for a walk in a park and emphasizes the importance of parks in providing communities with access to nature. Furthermore, in the act of contemplating nature, researchers have found that the brain is relieved of "excess" circulation (or activity), and nervous system activity is also reduced (Yogendra 1958).

Nature does have great importance to people. In a survey of 1,900 adults in the US, Cordell et al. (1998) found that approximately 45% of respondents rated wilderness as "very important" or "extremely important" for spiritual inspiration, and a further 56% stated that just knowing it exists was "very important" or "extremely important." This confirms the conceptual importance of nature to people described by Kaplan and Kaplan (1989).

Being in natural environments invokes a sense of "oneness" with nature and the universe, and can lead to transcendental experiences (Rohde and Kendle 1994). This is more likely to occur in wilderness settings, although as it relates to subjective experience it is probable that nature in urban environments could produce the same effect.

In order to encourage people to be in nature, the accessibility of urban green spaces should be considered. With current trends in Australia and other Western countries towards an aging demographic, it is important to make urban green space accessible to all. Furthermore, urban green spaces should be created as beautiful places in cities—places that are socially cohesive and promote social solidarity (Ward Thompson 2002).

Restorative settings

The increasing complexity of both technological tasks and the built environment is generally a source of many negative stress response patterns for the majority of people (West 1986, cited in Lewis 1996). In contrast, the natural environment has been found to have a restorative quality, particularly for people who live in urban environments. Natural places such as parks offer an opportunity to become revitalized and refreshed. Living in urban areas often means dealing with environmental demands such as crowds, noise, pollution, and primarily

uniformed structures. It has been demonstrated that these factors can cause mental fatigue and exhaustion (Furnass 1979; Rohde and Kendle 1994), whereas exposure to nature has been demonstrated to have the opposite effect. Symptoms of mental fatigue include: decreased ability to concentrate and solve problems, heightened irritability, and a greater susceptibility to make mistakes or cause accidents (Herzog et al. 1997).

Rachel Kaplan and Stephen Kaplan (Kaplan and Kaplan 1989, 1990; R. Kaplan 1992; S. Kaplan 1992, 1995) have developed the notion of "restorative environments" that foster recovery from this state of mental fatigue. Restorative environments require four elements: fascination (an involuntary form of attention requiring effortless interest, or curiosity); a sense of being away (temporary escape from one's usual setting or situation); extent or scope (a sense of being part of a larger whole); and compatibility with an individual's inclinations (opportunities provided by the setting and whether they satisfy the individual's purposes) (Kaplan and Kaplan 1989; Hartig et al. 1991). Parks are ideal for restorative experiences due to their ability to satisfy the four elements described above. When comparing a walk in a natural setting (a park), a walk in an urban setting, and relaxing in a comfortable chair, Hartig et al. (1991) found that mental fatigue was most successfully relieved by a walk in a park.

Furthermore, Kaplan et al. (1998) suggest that the implications for design and management of natural environments to be restorative are vast and vital. They suggested that the natural setting may be beneficial to not only its immediate users but also to those who view it from afar. In addition, they stated that "if treated as the opportunity for increasing the sanity and welfare of those who can see it, it becomes every bit as important as hallways and lighting" (Kaplan et al. 1998:77). Herzog et al. (2002:295), reporting on a study of undergraduate students in the USA, concluded that "the restorative potential of natural settings is probably underappreciated." This is supported by the results of research by Hartig et al. (2003), also involving university students, in which the restorative effects of natural settings were accentuated by the negative effects associated with the urban surroundings and windowless room that acted as "controls."

In recent years, Frances Kuo and her colleagues (2001) have conducted research to examine the effectiveness of the attention restoration theory in the inner city context. Their work has focused on high-rise residents and the effects of nearby nature on a range of factors, including the ability to cope with major life issues, attention deficit disorder (ADD), and children's self-discipline. For example, a study conducted by Taylor et al. (2002) examined the relationship between nearby views of "green" nature and children's ability to concentrate, inhibit impulses, and delay gratification. They found that the more "green" a girl's view from her high-rise window was, the better able to concentrate and the more self-disciplined she was.

Similarly, Kuo (2001) examined whether nearby nature affects high-rise residents' ability to cope with poverty and life issues. She found that residents with "green" surroundings were able to pay attention more effectively and found their major life issues to be less difficult to deal with than their counterparts with "barren" surroundings. Furthermore, Taylor et al. (2001) tested whether attention restoration theory could be applied to children and their capacity to deal with ADD. Through the use of parental surveys, children were tested for their attentional functioning in a range of play settings, and green settings were found to be

most effective in enhancing attention. The authors concluded that the "greener" a child's play setting, the less severe her ADD symptoms appeared (Taylor et al. 2001).

Leisure and recreation

Leisure and recreation experiences in natural environments probably reduce stress through a number of mechanisms, including a sense of control through active coping or escape, and the therapeutic effects of exposure to natural environments that most likely have learned as well as biological origins (Ulrich et al. 1991a). For example, many people each year flock to parks and wilderness areas for their annual holiday to "experience" the wilderness, and the number of people seeking these experiences is increasing (Freimund and Cole 2001). Associated with this is a rise in the number of people pursuing non-consumptive nature-related recreational activities, such as bird-watching. This is often referred to as "wildlife-watching" or "watchable wildlife" and includes observing, feeding, or photographing wildlife (US Department of the Interior et al. 1996). Much work has been carried out on this topic in the United States, and although similar trends are likely in Australia, there are almost no data on wildlife watching by Australians or visitors to Australia (D. Jones, personal communication).

Recreation in the natural settings provided by parks is becoming increasingly important as our lives become dominated by indoor activities. Some authors anticipate that allowing people to interact with nature (such as spending time in parks during the working week) to reduce tension and increase competence and productivity, will eventually become socially accepted and actively encouraged (S. Kaplan, cited in Lewis 1996). Pursuing recreation in a park setting enables people to develop a clearer understanding of their relatedness to nature, which can influence their everyday lives and preferences (Martin 1996). This can have quite a powerful effect as a form of intervention treatment—for example, as used in wilderness therapy.

Wilderness and related studies clearly demonstrate that being in a natural environment affects people positively, although the exact benefits are still largely unknown. There are also multiple benefits from brief encounters with nature or experiencing nature on a smaller scale, such as in urban parks. As outlined by Woolley (2003), the most obvious benefits and opportunities that urban green spaces may provide for inner-city living are social benefits: that is, opportunities for people to participate in events and activities. Similarly, the Sydney Urban Parks Education Research (SUPER) Group (2001) stated that urban green space, in particular parks and gardens, may generate a range of social and economic values for the Australian community. These benefits may include:

- Opportunities for activity for older people;
- Supervised child-care;
- Health improvement and fitness motivation;
- Education in sport, environment and other endeavors; and
- Individual personal development.

Survey work has shown that nature is important to people, and the number of people seeking nature-related recreation overseas is increasing. Similarly, research indicates that in

Sydney, Australia, inner-city residents have the highest visitation rate to urban parks, no doubt due to small or non-existent personal gardens or backyards (Veal 2001). Some of the benefits of being in nature in a park context are presented in Table 2.

Contact with plants: Incidental exposure to plants

What effect does simply having plants, parks, and gardens in close proximity have on human health? Street trees and other people's gardens, fields and unused lots, courtyards, and landscaped areas that are encountered in one's daily travels (as separate from parks or designated recreational areas) constitute important opportunities for experiencing nature (Kaplan and Kaplan 1989). In a study of apartment dwellers in the USA, Kaplan (2001) found that views of trees, gardens, and grassy areas were important for participants' well-being and were factors in neighborhood satisfaction. Kaplan suggests that "incidental" exposure to plants via window views may be far from "incidental"—that it may, in fact, provide "micro-restorative opportunities" that may accumulate to "provide long-term contact with the natural environment" (2001:540). Similarly, in a study of low-income children in the USA, Wells (2000) found that the "greenness" of their home environment (predominantly related to views from various windows) impacted on their cognitive functioning, with greater levels of "greenness" associated with higher cognitive functioning. Kearney, reporting on a study of residential density and neighborhood satisfaction, found that density per se was less important than "opportunities to visit nearby shared space and having views of nature from the home" (2006:112).

Even the knowledge that there is nature nearby (e.g., parks) has proven to have important effects on residents' satisfaction with their neighborhood, despite the fact that they may not make use of it regularly (Kaplan and Kaplan 1989). Rachel Kaplan and Stephen Kaplan refer to this as "conceptual" involvement in nature. Its benefits stem from the fact that nature is important to people and they value its presence, even though they may not experience it on a daily basis. Another study found higher neighborhood and life satisfaction among individuals who more regularly pursued gardening and other nature-related activities (such as bird-watching) than among those who did not have such interests (Frey 1981, cited in Kaplan and Kaplan 1989). People with access to nearby natural settings or parks have been found to be healthier overall than other individuals, and the long-term, indirect impacts of "nearby nature" can include increased levels of satisfaction with one's home, job, and with life in general (Kaplan and Kaplan 1989). A study by Wells and Evans of nearby nature as a buffer against stress among rural children found that "the impact of life stress was lower among children with high levels of nearby nature than among those with little nearby nature" (2003:311).

The observational mode of experiencing plants mentioned previously can occur wherever and whenever people encounter plants (Lewis 1990). Whether in parks or buildings, they are islands of green that provide opportunities for people to become refreshed by experiencing nature. Research has demonstrated that even brief encounters with nature can improve one's capacity to concentrate and remedy mental fatigue (Kaplan and Kaplan 1990; S. Kaplan 1992, 1995).

Failure to recognize, and to maximize, the benefits available from nearby plants, parks, and other natural settings could have serious consequences (Kaplan and Kaplan 1989). Considering the positive psychological effects that vegetation has on all sectors of the community, it seems unwise not to use this knowledge to improve productivity and quality of life. Too often parks and landscaping are considered as optional "amenities" rather than as essential components of urban design (Kaplan and Kaplan 1989).

Contact with animals: Companion animals

It is now widely recognized that healing influences exist in the relationships of humans to their pets (Birch 1993) and that people who own pets have better mental health and well-being than non-pet owners (Straede and Gates 1993; Rowan and Beck 1994). On the strength of this evidence, Rowan and Beck (1994) and others (Beck 1987; National Institutes of Health 1987; Bustad 1996; Fawcett and Gullone 2001) believe that there is a pressing need for detailed and serious research of human–animal interactions in large study populations. Some authors believe that because pet ownership cannot be patented and sold as a drug, however, there has been less than satisfactory research interest and funding into the health benefits of pet-keeping for individuals. A similar scenario exists for the effect of companion animals on societal health, and here too there is enough evidence to indicate that there are many benefits to be gained (Rowan and Beck 1994).

In terms of companion animals, parks provide an important outlet for people to interact with their pet (mostly applicable to dog owners), both formally (e.g., training) and informally (e.g., play). An added benefit is the opportunity to also interact socially with other pet owners and park users, expanding or enhancing social networks. It is also important to emphasize the opportunity that parks provide for observing or encountering wildlife, particularly in those protected area parks that preserve the habitat of native fauna.

Contact with animals: Wildlife

Apart from interactions with pets and other domesticated animals, humans also interact in various ways with wildlife. In the US and Canada more people visit zoos and aquariums each year than attend all professional sports events combined (Wilson 1993). Since its opening in the year 2000, the Melbourne Aquarium boasts an annual visitation rate of one million (Oceanis Australia 2002). In zoos and aquariums, visitors can safely view, interact with, and learn about animals that they would rarely encounter (or that are too dangerous to encounter) in the wild. There are also increasing numbers of people seeking contact with animals in their natural environment, particularly marine mammals, such as dolphins and whales. In Port Phillip Bay in Victoria up to 15,000 visitors each summer book organized tours to view and swim with dolphins. Increasing visitor pressure from tourists is so great in fact, that concerns are mounting for the welfare (and long-term survival) of the animals (Linnell 2002; Dolphin Research Institute Inc., n.d.).

Furthermore, in a national US survey on recreational interests (the National Survey on Recreation and the Environment, conducted in 1995) bird-watching was found to be the

fastest-growing recreational activity (Cordell et al. 1999). Other specific wildlife-watching pursuits are also emerging, such as butterfly-watching and whale-watching (Youth 2000). Whale watching in particular has gained immense popularity over the last couple of decades, and is the backbone of the tourist industry in towns such as Hervey Bay, Queensland, Australia. The enormous increase in wildlife-based ecotourism is indicative of the desire humans have to interact with nature, particularly animals.

Interacting with animals has multiple positive physiological and psychological effects on human health including: decreasing blood pressure, heart rate, and cholesterol; reducing anxiety and stress, and providing protection against stress-related diseases; provision of companionship and kinship; and offering the opportunity to nurture. All of these factors improve the quality of life and health. Parks are important in providing a setting for pet owners to interact both with their pet and with other pet owners and park users, which can positively influence the social aspects of health. Parks also preserve the habitat of native wildlife, providing people with the opportunity to observe or encounter animals in their natural environment. Some of the main benefits with specific relevance to parks are presented in Table 2.

Health benefits of nature: In practice

Further evidence for the positive effects on health and well-being from contact with nature is found in some unique forms of therapy based on the human relationship with nature. These forms of treatment have proven to be successful where conventional treatments have often had limited success.

Ecopsychology, or nature-guided therapy Ecopsychology, or nature-guided therapy, considers every aspect of the human–nature relationship. It is primarily concerned with the fundamental alienation of humans from nature and its effects on human health (Burns 1998; Gullone 2000; Scull 2001). The person–environment relationship is both the unit of analysis and the basis of treatment (Burns 1998). Although only relatively recently adopted in modern Western society, ecopsychology is essentially a modern interpretation of ancient views of humans and nature held by many indigenous peoples. In essence, most native cultures view humans as part of the rest of nature by believing that human beings are intricately linked to all life forms and life-like processes, and that by harming nature we harm ourselves (Suzuki 1990; Rockefeller and Elder 1992; Orr 1993; Knudtson and Suzuki 1994; Martin 1996; Burns 1998).

As echoed by researchers in other fields, ecopsychologists believe that disconnection from nature has a heavy cost in impaired health and increased stress (Katcher and Beck 1987; Glendinning 1995; Burns 1998; Gullone 2000; Scull 2001). Clinical ecopsychology operates on the premise that many psychological and physical afflictions can be due to withdrawal from the healing forces of the natural world (Levinson 1969; Roszak et al. 1995; Scull 2001). No longer able to identify with nature and its representatives, humans find themselves in a psychological void (Nasr 1968). However, people may be able to regain some emotional harmony by re-establishing a bond with the animate and inanimate world (Levinson 1969, 1983).

Many Western psychologists are now readily adopting ecopsychology as a form of treatment or are subscribing to its views (Durning 1995; Hillman 1995; Roszak et al. 1995; Burns 1998). In fact, the field of mainstream psychology is undergoing a paradigm shift as a result of new problems brought about by urban existence and the destruction of the natural environment that are proving difficult to treat (Hillman 1995). The Australian psychologist George Burns (1998) reviewed a selection of nature-based interventions. The work cited by him included the following beneficial effects from contact with nature: enhancement of positive affect, stress reduction, improvement in parasympathetic nervous system functioning, and enhancement of self-concept, self-esteem, and self-confidence.

Although ecopsychological treatment usually involves excursions into wilderness, it is now recognized that any exposure to nature, such as spending time with plants and animals, or going to a park, can have positive benefits (Cohen 2000; Scull 2001). Burns (1998) has documented his success treating patients with simple nature-based assignments. These assignments use natural objects or natural processes that have in the past assisted the patient with achieving a therapeutic goal, or are likely to do so in the future. Burns has successfully treated patients suffering from a variety of negative psychological states associated with severe trauma, cancer, depression, and anxiety, using nature as the basis for treatment.

Although there is a lack of scientific research in this area, in a similar way that wilderness therapy and outdoor adventure therapy also lack research evidence of their efficacy, anecdotal evidence suggests that ecopsychology is particularly successful in treating stress-related illness. However, unlike wilderness therapy and outdoor education, from which the benefits may be short-term, ecopsychological treatment is believed to have more lasting positive benefits than ordinary outdoor recreation (Scull 2001).

Stainbrook (1973, cited in Lewis 1996) states that an over-urbanized, dirty environment, and a lack of natural surroundings, confirm the negative self-appraisal a person may have developed through other negative contacts with society. Since self-esteem is the keystone to emotional well-being, a poor self-appraisal, among other factors, determines how people treat their surroundings and how destructive they will be towards themselves and others (Stainbrook 1973, cited in Lewis 1996). If the self were expanded to include the natural world, behavior leading to destruction of natural systems would be interpreted as self-destruction (Roszak 1995).

Hence, to suggest with the full weight of professional psychological authority that people are bonded emotionally to the earth gives a powerful new meaning into our understanding of the term "sanity" (Orr 1993; Roszak 1995). Furthermore, as Levinson (1969, 1983) states, humans must remain in contact with nature throughout life if they are to maintain good mental health, not too mention their humanity. It has been proposed that the modern life as prescribed by Western society results in adverse outcomes on the human psyche (Gullone 2000), the full impacts of which are yet to be realized.

Attention restoration Attention restoration theory suggests that contact with nature improves the ability to concentrate and aids recovery from mental fatigue. Mental fatigue, as mentioned earlier, can arise from extended periods of directed attention on a particular task, while shutting out distractions (Herzog et al. 1997). Symptoms include a lack of concentration, increased irritability, and a proneness to mistakes or accidents. The effect of nature on

children's capacity for concentration was studied by Taylor et al. (2001), who tested the ability of nature to improve the concentration of children diagnosed with ADD. They found that children functioned better after activities were carried out in natural play settings, and that the "greener" a play setting, the less severe the attention deficit symptoms (Taylor et al. 2001). ADD affects many children and can have a detrimental effect on most aspects of life, including school, interpersonal relationships, personal growth, etc. (Taylor et al. 2001). It is not an easy disorder to treat, but natural settings could be used to improve children's concentration, thereby somewhat alleviating the need for drugs, which have serious side effects and do not aid children's long-term health or development (Taylor et al. 2001). This research highlights the importance of "green" playgrounds and the availability and access to parks and nature for child-care centers, kindergartens, and schools.

However, attention restoration is not just relevant for children, but has increasing relevance for adults in the current social and economic environment in which people are working longer hours and spending long periods of time looking at computer screens. While Hartig et al. (2003) demonstrated that natural environments have both stress-reducing and attention restoration benefits for young adults (university students), a study by Herzog et al. (2002), also involving university students in the USA, found that recognition of the restorative effects of natural environments was limited. Herzog et al. (2002) suggest that strategies to address this lack of awareness should include communication of the benefits through images and narratives, and urban design that brings people closer to nature.

Wilderness experience and wilderness therapy As well as being restorative in terms of attention enhancement and stress reduction, natural environments can also be used educationally and therapeutically for other purposes. The terminology for such activities varies, and includes "outdoor education," "outdoor adventure," "wilderness experience," "wilderness therapy," "wilderness adventure therapy," and "bush adventure therapy." Whatever the terminology, participation in such activities is typically undertaken for physical, emotional, and/or psychological health reasons (Mitten 2004). However, its potential as a population-wide health promotion tool has only recently been recognized (Pryor et al. 2005).

Challenges presented by wilderness are used in wilderness experience programs such as Outward Bound to boost the self-confidence and self-esteem of participants. These programs encourage leadership ability, social cohesiveness, and facilitate an increased awareness of, and respect for, nature (Furnass 1979). Although these benefits can be substantial and have a long-term effect on individuals, it has been claimed that they are somewhat superficial compared to the psychological and spiritual benefits that can arise from contact with wilderness itself (Cumes 1998).

At least one wilderness program, however, draws on this aspect, namely the Wilderness Vision Quest Program, run in the United States (Easley 1991). This program, founded in 1976, emphasizes the spiritual dimensions of contact with the natural world and focuses on fostering conscious efforts to heal, enrich, and expand the human spirit (Brown 1984, cited in Easely 1991). Deeper experiences with wilderness are used in the emotional and psychological treatment of patients suffering from any number of conditions, including psychosis, substance abuse (Bennett et al. 1997) or violence, and injury (Crisp and O'Donnell 1998;

Beringer 1999). The combination of physical activity and social connection in the context of the natural environment has been found to be effective in preventing both the onset and the escalation of depression (Crisp and Hinch 2004). However, the multifaceted nature of the outcomes of such programs (particularly their broader social and environmental well-being outcomes) is often forgotten in the intense focus on the outcomes for individual participants. "When small groups of people adventure together in natural environments, the health and well-being of humans, communities and the natural environment are enhanced" (Pryor et al. 2005:11).

This area is only just beginning to be understood and no appropriate terms exist for the powerful effect of nature on the human psyche, although the term "wilderness rapture" has recently been suggested by Cumes (1998). More thorough research on wilderness therapy programs is required, particularly to determine whether beneficial effects on participants' lives are long-term. One commonly reported outcome of wilderness therapy is that self perceptions and perceptions about the one's relationship to the natural world change (Kaplan and Kaplan 1989). This can assist people in finding meaning or higher purpose in life.

Horticultural therapy Historically, plants are associated with healing (Lewis 1996) and the medicinal properties of plants used by ancient societies are still employed in the present day (e.g., traditional Chinese medicine, naturopathy). However, the use of plants in mental health therapy has now also been well established by the field of horticultural therapy (Relf 1992; Lewis 1996; Frumkin 2001). The restorative and therapeutic aspects of gardening are being used in a wide range of settings, including hospitals—where they are often referred to as "healing gardens" (Hartig and Cooper-Marcus 2006:536)—geriatric centers, drug rehabilitation centers, prisons, and schools for the developmentally disabled (Lewis 1990).

In a study conducted in retirement communities, residents had a strong preference for natural landscapes and, in fact, "pleasantly landscaped grounds" were a determining factor in their choice of retirement home (Browne 1992). The same study described how contact with plants (and nature) affected well-being. Five benefits were identified: psychological well-being, environmental stimulation, self-expression and personalization, motivation for physical exercise, and social interaction and networking (Browne 1992). Similarly, the use of horticultural therapy within a residential facility for people experiencing on-going mental health problems has provided benefits in terms of encouraging social interaction, providing opportunities for creativity and self-expression, and increasing self-esteem and confidence (Parker 2004).

The increasing popularity of therapeutic gardens within hospitals is supported by a study which found that visiting the garden associated with a children's hospital was a restorative experience (Whitehouse et al. 2001). Pilot data collected in a later study of the same facility (Sherman et al. 2005:181) revealed positive benefits in terms of "anxiety, sadness, anger, worry, fatigue, and pain" when comparing those inside the gardens with others inside the hospital building. Some healing gardens are reported to serve a dual purpose: as a place of prayer for those of faith, and as a place of nurture for others. In one facility for Alzheimer's patients, a "wandering garden" featuring a secure area for walking through a garden of non-toxic plants helps to evoke memories and to reconnect patients with the world

(Rauma 2003). Similar "wander gardens" have been used elsewhere with patients undergoing post-stroke rehabilitation, and have been shown to be beneficial for stimulating both mental and physical functions (Detweiler and Warf 2005).

Horticultural therapy is based on our emotional responses to nature, in this case to plants. Sensory gardens used in horticultural therapy provide people with a range of ways to respond to the plants and the setting, using the five senses (Lynch 2005). Plants, like animals, are non-judgmental, non-threatening, and non-discriminating, and can be an effective means of reaching someone who is not responding to conventional treatment (Lewis 1996). The growth of plants has a universal attraction in that it presents opportunities for interaction at a number of levels of intelligence, skill, and maturity (Lewis 1996). Of course, different people have different responses to nature, and what works for some may not work for others. Despite this, advocates for horticultural therapy rely on the innate connection that human beings have with living nature and the positive feelings that plants evoke within people (Lewis 1996). Horticultural therapy has been found to be highly beneficial, particularly to people with disabilities and to the elderly (e.g., Heliker et al. 2000; Pachanal et al. 2003).

However, although there appear to be health benefits to be bestowed on all age and ability groups in the act of gardening, further empirical research is warranted (Söderback et al. 2004; Relf 2005). It is likely that many of the benefits of horticultural therapy are experienced also by members of friends of parks and other environment groups, although the health of these groups has not yet been investigated.

Policy outcomes

Parks, nature, and triple bottom line reporting Triple bottom line reporting is a framework for measuring and reporting corporate performance against economic, social, and environmental parameters (SustainAbility Limited 2002; Elkington 1997). With their environmental and social focus, park management agencies were perhaps some of the earliest organizations to pursue the triple bottom line, before it was popularized as such. As it has become established in the business community, however, park organizations have almost seamlessly updated their approach to conform to contemporary triple bottom line concepts.

In parks management, the social bottom line previously has been satisfied by tailoring parks to visitor/user needs, enabling access for all user groups, supporting extensive volunteer and community projects (particularly friends groups and providing community grants), providing education and interpretation, and promoting and protecting significant environmental and cultural heritage sites. Now, parks have the opportunity to expand their social bottom line in terms of the key role they play in human health and well-being.

Human health and well-being is taking on an expanded role in triple bottom line reporting and sustainability. In fact, it has been hailed as one of the key indicators for sustainable development (Kickbusch 1989a). What is needed, however, is a focus on social equity, social investment, and social innovation in health and environment policy (Kickbusch 1989b). By promoting the health benefits of interacting with nature, and assuming a role in public health, parks could provide the innovation required.

The triple bottom line and public health The triple bottom line is almost effortlessly integrated into public health if an ecological approach to public health is adopted. Public health requires an expansion of the knowledge base underlying environmental health to include the triple bottom line of social, economic, and environmental outcomes in interpreting human–environment interactions (Brown 1996). In other words, these two disciplines can easily be combined in order to satisfy the requirements of the triple bottom line. Furthermore, it is important that the scope is broadened to include links between global, national, and international scales (Brown 1996). This is echoed in the concept of biohistory established by Stephen Boyden (Boyden 1992, 1996, 1999), relating to global human health and its total reliance on the health of the biosphere. As Boyden (1999) states, human society and culture have the capacity to affect the biosphere, both positively and negatively, and vice versa.

The triple bottom line concept is essentially the principle of an ecological theory of health put into practice. It entails enhancing individual and community health, well-being, and welfare by following a path of economic development that does not impair the welfare of future generations, providing for equity between and within generations, and protecting biodiversity and maintaining essential ecological processes and life support systems (Brown 1996).

Recommendations

It is clear from the evidence that humans have strong ties to nature that include physical, mental, and spiritual ties. Understanding how and why has partly been explained by theories such as biophilia, but researchers are still a long way from knowing all of the answers. More work is needed. Unfortunately, if governments, other decision-makers, and individuals wait for complete knowledge before changing current policies and lifestyles that are not sustainable, we may damage the health of the biosphere beyond repair, with potentially devastating consequences for humans.

As an outcome of the findings reported here, recommendations to governments, planners, park management bodies, and health policy makers are:

Support further research Further research is required to remedy gaps in current knowledge, to further knowledge in this area, to facilitate decision-making and policy formulation, and to foster interdisciplinary research into the benefits to individuals and communities to be gained from contact with nature. Specifically, research should be focused on:

- Collecting further empirical evidence demonstrating the health and well-being benefits of contact with nature;
- Exploring new opportunities for application of the health and well-being benefits of contact with nature by investigating nature-based interventions to address existing and emerging health problems;
- Exploring opportunities for using the health and well-being benefits of contact with nature as a preventive "upstream" health measure.

Encourage and facilitate the repositioning of parks First, by *communicating* to governments and the wider community that:

- Contact with nature is essential to human health and well-being;
- Through providing access to nature, parks improve and maintain human health and well-being (both at an individual and community level);
- By improving and maintaining human health and well-being, parks have the potential to reduce the burden on the health care system;
- Contact with nature and parks facilitates an holistic/ecological approach to health and well-being that is beneficial to individuals and society, as well as to the environment; and
- Through providing an holistic/ecological approach to health, contact with nature and parks reinstate people with a sense of empowerment and control over their own health and well-being.

Second, by *educating* government departments, health professionals, and the wider community about:

- How the above can be applied for improved health and well-being;
- How to incorporate this knowledge into public health policy and health promotion;
- How to collaborate in the pursuit of common goals; and
- The need for broadening the knowledge base in this area (via further research) for future dissemination.

Third, by *facilitating* the engagement of the community with nature in order to re-establish the importance of nature in people's lives and cultivate a holistic attitude towards life and health by:

- The communication and education outlined above;
- Continued exploration of the benefits to individuals and communities to be gained from contact with, and preservation of, nature through parks and other reserves; and
- Fostering park management practices that support community engagement with nature.

Develop ways of integrating parks and nature into public health Several considerations are relevant:

- Cooperation through a partnerships approach is required between government departments, park management agencies, health professionals, and researchers to successfully integrate parks and nature in public health.
- Health promotion agencies have already recognized the need for innovative, "upstream" approaches to health and well-being, and are seeking potential alliances and opportunities to this end.
- It may be beneficial to initiate this process by examining how contact with nature via parks could be used as a preventive measure, potentially contributing to, for example,

the Australian National Health Priority Areas of Cardiovascular Disease and Mental Health.

- The use of parks and nature to improve health and well-being is supported by the Jakarta Declaration (World Health Organization 1997) and its predecessor, the Ottawa Charter for Health Promotion (World Health Organization 1986), which call for creating supportive environments (both natural and social) and a reorientation of health services to be shared among individuals, community groups, health professionals, health service institutions, and governments.

Acknowledgments

This document is the collaborative effort of many individuals dedicated to disseminating the research on the health benefits of contact with nature. Particular thanks go to Ms. Natalya Maller for her "behind-the-scenes work" on this and many other NiCHE projects, and also Ms. Jenny Bartlett for coordinating input to the final product.

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Appendix A

Outdoor Recreation and Education Task Force

Research and Studies

Outdoor Industry and the Economic Picture:

Outdoor Industry Association Data Link -- https://outdoorindustry.org/advocacy/ (can look at all states individually)

- Outdoor Industry Association – Tennessee overall https://outdoorindustry.org/state/tennessee/
- Outdoor Industry Association – Tennessee First Congressional District https://drive.google.com/open?id=1_oScxy3k0BL-UFV3aVUvqMnR8R9iLi--
- Outdoor Industry Association – National Report https://drive.google.com/open?id=1Y_eucECzJvIljtHTex9BHtHkyVv-ziDI
- Bureau of Economic Analysis -- https://www.bea.gov/data/special-topics/outdoor-recreation
- Headwaters Economics -- https://headwaterseconomics.org/economic-development/trends-performance/outdoor-recreation-economy-by-state/
- EMSI/ESRI Data for Northeast TN Counties -- https://drive.google.com/open?id=1bisRdAljpThUIp-ZbbQPSqT2VSH3iJ2i
- TVA/UTIA Reservoir Economic Impact -- https://ag.tennessee.edu/news/Pages/NR-2017-05-EconomicimpactsTVArecreation.aspx
- Southwick and Associates is a leading firm in economic impact research for outdoor recreation. My contact is Rob Southwick -- Rob@SouthwickAssociates.com.

Important Research related to “access to outdoor recreation”

Articles 1-16 were accessed from Active Living Research using search keys ‘outdoors’ and ‘children K-12’ https://activelivingresearch.org/search/site/outdoors?page=4&f%5B0%5D=im_taxonomy_vocabulary_7%3A265

1. Pathways to Outdoor Recreation, Physical Activity, and Delinquency among Urban Latino Adolescents

The Challenge: Residents of underserved urban neighborhoods often face serious challenges related to crime, violence, and incivilities that make it difficult for them to be physically active outdoors.

Make an impact: Understanding the relationship between outdoor recreation and perception of crime and violence can inform interventions aimed at encouraging physical activity.

What the findings are about: This study examined whether fear, victimization, and perceived incivilities are associated with physical activity and outdoor recreation among Latino youth and whether involvement in physical activity is associated with delinquency.

Key Findings and Recommendations:

- Youth who were more fearful of crime were less physically active and engaged in less outdoor recreation, but being the victim of or witnessing crime was not related to either physical activity or outdoor recreation.
- Youth who were more acculturated to the US were less likely to engage in outdoor recreation.
- Girls may be more sensitive to neighborhood aesthetics than boys, while boys are more likely to be victims of violent crime or to be recruited into gangs, thus making crime a greater barrier to boys' physical activity.

Read the full article: Pathways to Outdoor Recreation, Physical Activity, and Delinquency among Urban Latino Adolescents

Suggested Citations:

Roman, C.G., et al. (2013). Pathways to Outdoor Recreation, Physical Activity, and Delinquency among Urban Latino Adolescents. Annals of Behavioral Medicine, 45(1Suppl): S151-S161

2. Environmental Barriers to Children's Outdoor Summer Play

BACKGROUND: Childhood obesity rates have risen markedly in the U.S. over the last 25 years. Apart from the nutritional considerations that are well-documented, child overweight is associated with low levels of physical activity (PA). Although a number of studies address the environmental barriers to adult PA, research on children is limited. The purpose of this study was to explore the barriers to outdoor play in the summertime as perceived by children themselves.

METHODS: In the summer of 2012, 281 children ages 6-14 years were surveyed as to things that would keep them from playing outdoors.

RESULTS: The top three factors named by boys were bad weather, fear of gangs/crime, and preferring indoor activities like video games. Girls also named bad weather most often, followed by it being too hot outdoors, and fear of gangs/crime.

CONCLUSION: Children view unsafe neighborhoods and bad weather as the primary barriers to outdoor play. Allowing access to unused school gymnasiums may be a useful strategy for facilitating children's PA in the summer months.

Worobey, J., Lelah, L., & Gaugler, R. (2013). Environmental Barriers to Children's Outdoor Summer Play. *Journal of Behavioral Health*, 2(4), 362-365.

3. Young Children in Urban Areas: Links Among Neighborhood Characteristics, Weight Status, Outdoor Play, and Television Watching

Kimbro, R.T., Brooks-Gunn, J., & McLanahan, S. (2011). Young Children in Urban Areas: Links Among Neighborhood Characteristics, Weight Status, Outdoor Play, and Television Watching. *Social Science & Medicine*, 72(5), 668-676.

Although research consistently demonstrates a link between residential context and physical activity for adults and adolescents, less is known about young children's physical activity. Using data from the U.S. Fragile Families and Child Wellbeing Study (N = 1822, 51% male), we explored whether outdoor play and television watching were associated with children's body mass indexes (BMIs) at age five using OLS regression models, controlling for a wide array of potential confounders, including maternal BMI. We also tested whether subjective and objective neighborhood measures - socioeconomic status (from U.S. Census tract data), type of dwelling, perceived collective efficacy, and interviewer-assessed physical disorder of the immediate environment outside the home - were associated with children's activities, using negative binomial regression models.

Overall, 19% of the sample were overweight (between the 85th and 95th percentiles), and 16% were obese (>=95th percentile). Hours of outdoor play were negatively associated with BMI, and hours of television were positively associated with BMI. Moreover, a ratio of outdoor play to television time was a significant predictor of BMI. Higher maternal perceptions of neighborhood collective efficacy were associated with more hours of outdoor play, fewer hours of television viewing, and more trips to a park or playground. In addition, we found that neighborhood physical disorder was associated with both more outdoor play and more television watching. Finally, contrary to expectations, we found that children living in public housing had significantly more hours of outdoor play and watched more television, than other children.

We hypothesize that poorer children may have more unstructured time, which they fill with television time but also with outdoor play time; and that children in public housing may be likely to have access to play areas on the grounds of their housing facilities.

4. Neighborhood Design and Children's Outdoor Play: Evidence from Northern California

Description:
Handy, S., Cao, X., & Mokhtarian, P. L. (2008). Neighborhood Design and Children's Outdoor Play: Evidence from Northern California. *Children, Youth and Environments*, 18(2), 160-179.

Today's children are spending less of their free time outdoors in the neighborhood, with negative consequences for health. Neighborhood design has attracted attention for both its contribution to the problem and its potential as a solution. However, relatively few studies have examined the causal relationship between neighborhood design and children's outdoor play. This study uses data from a 2003 survey of a random sample of households from eight Northern California neighborhoods. Using a quasi-longitudinal design, we apply ordered probit models to examine the effect of neighborhood characteristics on children's outdoor play while controlling for neighborhood preferences. The results provide support for a causal relationship between neighborhood design and outdoor play and point to cul-de-sacs, larger front yards, lower crime, and increased interaction among neighbors as key characteristics that influence outdoor play by increasing parents' perceptions of safety.

5. Association of After-school Programs Contextual Characteristics and Children's Moderate-to-Vigorous Physical Activity and Time Spent Sedentary

Description:
Presentation at the 2014 Active Living Research Annual Conference.

Background and Purpose
Nationwide, a majority of youth fail to meet current physical activity (PA) recommendations, making physical inactivity among youth an important public health concern (1). While past research has identified several settings (i.e. schools, home, neighborhood, etc.) that impact youth PA levels (2-3), the afterschool environment has recently emerged as an influential setting with the potential to substantially impact youth PA levels (4). With an estimated 8 million youth (age 5-18 years old) attending ASP in the United States, these programs represent an ideal setting to promote PA among a diverse group of children (5). However, very little is known about ASPs characteristics associated with children's MVPA and time spent sedentary. The purpose of the current study was to examine the relationship between ASP contextual factors, specifically size of indoor and outdoor play space, type of activity (free play vs. organized PA), program length, and MVPA and time spent sedentary among children attending a diverse sample of ASPs.

Objectives
To examine the association of the ASP contextual characteristics and their relationship with MVPA and time spent sedentary while attending an ASP.

Methods
Twenty ASPs across the South Carolina were selected to evaluate the impact of program contextual factors on children's PA levels. A total of 1,302 children (5-12yrs, 53% boys) wore accelerometers for 4 non-consecutive days while attending the ASPs. The physical size of the indoor and outdoor play space ASP used each day were measured via a measuring wheel (indoor) and GIS (outdoor), and inventoried via direct observation. The type of activity was evaluated via direct observation using the System for Observing Staff Promotion of Activity and Nutrition and classified as a ratio of free-play (e.g., children released to play on playground and open green spaces) to organized (e.g., adult-led structured games)

activity offerings based on the percentage of observational scans during physical activity time either indoors or outdoors.

Time allocated for PA opportunities was determined from each ASPs' daily schedule. PA and sedentary behavior were measured using accelerometers (ActiGraph GT3X models) (6-7). Time (min/d) spent in MVPA and sedentary indoors and outdoors was estimated using built-in light sensors (Lux values) (8). The analysis was conducted only on children attending the ASP for at least 60 minutes on a given day. Children's MVPA and time spent sedentary (min/d) during indoor and outdoor opportunities were evaluated separately in relation to size of the play space, type of activity provided, and amount of time allocated for PA using mixed model regressions.

- **Results**
  Girls and boys accumulated an average of 18.1 and 24.2min of MVPA/d. When comparing indoor and outdoor MVPA, approximately equal portions of activity were accumulated in each activity location.

- Girls obtained 9.0min of indoor MVPA/d (49.7%) and 9.1mins of outdoor MVPA/d (51.3%), while boys accumulated 12.4min of indoor MVPA/d (51.3%) and 11.8min of outdoor MVPA/d (49.7%). Regarding outdoor MVPA, each additional acre of play space was associated with a 2.8 and 1.5 min/d increase in outdoor MVPA for boys and girls, respectively, and a 2.1 min/d increase in outdoor sedentary behavior for boys.

- A higher free-play to organized activities ratio was associated with a 3.5 and 3.0 min/d increase in outdoor MVPA for boys and girls, respectively.

- Examining indoor activity levels, a higher ratio of free-play to organized activities was associated with a 2.4 min/d increase in indoor MVPA for boys. Time spent sedentary indoors increased by 0.5 and 0.7 min/d with each additional increase in 1,000ft2 of indoor activity space for boys and girls, respectively, while a higher free-play to organized activities ratio was associated with a 5.5 and 8.3 min/d increase in indoor sedentary behavior for girls. Length of time allocated for PA during the ASP was unrelated to MVPA and time spent sedentary.

Conclusions
These findings suggest limited influence of the physical size of play space on children's MVPA and sedentary behaviors during an ASP and that modifiable programmatic structure, in the form of the type of activity opportunities provided (free-play vs. organized games) was related to both MVPA and time spent sedentary. These are important findings, in that increasing physical play space is not a feasible or realistic strategy for ASPs. Conversely, more children were physically active indoors with the presence of more organized activities, yet this was related to a decrease in MVPA. Thus, future studies should develop effective strategies to increase PA levels by taking into account indoor and outdoor play opportunities.

Implications for Practice and Policy
While the ASP play space was associated with children's PA, the impact of this was minimal. Additional contextual factors impacting ASP youth PA, such as programming high quality PA experiences, are likely to lead to greater improvements in MVPA and reductions in sedentary behaviors. Policies, therefore, should target the PA programming to ensure children are afforded opportunities to be physically active while attending as

6. Physical and Social Contextual Influences on Children's Leisure-Time Physical Activity: An Ecological Momentary Assessment Study

Description:
Dunton, G.F., Liao, Y., Intille, S., Wolch, J., & Pentz, M. (2011). Physical and Social Contextual Influences on Children's Leisure-Time Physical Activity: An Ecological Momentary Assessment Study. *Journal of Physical Activity and Health*, 8(Suppl 1), S103-S108.

BACKGROUND: This study used real-time electronic surveys delivered through mobile phones, known as Ecological Momentary Assessment (EMA), to determine whether level and experience of leisure-time physical activity differ across children's physical and social contexts.

METHODS: Children (N = 121; ages 9 to 13 years; 52% male, 32% Hispanic/Latino) participated in 4 days (Fri.–Mon.) of EMA during nonschool time. Electronic surveys (20 total) assessed primary activity (eg, active play/sports/exercise), physical location (eg, home, outdoors), social context (eg, friends, alone), current mood (positive and negative affect), and enjoyment. Responses were time-matched to the number of steps and minutes of moderate-to-vigorous physical activity (MVPA; measured by accelerometer) in the 30 minutes before each survey.

RESULTS: Mean steps and MVPA were greater outdoors than at home or at someone else's house (all $P < .05$). Steps were greater with multiple categories of company (eg, friends and family together) than with family members only or alone (all $P < .05$). Enjoyment was greater outdoors than at home or someone else's house (all $P < .05$). Negative affect was greater when alone and with family only than friends only (all $P < .05$).

CONCLUSION: Results describing the value of outdoor and social settings could inform context-specific interventions in this age group.

7. School Gardens and Physical Activity: A Randomized Controlled Trial of Low-Income Elementary Schools

Description:
Presentation at the 2014 Active Living Research Annual Conference.nn

Background and Purpose
Recently, school gardens have begun to move from niche to norm as a strategy to promote public health (Severson, 2010; Otterman, 2010). However, despite growing interest, few studies have examined the effects of gardens on children's health or health behaviors. Evidence suggests that gardens may positively influence children's diet-related outcomes such as vegetable consumption, vegetable knowledge (Morris, Briggs & Zidenberg-Cherr, 2002), willingness to taste vegetables (Morris, Neustadter & Zidenberg-Cherr, 2001; Morris, Briggs & Zidenberg-Cherr, 2002) but studies of gardens' effects on children's physical activity (PA) are virtually nonexistent.

Despite the dearth of research examining school gardens and PA, the influence of school gardens on children's PA merits study for four reasons. First, preliminary evidence suggests that school gardens have the potential to influence PA (Hermann et al., 2006) and gardening has been linked to PA among adults (Twiss et al., 2003). Second, we know that time spent outdoors is a positive and consistent

predictor of PA among children (Ferreira, van der Horst, Wendel-Vox, van Lenthe & Brug, 2006; Sallis, Prochaska & Taylor, 2000).

Thus, one strategy to increase PA is to increase time outdoors, enhance children's desire to be outdoors, and thereby compete with the "draw" of indoor activities such as TV and computers. A third argument for gardening as a means to increase PA is that there may be carry-over effects from one context to another — in this case, from school to home. After participating in a community gardening program in San Bernardino, California, the number of students who gardened at home increased by 20% (Twiss et al., 2003). A fourth argument for gardening as a strategy to increase youth PA concerns the initiation of long-term health-related habits.

Children and youth in this country are not achieving recommended levels of PA (Pate, Freedson, Sallis et al. 2002). Among children ages 6-11, only 42% achieve the recommended 1 hour of PA per day (Troiano et al, 2007). Consistent with the life course perspective, empirical evidence suggests that life-long habits, including those related to food and PA (DiNubile, 1993), are established early (Elder 1998; Wethington, 2005). Introducing children to gardening may help to shift them from a life course trajectory of sedentary activities toward a positive trajectory of gardening and healthy habits.

Objectives

The objectives of this study are to examine:

1. the effects of school gardens on children's time spent outdoors and physical activity levels during the school day
2. the effects of school gardens on children's general activity and sedentary behavior patterns over time
3. among children in the intervention group, differences in activity and movement patterns while participating in an outdoor, garden-based lesson compared to while participating in an indoor, classroom lesson.

Methods

In a randomized controlled trial, this 2-year study examined the effects of a school garden intervention on elementary school children's time spent outdoors and physical activity. Eight low-income New York State schools were randomly assigned to receive school gardens or to serve as wait-list control schools that received gardens at the end of the data collection period. Physical activity was operationalized with three measures. Actigraph GT3X+ accelerometers worn during the school day for three days at each of four waves of data collection indicated children's levels of vigorous, moderate, and light physical activity as well as sedentary activity. Lux measures from the accelerometers provided a measure of children's time spent outdoors. The GEMS Activity Questionnaire (GAQ) (Treuth et al., 2003) documented changes in overall physical activity behaviors over the 2-year period. Lastly, the PARAGON direct observation measure (Myers & Wells, under review) was used to characterize the postures and movement associated with indoor versus outdoor learning.

Results

Lux readings from the accelerometers indicate that children in the garden intervention group showed an increase in the amount of time spent outdoors during the school day. In addition, accelerometry results indicate the intervention group increased proportion of time spent in moderate physical activity (MPA) and moderate to vigorous physical activity (MVPA) compared to pre-garden baseline and to the non-garden control group. Results from the GAQ suggest that over time, children in the garden intervention are less sedentary in their overall activities than the control group children. Lastly, direct observation

data suggest that while participating in a garden-based outdoor lesson, children engage in less sitting and in more walking and standing than while participating in an indoor lesson in the classroom.

Conclusions
School gardens appear to be a potent intervention to increase children's time spent outdoors as well as the proportion of time spent in MVPA during the school day. Gardens may also contribute to reduction of overall sedentary activities. Lessons delivered in the garden are associated with more movement than are indoor lessons.

Implications for Practice and Policy
This study provides evidence that school gardens should move from niche to norm in schools throughout the United States, as another strategy in our toolkit to increase physical activity.

8. Assessing the Social and Physical Contexts of Children's Leisure-Time Physical Activity: An Ecological Momentary Assessment Study

Description:
Dunton, G.F., Kawabata, K., Intille, S., Wolch, J., & Pentz, M.A. (2012). Assessing the Social and Physical Contexts of Children's Leisure-Time Physical Activity: An Ecological Momentary Assessment Study. *American Journal of Health Promotion*, 26(3), 135-142.

PURPOSE: To use Ecological Momentary Assessment with mobile phones to describe where and with whom children's leisure-time physical activity occurs.
DESIGN: Repeated assessments across 4 days (Friday–Monday) during nonschool time (20 total).
SETTING: Chino, California, and surrounding communities. SUBJECTS: Primarily low to middle income children (N = 121; aged 9–13 years; $\bar{x}$ = 11.0 years, SD = 1.2 years; 52% male, 38% Hispanic/Latino).
MEASURES: Electronic surveys measured current activity (e.g., active play/sports/exercise, watching TV/movies), social company (e.g., family, friends, alone), physical location (e.g., home, outdoors, school), and other perceived contextual features (e.g., safety, traffic, vegetation, distance from home).
ANALYSIS: Multilevel linear and multinomial logistic regression.
RESULTS: Most of children's physical activity occurred outdoors (away from home) (42%), followed by at home (indoors) (30%), front/backyard (at home) (8%), someone else's house (8%), at a gym/recreation center (3%), and other locations (9%). Children's physical activity took place most often with multiple categories of people together (e.g., friends and family) (39%), followed by family members only (32%), alone (15%), and with friends only (13%). Age, weight status, income, and racial/ethnic differences in physical activity contexts were observed.
CONCLUSIONS: The most frequently reported contexts for children's leisure time physical activity were outdoors and with family members and friends together.

9. Black Mothers' Perceptions about Urban Neighborhood Safety and Outdoor Play for their Preadolescent Daughters

Description:
Johnson Dias, J., & Whitaker, R. C. (2013). Black Mothers' Perceptions about Urban Neighborhood Safety and Outdoor Play for their Preadolescent Daughters. *Journal for the Health Care of the Poor and Underserved*, 24(1), 206-219.

Using narratives of single low-income Black mothers with preadolescent children in a high-crime neighborhood in Newark, New Jersey, this study aims (1) to understand if and how neighborhood safety influences mothers' decisions about allowing their daughters to play outdoors and (2) to identify what neighborhood changes would need to occur to alter their perceptions about safety. Mothers reported that unpredictable violence, related to drug and gang activity of neighbors, and the absence of safe play areas in their neighborhood led them to sequester their daughters indoors. Hostile neighborhood conditions contributed to children's physical inactivity and put girls at risk for obesity.

***10. I-PARK (Investigating Parks for Active Recreation for Kids)**

Research consistently shows that time spent outdoors is a strong predictor of children's physical activity and that there is an association between physical activity and access to parks and recreation areas. In addition to providing places to play and be active, parks are also neighborhood destinations that may provide near-by residents a place to walk/bike/skate.

This study will gather information from approximately 25 neighborhood parks in Durham, NC to determine the relationship between specific elements (e.g. play equipment, tennis courts, etc.) within neighborhood parks and children's physical activity. Researchers will assess the contribution of neighborhood park characteristics in explaining children's physical activity in parks. They will determine how neighborhood environments are related to the extent of children's use of parks for physical activity. They will also assess the importance of parent and adult supervision on children's use of parks for physical activity. Finally, researchers will determine whether the extent of park use and children's physical activity differs by race/ethnicity, socioeconomic status, and gender.

GRANTEE UPDATES

- Press Release, September 7, 2011: Hey Bobby, Slow Down! Helicopter Parents Can Impede Childs Ability to Play
- Robin Moore Discusses Children's Outdoor Activity on the Rick & Donna Martinez Show: The publication of "Park-Based Physical Activity Among Children and Adolescents" in the *American Journal of Preventative Mediciine* prompted an interview on WPTF, Raleigh. Questions about "Helicopter parenting" led to a discussing of how reducing the role of adult involvement in children's outdoor, free play experiences provides for higher levels of physical activity and higher collaborative skills. Listen to the podcast. The Robin Moore interview is on 9/13/11 at 47:30 minutes.
- January 5, 2012: An article in the Triangle Business Journal highlights findings from the publication "Park-Based Physical Activity Among Children and Adolescents" in the *American Journal of Preventative Mediciine.*
- I-PARK: Parks for Kids: A 6-minute video translation project interpreting research findings from a multi-disciplinary team at NC State University investigating local park use in Durham North Carolina. Findings include recommendations for adapting existing local parks, and their neighborhood infrastructure, to promote an active lifestyle.

11. Dynamics of School Playground Use in Low-Income Neighborhoods: Four Case Studies from Newark, New Jersey

Description:

Presentation at the 2008 Active Living Research Annual Conference

Background:
Substantial evidence suggests that children in low-income, central-city neighborhoods are deprived of opportunities for outdoor play because of the deteriorating quality of the urban environment. Even efforts by municipal governments to provide playgrounds in low-income communities do not always meet the real play needs of the children.

A particularly attractive solution to the dearth of outdoor play space in park-poor neighborhoods is the rebuilding of existing school playgrounds: the space is readily available, designated, and managed. Given the often-impoverished quality of the supporting public infrastructure in which inner-city schools are sited, the question exists as to whether local elementary school playgrounds can be effectively used to compensate for the general lack of children's outdoor play spaces. Using an ecological framework, this study investigated the dynamics of political, socioeconomic, and environmental attributes that mediate the use of school playgrounds by children.

Objectives:
This study of four low-income neighborhoods in Newark, New Jersey, investigated the hierarchy of relationships among institutional, neighborhood, and individual characteristics and how these factors influence children's use of school playground facilities. The strategy of renovating school playgrounds as a panacea to the present crisis of physical inactivity among youth tends not to consider the role of social context on use and the current work seeks to remedy this deficiency. The objective of this project is to draw attention to the need to consider the larger social and political landscape in which playground use takes place when formulating initiatives to encourage increased levels of physical activity among children.

Methods:
Four case studies were selected from among Newark's elementary schools. Three schools were recent recipients of newly renovated playgrounds by the same non- profit organization. The fourth school lacks equipment, but has playground markings. The study population was all fifth graders in each school, with the exception of special education children. Neighborhood sociodemographic data and crime data were obtained from official sources.

This three-phase study received IRB approval from the researcher's institute and consent from the Newark Public Schools. Fieldwork was from October 2006 to January 2007. Active guardian consent was necessary for child participation, and signed assent forms. Guardian questionnaires and consent forms were translated into Spanish and Portuguese to accommodate study participants.

Phase I: consisted of two sets of quantitative questionnaires designed and pre-tested by the investigator. The child's questionnaire was in most cases self-administered either in class or as homework. Each participating child took home and returned the guardian questionnaire. Factors investigated were neighborhood perceptions, school and playground features, and individual user characteristics.

Phase II: semi-structured qualitative interviews conducted by the investigator during the school day with principals, fifth-grade teachers, physical education teachers, and directors of the after-school program. Questions varied with interviewee category. Factors investigated were playground use, safety, supervision, and maintenance, as well as neighborhood perceptions.

Phase III: observations of how children used the playground during recess on three separate occasions. A map for each playground was partitioned into eight play areas based on architectural design. The investigator walked around the playground stopping at each area to record the type of activity taking place.

Items recorded included activity type, number and gender of children, and role of supervisor in area.

Results:
Adults residing in high-risk neighborhoods (e.g., crime, drugs, gang activity) tend to keep their children physically close and to restrict their outdoor activity, partially explaining why children remain indoors more than in former times.

Although children's perceptions of their neighborhoods tend to be more positive than adults' perceptions, children still prefer to be accompanied and supervised by an adult when they go to the playground if school is not in session, regardless of physical distance.

The school playground often becomes an urban wasteland when school is not in session; even when it is open to the community. It is plausible that there are racial differences in the standards by which neighborhood characteristics are perceived and evaluated. The provision of opportunities for physical activity within a neighborhood does not necessarily promote the desired outcome of facility utilization.

Conclusions:
The implicit and unproblematized strategy of "build it and they will come" does not consider the sociopolitical and institutional factors that mediate playground use. School administrators, extralocal stakeholders, parents, and others with decision-making power over playground access can influence child development, while the school playground itself can shape and structure the wider community. The solution of providing playground equipment as an incentive to increase outdoor physical activity for children living in hostile inner-city neighborhoods minimizes the importance of neighborhood context, public school bureaucracy, and individual preferences.

12. Using Behavior Mapping to Investigate Healthy Outdoor Environments for Children and Families: Conceptual Framework, Procedures and Applications
Description: (no summary, only citation provided)
Moore, R., & Cosco, N. (2010). Using Behaviour Mapping to Investigate Healthy Outdoor Environments for Children and Families: Conceptual Framework, Procedures and Applications. In C. Ward Thompson, P. Aspinall & S. Bell (Eds.), *Innovative Approaches to Researching Landscape and Health* (pp. 33-72). London: Taylor & Francis.

13. Well-Being by Nature: Therapeutic Gardens for Children
Description: (no summary, only citation provided)
Moore, R. & Cosco, N. (2005). Well-Being by Nature: Therapeutic Gardens for Children. In *Landscape Architecture Technical Information Series (LATIS) Forum on Therapeutic Garden Design*. Washington, D.C.: American Society of Landscape Architects

14. Park-Based Physical Activity Among Children and Adolescents

Description:

Floyd, M.F., Bocarro, J.N., Smith, W.R., Baran, P.K., Moore, R.C., Cosco, N.G., et al. (2011). Park-Based Physical Activity Among Children and Adolescents. *American Journal of Preventive Medicine*, 41(3), 258-265.

Robin Moore Discusses Children's Outdoor Activity on the Rick and Donna Martinez Show: The publication of *Park-Based Physical Activity Among Children and Adolescents* in the American Journal of Preventative Mediciine prompted this interview on WPTF, Raleigh. Questions about "Helicopter parenting" led to a discussing of how reducing the role of adult involvement in children's outdoor, free play experiences provides for higher levels of physical activity and higher collaborative skills. Listen to the podcast. The Robin Moore interview is on 9/13/11 at 47:30 minutes.

BACKGROUND: Availability of parks is associated with higher levels of physical activity among children and adolescents. Few studies examine actual park use and park-based physical activity in these populations. PURPOSE: This study examined associations among individual, park, and neighborhood environmental characteristics and children's and adolescent's park-based physical activity.

METHODS: Data were collected in 2007 on 2712 children in 20 randomly selected parks in Durham NC. The System for Observing Play and Recreation in Communities (SOPARC) provided measures of physical activity. Hierarchic regression analysis assessed associations among individual, park, and neighborhood environmental characteristics and children's park-based physical activity. Data were analyzed in 2010.

RESULTS: Of the 2712 children observed, 34.2% and 13.2% were engaged in walking or vigorous physical activity. Environmental features of parks were associated with activity levels whereas neighborhood characteristics were not. Physical activity was negatively associated with gender (girls) ($p=0.003$); presence of a parent ($p<0.0001$); presence of nonparental adult ($p=0.006$); and an interaction involving the 0–5 years age group and style of play ($p=0.017$). Higher level of physical activity was associated with presence of other active children ($p<0.0001$); courts (e.g., basketball); and an interaction between number of recreation facilities and formal activities ($p=0.004$).

CONCLUSIONS: These social factors and design features should be considered in order to stimulate higher levels of park-based physical activity among children and adolescents.

***15. Children Are More Physically Active in Greener Areas**

Summary:

The Challenge: The prevalence and amount of physical activity among adults and children in the United States and Europe is disturbingly low compared to levels recommended for maintaining good health. Underlying causes for the lack of physical activity may include changes in urban structure and the built environment that reduce opportunities for physical activity.

Make an Impact: Physical activity promotes health and reduces obesity risk, and evidence suggests that high levels of “greenness” (defined by the amount of nearby vegetation), may promote physical activity. In residential neighborhoods, greenness levels are generally higher for tree-lined walkways and parks than for sparsely-landscaped streets.

What the findings are about: This study examined relationships between greenness and children's physical activity using portable global positioning system (GPS) units, accelerometers (activity monitors), and satellite imagery data.

Key Findings and Recommendations:

- Children were more active when they were in greener areas of their neighborhoods, especially children living in a smart-growth community (characterized by more walkable streets with housing closer to shops, commercial services, parks and recreation areas).
- The amount of time spent being physically active was nearly five times higher among children who spent more than 20 minutes per day in greener areas than children who spent fewer than 90 seconds per day in such areas.
- Shade and aesthetics provided by tree-lined sidewalks may encourage walking and other outdoor activities.
- Integrating green elements into community design is a way to promote physical activity.
- Smart-growth communities encourage greater use of green spaces for physical activity

Read the full article: A Study of Community Design, Greenness, and Physical Activity in hildren Using Satellite, GPS and Accelerometer Data

Suggested Citations:
Almanza, E., Jerrett, M., Dunton, G., Seto, E., Pentz, M.A. (2012). A Study of Community Design, Greenness, and Physical Activity in Children Using Satellite, GPS and Accelerometer Data. Health & Place, 18(1), 46-54.

- DOWNLOAD "Children Are More Physically Active in Greener Areas" PDF (0.16 MB) Article Summary

15. **'The Park a Tree Built': Evaluating How a Park Development Project Impacted Where People Play**

Description:
King, D. K., Litt, J., Hale, J., Burniece, K. M., & Ross, C. (2015). 'The Park a Tree Built': Evaluating How a Park Development Project Impacted Where People Play. *Urban Forestry & Urban Greening*, 14(2), 293-299.

*Community parks have achieved recognition as a public health intervention to promote physical activity. This study evaluated changes in population-level physical activity when an undeveloped green space adjacent to transitional housing for refugees was transformed into a recreational park. A prospective, nonrandomized study design used the System of Observing Play and Recreation in Communities (SOPARC) to document the number and activity levels of park users over time, and to compare trends pre- and post-construction. T-tests or tests of medians (when appropriate) were used to compare pre- and post-construction changes in use of non-park and park zones for physical activity and changes in park use by age and gender.

Pre- and post-comparisons of people observed using non-park zones (i.e., adjacent streets, alleys and parking lots) and park zones indicated a 38% decrease in energy expended in non-park zones and a 3-fold increase in energy expended within the park (P = 0.002). The majority of park users pre- and post-construction were children, however the proportion of adolescent males observed in vigorous activity

increased from 11% to 38% (P = 0.007). Adolescent females and elderly continued to be under-represented in the park.

Our findings support an association between creation of accessible outdoor spaces for recreation and improvements in physical activity. Community involvement in park design assured that features included in the park space matched the needs and desires of the communities served. Some demographic groups were still under-represented within the park, suggesting a need to develop targeted outreach strategies and programming.

16. **Active Where?: Multi-Region Formative Research to Understand Children's Physical Activity Environments**

Description:
Presentation at the 2006 Active Living Research Annual Conference

Background
Most research on the physical environment and physical activity has been conducted with adults. Young people, however, are likely to be active in different places and respond to different environmental characteristics. Very little is known about parents' and children's perceptions of different activity locations such as in the home, local neighborhoods, commercial, and public spaces. Qualitative methods are needed to identify the relevant environmental issues and factors that potentially influence children's physical activity in order to subsequently evaluate these quantitatively.

Objectives
Structured interviews were conducted with children and parents in potential activity locations, in an effort to uncover previously unstudied environmental factors relevant to children's physical activity. Conducting interviews in local activity environments allowed for in-vivo questioning with the environment serving as a prompt to help participants explain their attitudes and experiences.

Methods
Data were collected in Cincinnati and San Diego from 16 pairs of parents and children (five- to 12- years old) or adolescents (13- to 17-years old) in a two-part interview process. Participants were recruited from four types of neighborhoods reflecting high and low-income and walkability (i.e., quadrants). First, parents were interviewed by phone regarding rules for their child's activity and their child's use of activity environments with the purpose of tailoring subsequent face-to-face interviews. These latter interviews with parents and children were semi-structured with open-ended questions relating to characteristics that might facilitate or hinder activity in their home, yard, local street and up to six familiar and nearby locations (including small and large parks, schools, recreation centers and malls).

The interview responses were grouped into the following categories: convenience, aesthetics, equipment, safety, social and other. Types of activities and activity settings were listed exhaustively. Parent rules were grouped by: behavior (walking or biking), outdoor location (neighborhood, park, recreation facilities, stores), home (particularly computer and TV use) and other. Two researchers independently reviewed and categorized responses. Frequency of themes were assessed and compared across age and neighborhood walkability.

Results
Frequent “convenience” themes included distance to the location and scheduling difficulties when driving was necessary. Distance was mentioned noticeably less often in the low walkable, low-income quadrant. The main two “aesthetic” themes were equipment condition and need for large open grassy spaces. Multiple activity and equipment choices were frequently emphasized. For example, parks were considered uninteresting if they had little limited equipment or no area for team activities. Parks were perceived more positively in low walkable, high-income neighborhoods.

Parents expressed many safety concerns, such as fear of abduction and drug dealers. Local neighborhoods were often considered unsafe to play in; supervised activities in recreation and other facilities were preferred. Street and traffic safety was a greater concern for children than adolescents. A recurrent theme was the need for activity areas to be fenced off and far enough from traffic. Lighting was also mentioned frequently.

Presence of peers was particularly important for adolescents, with absence of someone to play with noted most in low walkable, low-income neighborhoods. The most frequent activity locations were friend’s houses, recreation facilities, schools, parks, malls and local streets. The most frequent rules included ‘not going alone’, ‘taking a cell phone’, ‘staying in contact’, and ‘staying within sight (particularly for children)’. Many parents reported multiple rules to limit TV and computer time during the week.

Swing sets, basketball hoops, jungle gyms, monkey bars, bikes and soccer balls were the most frequently mentioned pieces of equipment, for all age groups and quadrants. Basketball, soccer and swimming were frequently mentioned activities but adolescents also mentioned walking and weight training as activities, while children played tag or on the jungle gym. High-income participants appeared to report a greater range of activities. Participants also noted age decreases in activity with more school work and driving.

Conclusions
This research has confirmed previous findings and identified many new themes, which have informed the development of a youth-oriented neighborhood environment survey. In particular, “new” rules regarding taking cell phones, avoiding strangers and cars and checking in were incorporated into the survey. Newly identified environmental and social supports included availability of large fenced off spaces, choice of activities, adult supervision and peer interaction. This innovative method of conducting interviews in the environments of interest was feasible and appeared to be effective in generating rich qualitative data regarding environmental influences on children’s physical activity.

Support
The Robert Wood Johnson Foundation Active Living Research program.

- **DOWNLOAD** "2006_children_parks__recreation_concurrent_session_kerr_0.pdf" PDF (0.43 MB) Presentations

Articles 17-20 were accessed at Active Living Research using search topics "academics"
https://activelivingresearch.org/search/site/academics?f%5B0%5D=im_taxonomy_vocabulary_7%3A265

17. Active Education: Growing Evidence on Physical Activity and Academic Performance

Summary:
The Challenge: One in three kids in the United States is overweight or obese. Obesity can have serious ramifications for kids' cognitive development and affect school attendance.

Make an impact:
Because children spend so much time at school, schools have a unique opportunity to help children become more healthy and active. Policies that support daily physical education and regular activity breaks during the school day can help increase physical activity, improve academic performance and improve classroom behavior among students.

What the findings are about: This research brief reviews evidence that examines how physical activity and fitness may help school-aged children maximize their academic performance, and provides an overview of the effects of physical activity on the developing brain.

Key Findings and Recommendations:
- Regular participation in physical activity has academic performance benefits.
- Single sessions of physical activity can enhance attention and memory.
- The effects of physical activity on brain health may explain improvements in academic performance.
- Educators, administrators and parents should thoughtfully integrate physical activity across the curriculum throughout the school day to facilitate learning for all students.

This Research Brief updates prior evidence on the role of physical activity in academic performance:
Active Education: Physical Education, Physical Activity and Academic Performance
INFOGRAPHIC:
- Findings presented in this brief are also available in the related *Active Kids Learn Better* infographic, available in English and Spanish.

18. Making the Connection: Linking Academic Achievement to Policies to Promote Physical Activity

Summary:
The Challenge: Overwhelming evidence links physical activity to improvements in student performance, including grades and standardized test scores. Yet, schools often fail to promote policies that ensure children and adolescents receive recommended levels of daily physical activity.

Make an impact: By making the connection between physical activity policies and positive academic outcomes, policymakers can enact win-win solutions that help enhance students' academic performance while improving their overall health.

What the findings are about: This brief discusses policy recommendations that promote academic achievement by incorporating physical activity in school-aged children.

Key Findings and Recommendations:

- Children who perform better on physical capacity tests are more likely to receive higher reading and math scores, even when the added time for physical activity takes away from time in the classroom.
- Intensive physical activity programs in schools can improve cognitive skills and attitudes, including concentration, attention and classroom behavior.
- Improve the quality and amount of physical education and physical activity in schools.
- Provide opportunities for students to engage in physical activity outside of classroom time.

Suggested Citations:

Leadership for Healthy Communities. Making the Connection: Linking Academic Achievement to Policies to Promote Physical Activity Brief. Princeton, NJ: Leadership for Healthy Communities, a National Program of the Robert Wood Johnson Foundation; 2011. Available from: www.leadershipforhealthycommunities.org.

19. Increasing Physical Activity Through Recess

Summary:

The Challenge: Regular physical activity can reduce children's risk of obesity and improve their classroom performance, but many schools provide few opportunities for students to be active.

Make an impact: Schools can provide excellent opportunities for children to be physically active through regular recess.

What the findings are about: This brief summarizes the growing body of research examining recess, which shows that providing recess during the school day is an effective and efficient way to increase physical activity and improve academic performance among children.

Key Findings and Recommendations:

- Providing recess breaks throughout the day can improve students' classroom behavior and attentiveness.
- Children can accumulate up to 40 percent of their total daily physical activity during recess.
- There are many effective strategies for increasing children's levels of physical activity during recess, including inexpensive playground equipment, interactive games with recess supervisors, painted playground surfaces, and designating space for "activity zones".
- The number of school districts that require or recommend daily recess may be decreasing.
- Children at high risk for obesity are least likely to have recess.

Suggested Citations:

Beighle A. Increasing Physical Activity Through Recess. A Research Brief. Princeton, NJ: Active Living Research, a National Program of the Robert Wood Johnson Foundation; January 2012. Available from: www.activelivingresearch.org.

- DOWNLOAD "Increasing Physical Activity Through Recess" PDF (0.21 MB) Research Briefs & Syntheses

20. Newly Implemented Comprehensive School Physical Activity Programs and Children's Physical Activity

Description:
Presentation at the 2014 Active Living Research Annual Conference.

Background and Purpose
A whole-of-school approach, such as Comprehensive School Physical Activity Program (CSPAP), continues to be endorsed as a promising way to increase the daily physical activity (PA) levels of children via five integral components: (a) physical education, (b) PA during school, (c) PA before/after school, (d) staff involvement and (e) family/community engagement. In 2012, the National Association for Sport and Physical Education [NASPE] created a professional development (PD) program to equip current teachers with the knowledge, skills and confidence to spearhead the implementation of at least one new school PA program beyond the CSPAP component of physical education. Understanding the PA influence of having a trained PA champion in schools with the greatest risk of obesity can provide timely evidence for the effectiveness and utility of similar training efforts nationwide.

Objectives
The purpose of this quasi-experimental, cluster non-randomized controlled study was to evaluate the impact of the CSPAP PD program on changes in the school PA levels of underserved 9-14 year-old children for one academic year post training.

Methods
A stratified sample of 16 certified full-time elementary (n = 9) and middle school (n = 7) teachers of high poverty (72% free and reduced lunch) and minority (81% African American) students were allocated to either a full treatment (n = 7, CSPAP trained in summer 2012 plus customized PD assistance), partial treatment (n = 4, CSPAP trained in summer 2012 only), or waitlist control (n = 5, CSPAP trained in summer 2013) group based on teaching experience and gender. Teachers recruited a random sample of students (M = 25) from their entire rosters of 9-14 year olds resulting in a total of 351 participating children (130 full treatment, 108 partial treatment, 113 waitlist control) who wore accelerometers for 2-5 consecutive school days during fall 2012 (baseline) and spring 2013 (post). Teachers and students completed weekly logs describing the types and timing of PA opportunities during each data collection period. The primary PA outcomes that served as the dependent variables were: (a) percentage of time spent in PA, (b) percentage of time spent in moderate-to-vigorous PA (MVPA), and (c) percentage of time spent in sedentary behavior over the five day period. The independent variables were the conditions of waitlist control, partial treatment, and full treatment.

Results
Of the 351 sampled children, 298 had full baseline/post data sets on all study variables. ANOVA revealed no significant differences between the partial and full treatment groups with regard to portion of time spent in PA ($p = .76$), MVPA ($p = .63$), and sedentary behavior ($p = .63$). Accordingly, the treatment conditions of full and partial were collapsed for the remaining analyses. ANOVA results revealed that all post PA mean values (e.g., Mcontrol = 20.00%, SD = 0.09; Mtreatment = 21.06%, SD = 0.05) were significantly lower than the pre PA mean values (e.g., Mcontrol = 26.32%, SD = 0.02; Mtreatment = 23.46%, SD = 0.05, $p < .001$). However, MANOVAs revealed [$F(1, 297) = 28.95$; $p < .001$; $R^2_{adjusted} = .09$] that the total proportion of children's PA time in schools with a partially or fully CSPAP trained teacher was significantly higher than children with a non-CSPAP trained teacher. This finding was also true for the proportion of time spent in MVPA, $F(1, 297) = 23.96$, $p < .001$; $R^2_{adjusted} = .08$. The portion of time

dedicated to sedentary behavior significantly decreased in children housed in schools with either a full or partial treatment teacher compared to control teachers, $F(1, 297) = 28.00$, $p < .001$, $R2adjusted = .09$.

Conclusions
Although all participating students significantly declined in the total amount of PA and MVPA over the school year, perhaps because of weather or mandated testing schedules, students taught by full or partial treatment teachers participated in significantly more PA and MVPA and significantly less sedentary behavior than the students taught by control teachers as a result of the increased number of PA opportunities offered by the CSPAP PD. These findings are encouraging, but effect sizes were small. We believe follow-up data may reveal differences between students in schools with a partial and full treatment teacher as some of the full effects of teacher's effort may not be observed until year 2 and 3 of CSPAP implementation.

Implications for Practice and Policy
This study provides preliminary evidence for the effectiveness of PD programs on improving school PA. We hope this work provides further evidence to advance the development and impact of national training efforts underway surrounding school PA champions (e.g., Physical Activity Leader). Consequently, it is our expectation that this research will inform policy decisions related to CSPAP implementation and its implications for evidence-based PD and increased student PA levels in schools.

Support / Funding Source
This research was funded by the Robert Wood Johnson Foundation, Active Living Research Building Evidence to Prevent Childhood Obesity Rapid Response Grant, Round 3.

- DOWNLOAD "2014_PA&Schools_Carson.pdf" PDF (10.66 MB) Presentations

Articles 21-34 were accessed at Active Living Research using search topics "mental health"
https://activelivingresearch.org/search/site/mental%20health?page=1&f%5B0%5D=im_taxonomy_vocabulary_6%3A220&f%5B1%5D=im_taxonomy_vocabulary_7%3A265&f%5B2%5D=bundle%3Acontent_research_paper

21. Physical Activity and Sedentary Behavior Patterns are Associated with Selected Adolescent Health Risk Behaviors

Description:
Nelson, M.C. & Gordon-Larsen, P. (2006). Physical Activity and Sedentary Behavior Patterns are Associated with Selected Adolescent Health Risk Behaviors. *Pediatrics*, 117(4), 1281-1290.

OBJECTIVE: Little is known about how physical activity (PA), sedentary behavior, and various adolescent health risk behaviors are associated. The objective of this study was to examine relationships between PA and sedentary behavior patterns and an array of risk behaviors, including leading causes of adolescent morbidity/mortality.

METHODS: Nationally representative self-reported data were collected (National Longitudinal Study of Adolescent Health; wave I: 1994-1995; II: 1996; N = 11957). Previously developed and validated cluster analyses identified 7 homogeneous groups of adolescents sharing PA and sedentary behaviors. Poisson regression predicted the relative risk of health risk behaviors, other weekly activities, and self-esteem

across the 7 PA/sedentary behavior clusters controlling for demographics and socioeconomic status. Main outcome measures were adolescent risk behaviors (eg, truancy, cigarette smoking, sexual intercourse, delinquency), other weekly activities (eg, work, academic performance, sleep), self-esteem.

RESULTS: Relative to high television (TV) and video viewers, adolescents in clusters characterized by skating and video gaming, high overall sports and sports participation with parents, using neighborhood recreation center, strict parental control of TV, reporting few activities overall, and being active in school were less likely to participate in a range of risky behaviors, ranging from an adjusted risk ratio (ARR) of 0.42 (outcome: illegal drug use, cluster: strict parental control of TV) to 0.88 (outcome: violence, cluster: sports with parents). Active teens were less likely to have low self-esteem (eg, adolescents engaging in sports with parents, ARR: 0.73) and more likely to have higher grades (eg, active in school, ARR: 1.20).

CONCLUSIONS: Participation in a range of PA-related behaviors, particularly those characterized by high parental sports/exercise involvement, was associated with favorable adolescent risk profiles. Adolescents with high TV/video viewership were less likely to have positive risk behavior outcomes. Enhancing opportunities for PA and sport may have a beneficial effect on leading adolescent risk behaviors.

22. Built and Social Environments: Associations with Adolescent Overweight and Activity

Description:
Nelson, M.C., Gordon-Larsen, P., Song, Y., & Popkin, B.M. (2006). Built and social environments: Associations with adolescent overweight and activity. *American Journal of Preventive Medicine*, 31(2), 109-117.

BACKGROUND: Little is known about the patterning of neighborhood characteristics, beyond the basic urban, rural, suburban trichotomy, and its impact on physical activity (PA) and overweight. METHODS: Nationally representative data (National Longitudinal Study of Adolescent Health, 1994-1995, n = 20,745) were collected. Weight, height, PA, and sedentary behavior were self-reported. Using diverse measures of the participants' residential neighborhoods (e.g., socioeconomic status, crime, road type, street connectivity, PA recreation facilities), cluster analyses identified homogeneous groups of adolescents sharing neighborhood characteristics. Poisson regression predicted relative risk (RR) of being physically active (five or more bouts/week of moderate to vigorous PA) and overweight (body mass index equal or greater than the 95th percentile, Centers for Disease Control and Prevention/National Center for Health Statistics growth curves).

RESULTS: Six robust neighborhood patterns were identified: (1) rural working class; (2) exurban; (3) newer suburban; (4) upper-middle class, older suburban; (5) mixed-race urban; and (6) low-socioeconomic-status (SES) inner-city areas. Compared to adolescents living in newer suburbs, those in rural working-class (adjusted RR[ARR] = 1.38, 95% confidence interval [CI] = 1.13-1.69), exurban (ARR = 1.30, CI = 1.04-1.64), and mixed-race urban (ARR = 1.31, CI = 1.05-1.64) neighborhoods were more likely to be overweight, independent of individual SES, age, and race/ethnicity. Adolescents living in older suburban areas were more likely to be physically active than residents of newer suburbs (ARR = 1.11, CI = 1.04-1.18). Those living in low-SES inner-city neighborhoods were more likely to be active, though not significantly so, compared to mixed-race urban residents (ARR = 1.09, CI = 1.00-1.18).

CONCLUSIONS: These findings demonstrate disadvantageous associations between specific rural and urban environments and behavior, illustrating important effects of the neighborhood on health and the inherent complexity of assessing residential landscapes across the United States. Simple classical urban-suburban-rural measures mask these important complexities.

23. Shared Use of School Facilities With Community Organizations and Afterschool Physical Activity Program Participation: A Cost-Benefit Assessment

Description:
Kanters, M. A., Bocarro, J. N., Filardo, M., Edwards, M. B., McKenzie, T. L., & Floyd, M. F. (2014). Shared Use of School Facilities With Community Organizations and Afterschool Physical Activity Program Participation: A Cost-Benefit Assessment. *Journal of School Health*, 84(5), 302-309.

BACKGROUND: Partnerships between school districts and community-based organizations to share school facilities during afterschool hours can be an effective strategy for increasing physical activity. However, the perceived cost of shared use has been noted as an important reason for restricting community access to schools. This study examined shared use of middle school facilities, the amount and type of afterschool physical activity programs provided at middle schools together with the costs of operating the facilities.

METHODS: Afterschool programs were assessed for frequency, duration, and type of structured physical activity programs provided and the number of boys and girls in each program. School operating costs were used to calculate a cost per student and cost per building square foot measure. Data were collected at all 30 middle schools in a large school district over 12 months in 2010-2011.

RESULTS: Policies that permitted more use of school facilities for community-sponsored programs increased participation in afterschool programs without a significant increase in operating expenses.

CONCLUSIONS: These results suggest partnerships between schools and other community agencies to share facilities and create new opportunities for afterschool physical activity programs are a promising health promotion strategy.

24. Environmental Justice: Obesity, Physical Activity, and Healthy Eating

Description:
Taylor, W.C., Poston, W.S.C., Jones, L., & Kraft, M.K. (2006). Environmental Justice: Obesity, Physical Activity, and Healthy Eating. *Journal of Physical Activity and Health*, 3(S1), S30-S54.

Background: The term “environmental justice” refers to efforts to address the disproportionate exposure to and burden of harmful environmental conditions experienced by low-income and racial/ethnic minority populations.

Methods: Based on computer and manual searches, this paper presents a review of articles in the published literature that discuss disparities in physical activity, dietary habits, and obesity among different populations.

Results: This paper provides evidence that economically disadvantaged and racial/ethnic minority populations have substantial environmental challenges to overcome to become physically active, to acquire healthy dietary habits, and to maintain a healthy weight. For example, residents living in poorer areas have more environmental barriers to overcome to be physically active.

Conclusions: We propose a research agenda to specifically address environmental justice with regard to improving physical activity, dietary habits, and weight patterns.

- DOWNLOAD "Environmental Justice: Obesity, Physical Activity, and Healthy Eating" PDF (0.15 MB) Research Papers

25. **Childhood Obesity and Proximity to Urban Parks and Recreational Resources: A Longitudinal Cohort Study**

Description:
Wolch, J., Jerrett, M., Reynolds, K., McConnell, R., Chang, R., Dahmann, N., et al. (2011). Childhood Obesity and Proximity to Urban Parks and Recreational Resources: A Longitudinal Cohort Study. *Health & Place*, 17(1), 207-214.

The objective of the research was to assess how proximity to parks and recreational resources affects the development of childhood obesity through a longitudinal study. Data were collected on 3173 children aged 9-10 from 12 communities in Southern California in 1993 and 1996. Children were followed for eight years to collect longitudinal information, including objectively measured body mass index (BMI). Multilevel growth curve models were used to assess associations between attained BMI growth at age 18 and numerous environmental variables, including park space and recreational program access. For park acres within a 500 m distance of children's homes, there were significant inverse associations with attained BMI at age 18. Effect sizes were larger for boys than for girls. Recreation programs within a 10 km buffer of children's homes were significantly and inversely associated with achieved levels in BMI at age 18, with effect sizes for boys also larger than those for girls. We conclude that children with better access to parks and recreational resources are less likely to experience significant increases in attained BMI.

26. Environmental Barriers to Children's Outdoor Summer Play

Description:
Worobey, J., Lelah, L., & Gaugler, R. (2013). Environmental Barriers to Children's Outdoor Summer Play. *Journal of Behavioral Health*, 2(4), 362-365.

BACKGROUND: Childhood obesity rates have risen markedly in the U.S. over the last 25 years. Apart from the nutritional considerations that are well-documented, child overweight is associated with low levels of physical activity (PA). Although a number of studies address the environmental barriers to adult PA, research on children is limited. The purpose of this study was to explore the barriers to outdoor play in the summertime as perceived by children themselves.

METHODS: In the summer of 2012, 281 children ages 6-14 years were surveyed as to things that would keep them from playing outdoors.

RESULTS: The top three factors named by boys were bad weather, fear of gangs/crime, and preferring indoor activities like video games. Girls also named bad weather most often, followed by it being too hot outdoors, and fear of gangs/crime.

CONCLUSION: Children view unsafe neighborhoods and bad weather as the primary barriers to outdoor play. Allowing access to unused school gymnasiums may be a useful strategy for facilitating children's PA in the summer months.

27. Impact of Park Renovations on Park Use and Park-Based Physical Activity

Description:
Cohen, D. A., Han, B., Isacoff, J., Shulaker, B., Williamson, S., Marsh, T., et al. (2015). Impact of Park Renovations on Park Use and Park-Based Physical Activity. *Journal of Physical Activity and Health*, 12(2), 289-295.

BACKGROUND: Given the concerns about low rates of physical activity among low-income minority youth, many community-based organizations are investing in the creation or renovation of public parks to encourage youth to become more physically active. To what degree park renovations accomplish this goal is not known.

METHODS: We used the System for Observing Play and Recreation in Communities (SOPARC) to measure park users and their physical activity levels before and after 2 parks were renovated. We compared findings with 4 parks: 2 that were unrenovated parks and 2 that were undergoing renovation. We also surveyed park users and local residents about their use of the parks.

RESULTS: Compared with parks that had not yet been renovated, the improved parks saw more than a doubling in the number of visitors and a substantial increase in energy expended in the parks. Increased park use was pronounced in adults and children, but was not seen in teens and seniors. Park renovations were associated with a significantly increased perception of park safety.

CONCLUSIONS: Park improvements can have a significant impact on increasing park use and local physical activity.

28. Active Living for Rural Youth: Addressing Physical Inactivity in Rural Communities

Description:
Yousefian, A., Ziller, E., Swartz, J., & Hartley, D. (2009). Active Living for Rural Youth: Addressing Physical Inactivity in Rural Communities. *Journal of Public Health Management and Practice*, 15(3), 223-231.
Rural youth are at greater risk than urban youth for obesity and physical inactivity. Active living research incorporates an ecological approach to promoting physical activity (PA) by recognizing that individual behavior, social environments, physical environments, and policies contribute to behavior change. Active living research and interventions have been limited primarily to urban settings. Because rural communities have unique environmental features and sociocultural characteristics, this project combines insights from current active living models with more focused consideration of the physical and social realities of rural areas. In this study, we report on our efforts to develop, test, and refine a conceptual model describing the interaction between the individual and the environment as it enhances

or thwarts active living in rural communities. Our findings revealed a host of relevant "predisposing" and "enabling" factors, including sociodemographic, environmental, policy, and programmatic elements, that extend across the four domains of active living--transportation, recreation, occupation, and household. A one-size approach to PA promotion will not fit the needs of rural youth. Given the unique challenges that rural communities face, efforts to combat childhood obesity must consider rural residents a priority population. More research, interventions, and evaluations on ways to promote rural PA are needed.

29. The Role of Recreational Spaces in Meeting Physical Activity Recommendations among Middle School Students

Description:
Chomitz, V.R., Aske, D.B., McDonald, J., Howard, C., & Hacker, K. (2011). The Role of Recreational Spaces in Meeting Physical Activity Recommendations among Middle School Students. *Journal of Physical Activity and Health*, 8(Suppl. 1), 8-16.

BACKGROUND: There is growing recognition of the importance of recreational space utilization for promoting physical activity (PA) among youth.

METHODS: An cross-sectional study was conducted with a sample of 926 diverse 6th-8th grade students in Somerville, MA. Participants completed the 2007 Youth Risk Surveillance Survey (YRBS). Chi-square testing and logistical regression modeling were performed to predict meeting national PA recommendations for moderate, vigorous, and 60 minutes or more (60+) PA.

RESULTS: The participants reported meeting recommended PA levels for moderate (27%), vigorous (70%) and 60+ (21%) PA. In multivariate analysis, being male and speaking English were significantly associated with meeting all 3 PA recommendations. Recreational spaces significantly associated with meeting PA recommendations included neighborhood parks and walk/bike paths, playing fields and courts, and recreational centers. Recreational space utilization varied by gender, race/ethnicity, and language.

CONCLUSIONS: Recreational space utilization was an important predictor of meeting PA recommendations among middle school students. Our results showed that PA attainment and recreational space utilization varied by demographic characteristics. The role of each recreational space in predicting PA varied depending on the outcome used. This study demonstrates the potential use of YRBS data to inform resource allocation for PA promotion in diverse communities.

30. Physical Activity Among Adolescents: When Do Parks Matter?

Description:
Babey, S.H., Hastert, T.A., Yu, H., & Brown, E.R. (2008). Physical Activity Among Adolescents: When Do Parks Matter? *American Journal of Preventive Medicine*, 34(4), 345-348.

Background: The availability of places to engage in physical activity may influence physical activity levels. This study examined whether the relationship between physical activity and access to parks differs depending on adolescents' sociodemographic, housing, and neighborhood characteristics.

Methods: Data were analyzed from 4010 adolescents who responded to the 2003 California Health Interview Survey (CHIS). Analyses were conducted in 2005–2006. Five sets of logistic regressions were conducted to examine the relationship between physical activity and access to a safe park among adolescents living in (1) urban versus rural areas; (2) apartment buildings versus houses, (3) neighborhoods perceived as unsafe versus safe; (4) lower- versus higher-income families; and (5) adolescents who were Latino, African American, Asian, or white. Analyses also examined interactions between park access and these factors.

Results: Access to a safe park was positively associated with regular physical activity and negatively associated with inactivity for adolescents in urban areas, but not rural areas. Additionally, adolescents with access to a safe park were less likely to be inactive than those without access among those living in (1) apartment buildings, (2) unsafe neighborhoods, and (3) lowerincome families. Park access was not associated with regular physical activity for these groups. The association between park access and physical activity varied by race/ethnicity.

Conclusions: These findings suggest that the relationship between physical activity and access to parks differs depending on adolescents' sociodemographic, housing, and neighborhood characteristics, and that parks may be particularly important for promoting physical activity among urban adolescents.

- DOWNLOAD "Physical Activity Among Adolescents: When Do Parks Matter?" PDF (0.05 MB) Research Papers

***31. Promoting Active Living in Rural Communities**

Summary:
The Challenge: Rural children and adults have significantly higher rates of obesity than their urban counterparts, even after accounting for differences such as socioeconomic factors, eating behaviors, and physical activity. Higher rates of overweight and obesity among rural residents, even after accounting for these demographic and behavioral factors, suggests that rural environments themselves may somehow promote obesity.

Make an impact: Because rural residents make up 15 percent of the U.S. population, and face health challenges including high obesity rates, high levels of poverty, and limited access to healthcare providers and services, this population has been identified by some researchers as a "priority population" in the fight to reduce obesity and improve health overall.

What the findings are about: This research brief summarizes current research on elements of the rural built environment that may be related to obesity or physical activity. It also provides policy implications and a list of important rural-specific built environment measures that have been developed and tested for assessing active living supports, barriers and perceptions.

Key Findings and Recommendations:

- A major difference between urban and rural environments is that regular active transportation may be an unrealistic option for some rural residents. This increases the importance of active recreation opportunities in rural communities, and the need for investment in recreation amenities and transport options to help residents get to those amenities.

- Enhancing features of the rural environment, such as playgrounds, parks and recreational facilities, and diminishing barriers, including isolation, climate, safety fears, cost, lack of transportation, and lack of access to physical activity areas, are both key in addressing active living and obesity in rural communities.
- Building infrastructure (e.g., wider paved shoulders along rural roads, and pedestrian crossings) and implementing Complete Streets policies that accommodate the needs of pedestrians and bicyclists can help reduce barriers to being physically active.
- Especially where resources and budgets are limited, rural communities might consider starting with smaller changes (e.g., repainting existing crosswalks, adding pedestrian signs, updating and promoting Safe Routes to School and shared-use policies, reviewing town-wide snow-removal policies) to build momentum toward larger changes (e.g., widening street shoulders, adding or improving sidewalks, adding physical activity facilities to an existing park or building a new park, budgeting for late school buses). Communities can start by identifying and improving infrastructure and policies that already exist in schools, churches, worksites, and other community resources.
- Isolation, lengthy travel distances, and lack of transportation opportunities may be the largest barriers to being physically active in many rural areas, especially for those who live too far away to walk to school or work, for children who rely on adults for transportation and for others without access to a car. Expanding transportation options (e.g. late school buses, vans and ride-shares) can help get rural children and adults to physical activity facilities and programs.
- Creative, local solutions tailored to specific community culture, geography, climate and needs are necessary when addressing rural active living. Bringing rural community members and stakeholders together can help initiate conversations and positive changes in communities.
- It is important to consider the needs of rural subpopulations, including minorities, seniors, individuals with disabilities, children and others when designing environmental, programmatic, and policy changes related to active living.

Suggested Citations:
Yousefian Hansen, A. & Hartley, D. Promoting Active Living in Rural Communities. San Diego, CA: Active Living Research; 2015. Available at www.activelivingresearch.org.

- DOWNLOAD "Promoting Active Living in Rural Communities" PDF (0.50 MB) Research Briefs & Syntheses

32. Parks and Recreational Programs Help to Reduce Childhood Obesity

Summary:
The Challenge: Regular physical activity improves health and reduces risk for obesity, but children who live further from parks and recreational facilities are less active than those who live closer to such facilities.

Make an impact: Government, non-profit and private agencies can ensure that more funding for parks and recreation resources is allocated to communities with fewer of these resources.
What the findings are about: This policy brief summarizes findings from a ten-year longitudinal study showing that children who lived closer to parkland and recreational programs had much lower body mass index measurements at age 18 than comparable children who lived further away.

Key Findings and Recommendations:

- Having parkland and recreational programs nearby significantly reduced children's risk of overweight and obesity when they reached age 18. Recreational programming affected children's body mass index much more than parkland.
- Researchers estimated that if all children in the study had similar recreational programs near their homes, up to 9.5 percent would move from overweight to normal and approximately 2 percent would move from obese to overweight.
- Policy makers should not only increase parks and recreation spending, but to also ensure that more funding goes to neighborhoods with fewer parks and recreational programs.

Suggested Citations:
University of California, Berkeley. Parks and Recreational Programs Help to Reduce Childhood Obesity Policy Brief. July 2011. University of California Regents.

- DOWNLOAD "Parks and Recreational Programs Help to Reduce Childhood Obesity" PDF (0.33 MB) Research Briefs & Syntheses

33. Power of Trails for Promoting Physical Activity in Communities

Summary:
The Challenge: Obesity rates in the U.S. have skyrocketed in recent decades. Regular physical activity is an important strategy for reversing the obesity epidemic, and evidence has shown that community trails are a cost-effective means for promoting physical activity.

Make an impact: Community trails can provide children and adults with a low-cost way to be physically active and potentially reduce medical expenses.

What the findings are about: This brief highlights trail characteristics that encourage regular trail use and examines how trails influence physical activity among various populations.

Key Findings and Recommendations:

- Evidence suggests that trails promote physical activity in adults. For children, living close to park areas including nature trails and bike paths is also associated with greater levels of physical activity.
- Convenient location, good surface condition and certain trail amenities (such as drinking fountains, restrooms and parking lots) are among the trail characteristics that are positively associated with trail use.
- Public health, transportation, planning, and parks and recreation officials should collaborate to identify populated areas suitable for building trails that will support walking, bicycling and other modes of recreational physical activity and active transport.

Suggested Citations:
Troped P. The Power of Trails for Promoting Physical Activity in Communities. A Research Brief. Princeton, NJ: Active Living Research, a National Program of the Robert Wood Johnson Foundation; January 2011. Available from: www.activelivingresearch.org.

- DOWNLOAD "Power of Trails for Promoting Physical Activity in Communities" PDF (0.69 MB) Research Briefs & Syntheses

***34. Do All Children Have Places to Be Active? Disparities in Access to Physical Activity Environments in Racial and Ethnic Minority and Lower-Income Communities**

Summary:
The Challenge: Children who live in lower-income communities and communities of color are more likely to be overweight or obese than White children and children from more affluent backgrounds. They also are likelier to live in neighborhoods with barriers to physical activity such as lower-quality sidewalks, fewer parks and greater danger from crime and traffic. Regular physical activity can improve health and reduce the risk of obesity.

Make an impact: Walkable neighborhoods; safe, clean, and attractive environments; and access to parks and recreational resources can encourage physical activity among all groups, including those at high risk for obesity.

What the findings are about: This synthesis examines the growing body of evidence showing that racial and ethnic minority and lower-income communities often lack environments that support physical activity.

Key Findings and Recommendations:

- Racial and ethnic minority and lower-income youth tend to get less recreational physical activity than White youth or youth from higher-income families.
- Racial and ethnic minority and lower-income people are more likely to live in neighborhoods that lack resources, safety and aesthetic appeal that promote walking and other physical activities.
- Policy makers should pursue strategies that improve walkability; access to parks, green space and recreational facilities; and neighborhood safety for ethnic minority and lower-income communities.

FACT SHEET:

- An abbreviated Fact Sheet, Do All Children Have Places to Be Active? (May 2012), is available that highlights the research synthesis' main findings.

Active Living Research

Using Evidence to Prevent Childhood Obesity and Create Active Communities

FACT SHEET
May 2012

Do All Children Have Places to be Active?

Childhood obesity is one of the country's most significant health problems. Many efforts to prevent childhood obesity aim to make it easier for children to be active in their communities. Neighborhoods that have well-maintained sidewalks, bicycle lanes, and parks and recreation resources, and that are clean and safe from crime and traffic, generally promote more physical activity. Yet many communities of color and lower-income communities lack such features and amenities.

This fact sheet highlights research showing that racial and ethnic minorities and lower-income people live in environments that make being active more difficult and less appealing. These disparities contribute to the low rates of physical activity and higher rates of obesity among children of color and lower-income children.

Lower-income communities and communities with more residents of color generally lack clean and well-maintained sidewalks, trees, appealing architecture and nice scenery—factors that promote walking and other forms of physical activity.

- Across the nation, 81 percent of American Indian-Alaskan Native women and 54 percent of African-American women reported that their neighborhoods lack sidewalks, compared with 47 percent of White women.[1]
- A 2001 study found that enjoyable scenery was the most important factor in promoting physical activity among lower-income adults, yet they were nearly 16 percent less likely than higher-income adults to have attractive scenery in their neighborhoods.[2]
- In North Carolina, American Indians were significantly less likely to live in communities with sidewalks and streetlights than Whites. They were also significantly less likely to be active.[3]

FAST FACTS

- Racial and ethnic minority and lower income children are more likely to be overweight or obese.[23]
- Lower-income and African-American communities have significantly less parks and green spaces than White and wealthier communities.[24]
- African-American and Latino adolescents are more likely to live in high-crime areas than are White teens.[25]

This fact sheet highlights findings from the research synthesis, *Do All Children Have Places to Be Active? Disparities in Access to Physical Activity Environments in Racial and Ethnic Minority and Lower-Income Communities.*

Full research synthesis is available at:
http://www.activelivingresearch.org/disparities

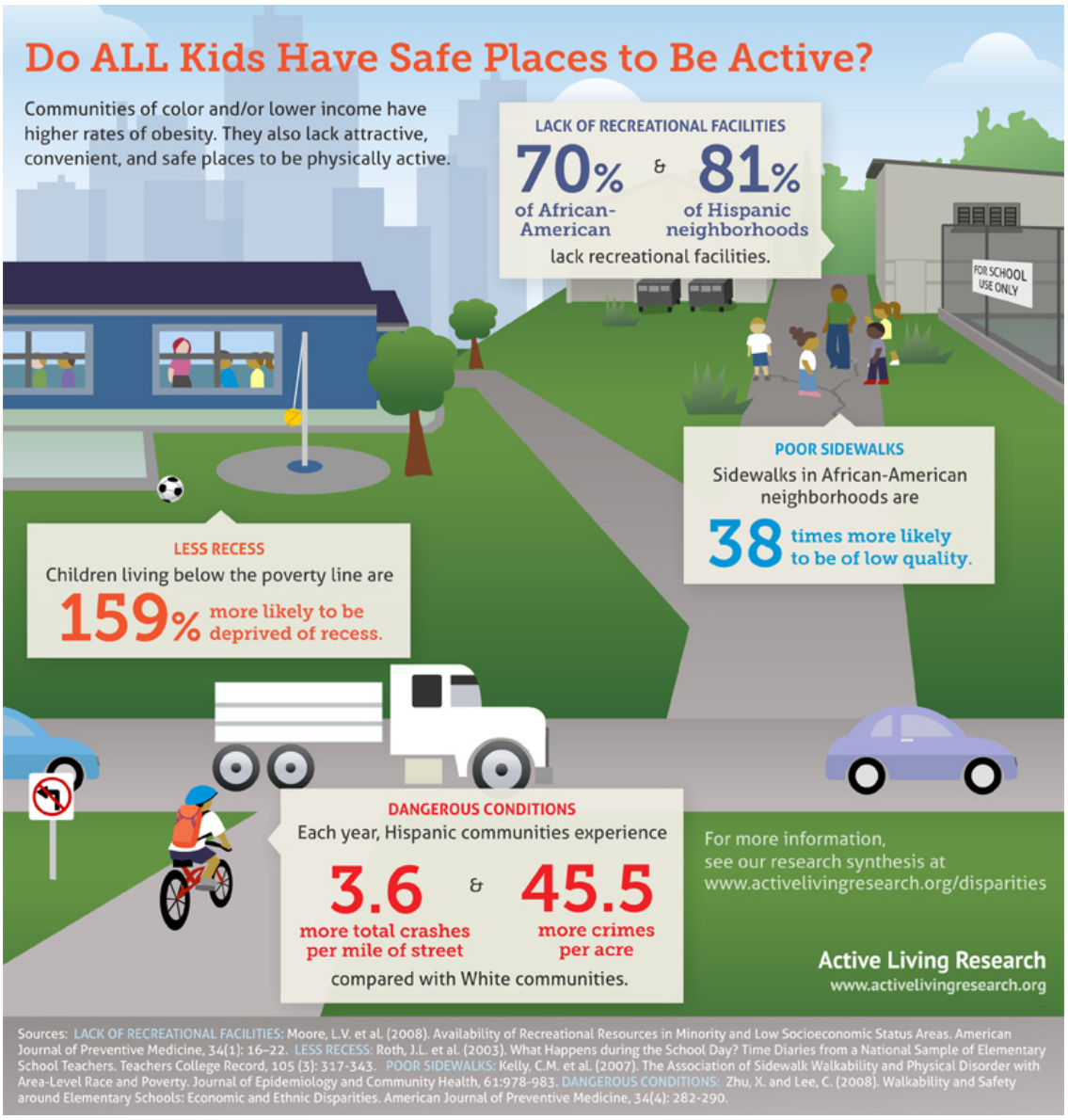
For more information on Active Living Research, visit: www.activelivingresearch.org/

A national program of the Robert Wood Johnson Foundation, with direction and technical assistance provided by the University of California, San Diego.

Robert Wood Johnson Foundation

INFOGRAPHIC:

- Findings presented in this brief are also available in the related Do All Kids Have Safe Places to Be Active? infographic, available in English and Spanish.



Sources: LACK OF RECREATIONAL FACILITIES: Moore, L.V. et al. (2008). Availability of Recreational Resources in Minority and Low Socioeconomic Status Areas. American Journal of Preventive Medicine, 34(1): 16–22. LESS RECESS: Roth, J.L. et al. (2003). What Happens during the School Day? Time Diaries from a National Sample of Elementary School Teachers. Teachers College Record, 105 (3): 317-343. POOR SIDEWALKS: Kelly, C.M. et al. (2007). The Association of Sidewalk Walkability and Physical Disorder with Area-Level Race and Poverty. Journal of Epidemiology and Community Health, 61:978-983. DANGEROUS CONDITIONS: Zhu, X. and Lee, C. (2008). Walkability and Safety around Elementary Schools: Economic and Ethnic Disparities. American Journal of Preventive Medicine, 34(4): 282-290.

Suggested Citations:
Taylor W and Lou D. Do All Children Have Places to Be Active? Disparities in Access to Physical Activity Environments in Racial and Ethnic Minority and Lower-Income Communities. A Research Synthesis. Princeton, NJ: Active Living Research, a National Program of the Robert Wood Johnson Foundation; November 2011. Available from: www.activelivingresearch.org.

- DOWNLOAD "Do All Children Have Places to Be Active? Disparities in Access to Physical Activity Environments" PDF (0.72 MB) Research Briefs & Syntheses

35. The Community Guide: What Works Fact Sheet: Increasing Physical Activity
This brochure summarizes information in The Guide to Community Preventive Services (The Community Guide) about intervention approaches to increase physical activity. It is designed to help public health

professionals find proven intervention approaches—including programs, services and other interventions—to increase physical activity. It can help decision makers in both public and private sectors make choices about what intervention approaches are best for their communities.
https://www.thecommunityguide.org/sites/default/files/assets/What-Works-Factsheet-PhysicalActivity.pdf

36. The Community Guide: Physical Activity: Creating or Improving Places for Physical Activity
Summary of CPSTF Finding

The Community Preventive Services Task Force (CPSTF) recommends the creation of or enhanced access to places for physical activity to increase physical activity and improve fitness.
Intervention

In these types of interventions, worksites, coalitions, agencies, and communities work together to change local environments to create opportunities for physical activity. Changes can include creating or improving walking trails, building exercise facilities, or providing access to existing facilities.

CPSTF Finding and Rationale Statement
Read the CPSTF finding [PDF - 133 kB].
https://www.thecommunityguide.org/findings/physical-activity-creating-or-improving-places-physical-activity

APPENDIX B

PROGRAMS & FUNDING

Conservation Education

9/4/2019

Tennessee Forestry Camp

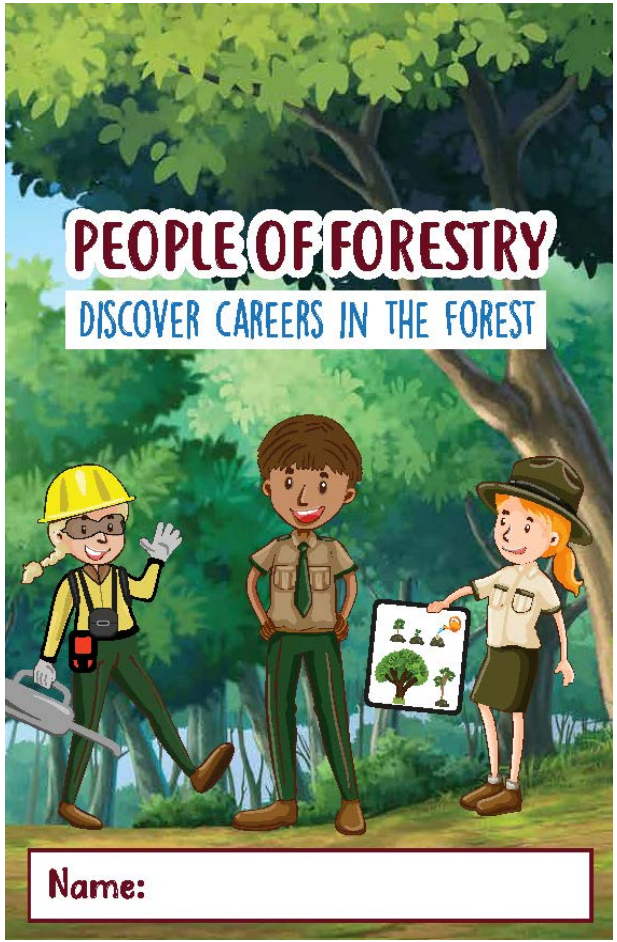
FFA Forestry Contest

Envirothon

Tennessee Residence Tree Trail

#Healthy Trees Healthy Lives

People of Forestry:
Discover Careers in the Forest



https://youtu.be/dMHYL-4ZfUA

Building Capacity Through Partnerships

- PLT
- Teacher Conservation Workshops
- Tennessee Healthy Hardwoods
- County/Local Field Days

Department of Agriculture | Forestry

Protect TN Forests.org

Facebook: @ProtectTNForests
Twitter: @TN_Forests
Instagram: @ProtectTNForests

Contact

Tim.R.Phelps@tn.gov
615-428-5913

County	Program Name	Region	Brief Description	Funding Source	Operator	Link
Anderson	Kids in Action Junior Master Gardeners	East	Gardening	Grants/Fees	Children's Museum of Oak Ridge	http://imgkids.us/contact/
Anderson	Wonderful Webs	East	Nature Education	Grants/Fees	Children's Museum of Oak Ridge	
Anderson	Awesome Autumn	East	Nature Education	Grants/Fees	Children's Museum of Oak Ridge	
Anderson	Kids go Green!	East	Gardening	Grant from the Institute of Museum and Library Services Museums for America Grant	Children's Museum of Oak Ridge	https://childrensmuseumofoakridge.org/kids-go-green/
Anderson	Kids in Action	East	Nature Education	Grants/Fees	Children's Museum of Oak Ridge	https://childrensmuseumofoakridge.org/kids-in-action/
Anderson	Walking Classroom	East	Walking	Coordinated School Health	Clinton City Schools	https://www.thewalkingclassroom.org/our-program/
Anderson	Running Club	East	Running	Coordinated School Health	Clinton City Schools	http://www.clintonschools.org/
Anderson	Family Fun Night	East		Clinton City Schools	Clinton City Schools	http://www.clintonschools.org/
Anderson	Kindergarten Walking Tour	East	Walking	Clinton City Schools	Clinton City Schools	http://www.clintonschools.org/
Anderson	5th/6th Walk to Museum	East	Walking	Clinton City Schools	Clinton City Schools	http://www.clintonschools.org/
Anderson	6th Grade Park Day	East	Free Play	Clinton City Schools	Clinton City Schools	http://www.clintonschools.org/
Anderson	6th Grade Environmental Camp	East	Nature Education	Fees	Clinton City Schools	http://www.clintonschools.org/
Anderson	End of Year Celebrations	East	Free Play	Clinton City Schools	Clinton City Schools	http://www.clintonschools.org/
Anderson	3rd Grade Farm Day	East	Nature Education	Clinton City Schools	Clinton City Schools	http://www.clintonschools.org/
Bedford	Community Run/Walk Club	South Central	Run club that both parents and children can participate in		Local Volunteers	
Bedford	Run/Walk Club	South Central	Run club at Thomas Magnet School			
Blount	Girls in Science Camp	East	Nature Education - summer camp	Fees/National Park	Great Smoky Mountains Institute at Tremont	https://gsmit.org/event/girls-in-science-camp-2020/
Blount	Wilderness Adventure Trek	East	Backpacking/Hiking - summer camp	Fees/National Park	Great Smoky Mountains Institute at Tremont	https://gsmit.org/event/wilderness-adventure-trek-i-2020/
Blount	Discovery Camp	East	Nature Education - summer camp	Fees/National Park	Great Smoky Mountains Institute at Tremont	https://gsmit.org/event/discovery-camp-i-2020/
Blount	Backcountry Ecological Expedition	East	Nature Education - summer camp	Fees/National Park	Great Smoky Mountains Institute at Tremont	https://gsmit.org/event/backcountry-ecological-expedition-2020/
Blount	Firefly Camp	East	Nature Education - one night summer camp for child and parent	Fees/National Park	Great Smoky Mountains Institute at Tremont	https://gsmit.org/event/firefly-camp-2020/
Blount	Teen High Adventure	East	Backpacking/Hiking	Fees/National Park	Great Smoky Mountains Institute at Tremont	https://gsmit.org/event/teen-high-adventure-2020/
Carter	Little Bellas Mountain Biking	Northeast	mountain biking program for girls to learn new skills and build confidence in a positive, fun environment	Tuition and some commercial sponsors	Little Bellas	https://littlebellas.com/camp/johnson-city-tn-weekly-program/
Carter	Junior Ranger (Roan Mountain State Park)	Northeast	outdoor camps for ages 6-14 to inspire a love of nature and outdoors	TDEC/registration fees	Tennessee State Parks	https://tnstateparks.com/about/special-events/junior-ranger-camp/#/?holiday=junior-ranger-camp
Coffee	Walking Classrooms	South Central	Students listen to lessons as they walk on a walking track		Westwood and College Street Elementary Schools	https://www.thewalkingclassroom.org/our-program/
Cumberland	Summer Youth Camp	Upper Cumberland	summer camp including trips to the park, the pool and nearby state parks	THDA and HUD	Crossville Housing Authority	https://crossvillehousing.org/Youth-Programs
Cumberland	Clyde York 4-H Center Summer Camp	Upper Cumberland	overnight summer camp in the woods	UT Extension	UT Extension	https://extension.tennessee.edu/clydeyork4hcenter/Pages/4-H%20Camp.aspx
Cumberland	Learning Works with Crossville Housing Authority	Upper Cumberland	After School Program/Physical Activity Club	THDA and HUD	Crossville Housing Authority program directors or the health dept.	https://crossvillehousing.org/Youth-Programs
Cumberland	Fit 20	Upper Cumberland	5k series for families	Healthier TN Crossville	Cumberland County and City of Crossville Parks	https://www.healthiertncrossville.org/join-our-race-series
Davidson	The Bike Workshop	Metro	Kids participate in workshops for 6-8 weeks to build their own custom bikes, learn to maintain it, and become an advocate for physical activity	TDH Access to Health grant	Oasis Center, Inc.	https://oasiscenter.org/for-youth/the-bike-workshop
Dayton City	Health & Wellness Storybook Trail Project, and outdoor classroom	Southeast	Nature/health themed story signage on a walking path - this district is using their walking track and outdoor classroom space			
Fentress	Big South Fork Youth Conservation Corps	Upper Cumberland	Work-learn-earn program	NPS and USDA Forest Service	TN Dept. of Education	https://www.nps.gov/biso/learn/news/big-south-fork-youth-conservation-corps.htm
Greene	Girls on the Run	Northeast	for 3rd - 8th grade girls to develop skills and an appreciation for health and fitness	individual donors and partners	Girls on the Run	https://www.gotrnetn.org/
Hamblen	Healthy Kids Running Series	East	Run Club	Non-Profit	Volunteers	https://runsignup.com/Race/71024/Sponsor/180132
Hamblen	Bio Lab	East	Nature Education	Non-Profit	Volunteers	
Hamblen	Citizen Science	East	Nature Education	Non-Profit	Volunteers	https://www.outdoorlearninginitiative.com/citizen-science.html
Hamblen	Outdoor Adventures	East	Nature Education	Non-Profit	Volunteers	
Hamblen	Leave No Trace	East	Nature Education	Non-Profit	Volunteers	https://lnt.org/
Hamblen	BMX	East	Mountain Biking Club	Unknown	Morristown BMX	
Hickman	Marathon Kids	South Central	running clubs at various elementary and middle schools		TN Coordinated School Health	https://marathonkids.org/
Hickman	Cross-Country	South Central				
Hickman	Track and Field	South Central				
Jackson	Camp Discovery	Upper Cumberland	summer camp oriented towards children with special needs	Jaycees and individuals	Jaycees	https://www.jayceecamp.org/
Jefferson	Walking the Appalachian Trail	East	Homeroom classs track miles walked during school hours (on a walking path) to reach milestones on the AT. Teaching interdisciplinary connections with incentives for milestones			
Johnson	Girls on the Go	Northeast				
Lawrence	Annual Healthy Kids Summit	South Central	Event for K-6th grade and their families with informational booths and activities		Lawrence County Health Council	
Lewis	Annual Special Olympics Field Day	South Central				
Lewis	Cross Country	South Central				
Manchester City	Walking Classrooms	South Central	Students listen to lessons as they walk on a walking track - featuring guest walkers		TN Coordinated School Health	
Marshall	Community Run/Walk Club	South Central				
Marshall	Run/Walk Club	South Central			Westhills Elementary School	
Marshall	Run/Walk Club	South Central			Chapel Hill Elementary School	
Maury	June Jam	South Central	annual event where students receive education and take part in several outdoor activities		Health Department partners with Boys and Girls Club	
Maury	Cross Country	South Central				
McNairy	Oudoor painted play spaces	Southwest	Painted mirror me, hopscotch, four square, basketball court, and others on outdoor play aresa and outside classroom doors exiting the building		TN Coordinated School Health	
Monroe	Monroe-n-Motion	East	Exercise Club	1801 Grant	Monroe County Schools CSH	https://www.tn.gov/education/active-academics/active-students--active-learners/active-academics-before-after-schoo.html
Monroe	Resurrection Run Club	East	Run Club	Unknown	Sweetwater City Schools	
Monroe	Junior Ranger (Fort Loudon State Historic Park)	East	Campers join British army and learn about military tactics in a state park	TDEC/registration fees	Tennessee State Parks	https://tnstateparks.com/about/special-events/junior-ranger-camp/#/?holiday=junior-ranger-camp
Perry	21st Century After-School Program	South Central	after-school program, students walk 30 minutes each day, 5 days a week		Linden Elementary and Linden Middle Schools	
Pickett	Pioneer Camp (Cordell Hull Birthplace State Park)	Upper Cumberland	Offers children a perspective of what life was like in the 1800s	TDEC/registration fees	Tennessee State Parks	https://tnstateparks.com/about/special-events/junior-ranger-camp/#/?holiday=junior-ranger-camp
Putnam	School Age Care	Upper Cumberland	summer day-care including outdoor activities	parent tuition funded	TN Dept. of Education	http://www.pcsstn.com/departments/operations_and_support_services/school_age_care
Putnam	Summer day camp and "adopt a highway type volunteering"	Upper Cumberland	summer camp and year round volunteering	THDA/HUD	Highlands Residential Services	
Putnam	Summer Basketball Camp	Upper Cumberland	Summer day camp for children ages 7-15 who want to improve basketball skills	Tuition	Leisure Services and 1Shot Athletics	https://www.cookeville-tn.gov/293/Summer-Camp
Putnam	Recreational Day Camp	Upper Cumberland	summer day camp	City of Cookeville and Individuals	City of Cookeville	https://www.cookeville-tn.gov/293/Summer-Camp
Putnam	Putnam County YMCA Summer Camp	Upper Cumberland	summer camp	YMCA and Individuals	Putnam County YMCA	https://putnamymca.org/youth-opportunity-programs/
Sullivan	Girls on the Run	Northeast	for 3rd - 8th grade girls to develop skills and an appreciation for health and fitness	individual donors and partners	Girls on the Run	https://www.gotrnetn.org/
Sullivan	Girls on the Run	Northeast	for 3rd - 8th grade girls to develop skills and an appreciation for health and fitness	individual donors and partners	Girls on the Run	https://www.gotrnetn.org/
Sullivan	Morning Mile	Northeast	Morning run/walk program at schools every day before school starts	sponsors and donors	Morning Mile	https://morningmile.com/
Sumner	School Garden/greenhouse	Mid Cumberland	Union elementary - Integrate STEM and PA in the school day		Union Elementary	
Sumner	Run/Fit Clubs	Mid Cumberland	10+ walking/activity groups before/after school, including marathon kids			
Sumner	Walking tracks	Mid Cumberland	Installed at all but 1 elementary schools and some middle schools	Project Diabetes/CSH	TN Coordinated School Health	
Sumner	Math & Movement	Mid Cumberland	Skip-counting stencils painted outside	TN Coordinated School Health	TN Coordinated School Health	
Sumner	Walking classroom	Mid Cumberland	Oakmont Elementary - Students listen to lessons as they walk on a walking path		TN Coordinated School Health	
Unicoi	Footsteps with Foodies	Northeast	hiking and nutrition class	TDH	Unicoi Unites	https://www.johnsoncitypress.com/Health-Fitness/2019/01/06/Unicoi-Unites-for-healthier-eating-and-fitness.html
Van Buren	Read to be Ready	Upper Cumberland	summer youth program in Van Buren, part of which involves swimming and hiking at Fall Creek Falls State Park	TN Dept. of Education	TN Dept. of Education	
Warren	Bike McMinnville	Upper Cumberland	recreational bike riding groups for kids and adults around McMinnville	volunteer run/no funding	Bike McMinnville group	https://www.mainstreetmcminnville.org/bike-mcminnville
Warren	Junior Ranger (Rock Island State Park)	Upper Cumberland	outdoor camps for ages 6-14 to inspire a love of nature and outdoors	TDEC/registration fees	Tennessee State Parks	https://tnstateparks.com/about/special-events/junior-ranger-camp/#/?holiday=junior-ranger-camp
Warren	Mini Junior Ranger (Rock Island State Park)	Upper Cumberland	introduces young children to rewards of being outside	TDEC/registration fees	Tennessee State Parks	https://tnstateparks.com/about/special-events/junior-ranger-camp/#/?holiday=junior-ranger-camp
Washington	Storybook Trail	Northeast	10 posts installed at Ridgeview Elementary track - kickoff book was "I Am Yoga"		CSH, Health Council and local community partners	
Washington	Girls on the Run	Northeast	for 3rd - 8th grade girls to develop skills and an appreciation for health and fitness	individual donors and partners	Girls on the Run	https://www.gotrnetn.org/
Washington	Up & At 'Em pump track	Northeast	programming to address increased physical activity, socialization, and mentorship needs among disadvantaged youth at pump track funded by TDH	TDH Access to Health grant	Up & At 'Em	
White	Camp Clements	Upper Cumberland	FFA summer camp	individuals and FFA	FFA	https://tnffa.org/camp-clements
Wilson	Junior Ranger (Cedars of Lebanon State Park)	Mid Cumberland	outdoor camps for ages 6-14 to inspire a love of nature and outdoors	TDEC/registration fees	Tennessee State Parks	https://tnstateparks.com/about/special-events/junior-ranger-camp/#/?holiday=junior-ranger-camp

Grant name	Granting Agency	What's it for?	Who can apply/ Eligibility requirements	How much?	What's the match?	Deadline	Competitiveness? (high, med, low)	notes	Grant Website
Trails and Multi-modal Transport Oriented									
Community Transportation Planning Grant	TDOT	Varies. Community mobility plans, corridor studies, multi-modal studies, major street plans,	Cities outside of MPOs	up to $250k	10%	varies by year	low	Lafayette $75k in	https://www.tn.gov/tdot/long-range-planning-home/longrange-oct/longrange-planning-grant.html
Multi-Modal Access Grants	TDOT	Multi-modal infrastructure improvements along state routes	Cities outside of MPOs / must be along state routes	up to $1 million	5%	varies by year	medium		https://www.tn.gov/tdot/multimodal-transportation-resources/multimodal-access-grant.html
Surface Transportation Block Grant	TDOT	Transportation system improvements	Automatically granted to municipalities >5,000	varies	0%-20%	n.a.	n.a. (automatically		https://www.tn.gov/content/dam/tn/tdot/programdevelopment/localprograms/funding-options/STBGProgram.pdf
Transportation Alternatives Program (TAP)	TDOT	Main funding source for general pedestrian and bicycling infrastructure projects.	Local governments	soft cap of $1	20%	July 1-October 3	medium / low for	Dedicated funding	https://www.tn.gov/tdot/program-development-and-administration-home/local-programs/tap.html
People for Bikes grants	People for Bikes	Making your community bike friendly. Broad grants	Local governments (or gov't agencies working locally) and	$10,000	50%	2 cycles per year.	high		http://peopleforbikes.org/grant-guidelines/
Recreational Trails Programs (RTPs)	TDEC	Land acquisition for trails, trail maintenance, trail construction, trail rehabilitation and for	Local, state and federal land managing organizations as	$25k-$250k	20%	early spring of	medium		https://www.tn.gov/environment/program-areas/res-recreation-educational-services/res-recreation-educational-services-grants0.html
Jeff Roth Cycling Foundation grants	Jeff Roth Cycling Foundation	Making your community bike friendly. Must go towards a specific project or program	bike-supporting non-profits	$1,000	0	2019 deadline is F	med-high (6/year)	partner with Bike-W	https://www.jeffrothcyclingfoundation.org/bike_grants.html
Community Development Block Grants	TNECD for HUD	Providing essential, pressing community development needs in underserved areas. Can go towa	cities and counties / All CDBG projects must meet one of t	up to $300k for livat	varies, but about 20% for	usually February	med-high	only 10% go towards	https://www.tn.gov/ecd/community-development-block-grant/cdbg/cdbg-about.html
America Walks Community Change Grants	America Walks	Improving community walkability---eligible for program, policy, or environmental projects	Non-profits or local governments	$1,500	0	November in 2018	High		https://americawalks.org/community-change-grants/
AAA Traffic Safety Grant	AAA	improving traffic safety for all road users through activities, programs and training	tax-exempt organizations	unknown, probably	under $10k	15-Mar	low-medium	2019 TN Contact: Megan Cooper, MACooper@AAAsouth.com; phone: 615-716-7243	
Parks and Placemaking									
Local Parks and Recreation Funds (LPRFs)	TDEC	Land acquisition, indoor and outdoor recreation facilities, trail development	city or county governments	up to $1 million	50%	early spring of	med-high		https://www.tn.gov/environment/about-tdec/grants/grants-recreation-grants/grants-local-parks-and-recreation-fund-lprf-grants.html
Creative Placemaking	TN Arts Commission	Art that makes places more inviting	local governments, quasi-governmental entities, 501c3s /	$8,000 unless joint	20%	before Jan 22,	at least 2 to	contact Shannon	http://tnartscommission.org/grants/community-arts-dev/creative-placemaking-grants-competition/
Arts Build Communities	TN Arts Commission	Getting art to happen in our communities (mainly programs and events, but also art in public	local governments, 501c3, higher ed if benefits public /	$500 to $2,500	50%	April 1- July 2	medium	contact Shannon	http://tnartscommission.org/grants/community-arts-dev/arts-build-communities-grant-2/
Commit to Health	NPRA, the Walmart Foundation	Increasing healthy meals served to children, improving nutrition literacy in kids, and	Applicants must: be a local government agency, serve	$25,000	0%	before March	20	seems more likely	https://www.nrpa.org/our-work/partnerships/initiatives/commit-to-health/commit-to-health-today/
Tourism Enhancement Grant	TN Dept of Tourist Development	Developing and improving tourism assets for tourism-related economic impact	city or county governments / one application per county; n	up to $75,000	varies by economic tier	n.a.	low-medium	funding may have ex	https://www.tn.gov/tourism/statewide-partners/tourism-enhancement-grant.html
Kaboom	Kaboom!	Playgrounds	Just about any group / Must be a public park, use	$15,000	minimum of 37.5% + site	rolling	high		https://kaboom.org/grants/build_it_yourself
Play Space	National Parks and Recreation Asso	Inclusive play spaces	Local Parks and Rec Agencies / administer surveys and coll	$30k in 2018	50%	yearly before marc	High - 25 nationwid	Nashville and Chatta	http://www.nrpa.org/our-work/partnerships/initiatives/meet-me-at-the-park/
REI Foundation Grants	Recreational Equipment Inc. (REI)	Improving access to nature through preserving/improving places and through programs	Invitation only by local REI managers (Brentwood, Knoxville	usually <$15,000	0%	rolling	medium-high		https://www.rei.com/stewardship/creating-access
The Explore Fund	The North Face	Increasing participation in the outdoors and working in innovative ways to protect the environr	501c3s	$5,000-$25,000	0%	4/2/2019	high	looking to enable ne	https://www.thenorthface.com/about-us/outdoor-exploration/explore-fund.html
Acres for America	National Fish & Wildlife Foundation	Providing access for people to enjoy the outdoors; and, ensure the future of local economies th	501c3s, state and local governments, Indian tribes, and ed	$500,000	unknown	late April yearly	medium-high		https://www.nfwf.org/acresforamerica/Pages/2018rfp.aspx
The Paddle Nation Project	Outdoor Foundation and outdoor In	Improving paddling access and education programs for kids	501c3s	$5,000	0%	mid April	n.a.		https://www.cybergrants.com/pls/cybergrants/quiz_display_question?x_gm_id=44948x_quiz_id=51708x_order_by=1
BlueCross Healthy Places	BCBSTN	Making active, healthy public spaces (likely parks) / can't go towards purchasing land, staffing	Government entities and non-profit organizations with	up to ~$2.5 million	0	31-Aug-19	high	project will be	https://www.bcbst.com/about/in-the-community/healthy-places/funding-criteria.shtml
2019 NEEF Health and Natural Environment	National Environmental Education	Mobilizing a diverse community of volunteers, primarily youth and hispanic families, and	501c3s with an existing connection to Forest Service	$4,000	0	1-Mar-19	unknown, but		https://www.neefusa.org/resource/2019-neef-health-and-natural-environment-grant-open
KEEN Effect Grants	KEEN	Inspiring youth outdoor participation and engaging diverse audiences through innovative and	501c3s	$10,000 or $20,000,	n.a. but no apparent	end of February	high - nationwide		
Climbing Conservation Grant Program	Access Fund	Preserving or enhancing climbing access and opportunities and conserving the climbing	nearly anyone (even individuals)	usually <$4,000 but	>=50% encouraged along	March 1 and			https://www.accessfund.org/take-action/apply-for-a-grant
Cornerstone Conservation Grant	American Alpine Club, REI and Clif	creates healthy climbing landscapes, promotes respect for places people climb, and	Appears fairly open, but must at least partner with	up to $8,000	some match encouraged,	15-Aug	unknown, but		https://americanalpineclub.org/cornerstone-conservation-grant/
Challenge America	National Endowment for the Arts	Supporting small and mid-sized organizations for projects that extend the reach of the arts to	501c3s, local or state government units/ Must have 3+	$10,000	$10,000	11-Apr	unknown, but		https://www.arts.gov/grants-organizations/challenge-america/grant-program-
TN Disability Coalition Small Grants	TN Disability Coalition	build capacity in the disability community to serve individuals with disabilities and their	501c3s and government entities	$10,000	0	LOIs due March	uncertain - 10	use drop-down	https://www.tndisability.org/smallgrants
BOGS Impact Fund	BOGS	outdoor education opportunities for low income and underserved communities	501c3s	$10,000/yr for 3	0	22-Jul	unknown - 1st time		https://www.cybergrants.com/pls/cybergrants/quiz_display_question?x_gm_id=44948x_quiz_id=76648x_order_by=1
Schools									
Fuel up to play 60	NFL and National Dairy Council	Nutrition and Physical activity improvements (cannot go towards water bottle filling stations	Schools / enroll in Fuel Up to Play 60 for the school year,	<=$4,000	0	Deadlines in	medium	don't think CSH	https://www.fueluptoplay60.com/funding/general-information
Donors Choose	individuals	Teachers' equipment and funding for programs	Teachers	no higher limit, but	0	rolling	low		https://www.donorschoose.org/teachers
School Breakfast Grant Program	Action for healthy kids	Starting or expanding school breakfast participation	schools	<=$3,000 for	0	5-Apr	n.a.	looks like they may	http://www.actionforhealthykids.org/tools-for-schools/apply-for-grants
Game on Grants	Action for healthy kids	funding and resources for schools to improve or introduce new nutrition and PA programs	schools	$1,000	0	5-Apr	n.a.		http://www.actionforhealthykids.org/tools-for-schools/apply-for-grants
Technical Assistance and Training									
Safe Routes to Parks Activating Communities	Safe Routes Partnership	Developing an action plan and executing it to deliver safe non-car routes to parks	community based non-profits	expert support,	none	early December	n.a.		https://www.saferoutespartnership.org/healthy-communities/saferoutestoparks/2019
Walking College	America Walks	Developing walking and walkable community advocates	anyone	Covers training,	no match	end of February	n.a.		https://americawalks.org/walkingcollege/
Recreation Economy for Rural Communities	EPA	Bringing in planning TA to help communities bring together local residents and other	local governments, tribes, and non-profit institutions.	?	?	May 31, 11:59 EST	n.a.		https://www.epa.gov/smartgrowth/recreation-economy-rural-communities-2019-application
General									
Project Diabetes	TDH	Getting communities more active and eating healthier through policy, systems and environmen	Government entities and non-profits	$450,000 type A, $3	0	early/mid-spring e	medium-high		https://www.tn.gov/health/health-program-areas/mch-diabetes/d/project-diabetes.html
AHHABE Grants (non-competitive)	TDH	Healthy built environments	County Governments	$20,000	0	spring odd years	n.a.		http://tdh.maps.arcgis.com/apps/Shortlist/index.html?appid=82b225d0d913b4d07b817ac80539cfad2
AHHABE Grants (competitive)	TDH	Healthy built environments	any public or non-profit / provide direct public benefit	$90,000 ($5k for	0	late fall even	medium (~30%	I can't help apply	https://www.tn.gov/health/funding-opportunities.html
Tennessee Downtowns	TN ECD	Downtown revitalization projects following at least one of the four points of the Main Street Pr	TN Downtown Groups / long list, see website	$15,000	0	next round early 2	medium - dependent	on competitive dow	https://www.tn.gov/ecd/rural-development/tennessee-main-street/tennessee-downtowns.html
Tennessee Main Street	TN ECD	Main Street revitalization	TN Main Street Groups / long list, see website	$150,000	0	n.a.	n.a.		https://www.tn.gov/ecd/rural-development/tennessee-main-street/tennessee-main-street.html
Three-Star - Tier 1	TNECD	1)Jobs and Economic Development 2)Fiscal Strength and Efficient Government 3)Public	counties / must be a 3 star designated community	$5,000	0	late July	medium	discretion of county	https://www.tn.gov/ecd/rural-development/three-star-tnecd/threestar-program-materials.html
Three Star - Tier 2	TNECD	1)Jobs and Economic Development 2)Fiscal Strength and Efficient Government 3)Public	counties / must be a 3 star designated community	$5,000	0	late July	low-medium	discretion of county	https://www.tn.gov/ecd/rural-development/three-star-tnecd/threestar-program-materials.html
Three Star - Tier 3	TNECD	1)Jobs and Economic Development 2)Fiscal Strength and Efficient Government 3)Public	counties / must be a 3 star designated community	$15,000	0	late July	low-medium	discretion of county	https://www.tn.gov/ecd/rural-development/three-star-tnecd/threestar-program-materials.html
Three Star - Tier 4	TNECD	1)Jobs and Economic Development 2)Fiscal Strength and Efficient Government 3)Public	counties / must be a 3 star designated community	$25,000	0	late July	low	discretion of county	https://www.tn.gov/ecd/rural-development/three-star-tnecd/threestar-program-materials.html
Community facilities grants and loan	USDA	Community facilities. Can be for health related, but not primarily for recreation.	local governments (<20,000) and community based non-	no cap listed.	Varies widely. Smaller for	rolling	medium		https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program
St. Thomas Hospital Grants	St. Thomas	Evidence based projects that align w/ focus areas from CHNAs	must be in communities the hospitals are in	up to $10k/$15k	0	rolling	low	link to	https://www.sthealth.com/about-us/mission-integration/community-health
Healthier Tennessee	Governor's Foundation for Health	Pretty much anything sustainable related to nutrition and PA	Healthier TN Communities / previously fulfill program	$5,000	0	depends on	non-competitive		https://healthiertn.com/
Clif Bar Family Foundation Small Grants	Clif Bar Family Foundation	Through engaging with the local community, address some combination of: Environmental pres	non-profits	$7,000	0	February 1, June 1	n.a.		http://clifbarfamilyfoundation.org/Grants-Programs/Small-Grants
Upper Cumberland Electric Membership	Upper Cumberland Electric	Health, education, safety	non-profits in service area (offices in Carthage,	<$5,000	0	rolling monthly	8-10/month		http://www.ucemc.com/
VEC Customers Share	Volunteer Electric Cooperative	General community improvement	non-profits in the service area (contains Byrdstown,	usually <$1 ,000	0	monthly	low		https://vec.org/community-programs/vecustomers-share/
SVEC Cares	Sequatchie Valley Electric Co-Op	general community improvement	non-profits in the service area (Marion, Grundy, Coffee	~$2,000 or less	0	monthly	low		http://www.svalleyec.com/content/svecares
Project Hometown Help	Middle Tennessee Natural Gas Utili	advancing education, assisting economic development, promoting local charities	schools/school clubs, non-profits, civic groups, and city or c	$5,000 or less	0	monthly	low		https://www.mtng.com/taxonomy/term/6
Improving Social Connectedness Among Older	AARP Foundation	Evidence-based projects to improve social connectedness among older adults. Direct service (re	Nearly anyone can apply / basically must show evidence of	$50,000 to $250,000	50%	3-May	unknown, but natio	long application and	https://www.aarp.org/aarp-foundation/grants/info-2019/advancing-effective-solutions.html
ARC Grants	Appalachian Regional Commission t	Must measurably address one of the 5 goals of the 2016-2020 ARC strategic plan: economic opp	difficult to tell. appears local governments.	up to $500,000 for c	varies based on economic	December 7th in 2	unknown	there is flexibility to	https://www.tn.gov/ecd/community-development-block-grant/appalachian-regional-commission/2019-tn-arc-preliminary-application.html
Healthy Food									
Farmers Market Promotion Program	USDA	Improving taking goods directly from farmers to market	all organizations involved in getting food directly from prod	$50,000-$500,000	0	middle of May	n.a.		https://www.ams.usda.gov/services/grants/fmpp
Local Food Promotion Program	USDA	Planning or implementing new local and regional food business enterprises	supporters of local and regional food business enterprises	planning up to $100	25% cash or in-kind	middle of May	n.a.		https://www.ams.usda.gov/services/grants/llpp
Healthy Food Financing Initiative	USDA (through the Reinvestment Fu	providing healthy food retail options in underserved areas	SNAP processing staple and perishable food retailers in und	$25,000-$250,000	0	February 14th	n.a.	technical assistance	https://www.investinginfood.com/
Farm to School	USDA	Farm to school activities: increasing local foods served through child nutrition programs, teach	school districts, state and local agencies, tribal organizatior	$50k-$200k	>=25%	Early December	medium-high -~20%	grant rate	https://www.fns.usda.gov/farmtoschool/farm-school-grant-program
Community Food Projects (CFP) Competitive G	USDA	Purpose of CFP is to create community-based food projects; purpose of PP (Planning projects)	Public food program service providers, tribal organizations	CFP: $125,000 in sin	50% (dollar for dollar)	3-Jun	medium-high: 18% of	projects are funded	https://nifa.usda.gov/funding-opportunity/community-food-projects-cfp-competitive-grants-program
Gro More Grassroots	KidsGardening	development of new and expansion of existing youth garden programs and greenspaces	non-profits and tax-exempt orgs (including schools)	$1,000 to 25 and	0	Middle of	medium		https://kidsgardening.org/2019-gromore-grassroots-grant/
Youth Garden Grant	KidsGardening	school or youth community gardens and gardening programs	non-profits, public or private schools or youth programs	tools and materials	0	early December	medium-high		https://kidsgardening.org/2019-youth-garden-grant/
Safer School Garden Grant	Safer Brand	School garden development	students on behalf of their schools	$500	encouraged to find in-kinc	1-Dec	n.a.		http://www.saferbrand.com/articles/how-to-start-a-school-garden
Increasing Access to Healthy Foods Innovation	National Recreation and Park Assoc	Building off of existing nutrition programs (i.e. USDA summer nutrition, nutrition ed, communit	501c3 or local government agency involved with parks and	$30,000-$35,000	0	6-Mar	unknown, but nationwide		
Garden Grant Program	Whole Kids Foundation	Edible, educational school/youth gardens	School systems or non-profits	$2,000	0	15-Oct-18	unknown, but nationwide		https://www.wholekidsfoundation.org/programs/school-gardens-grant
Improving Senior (age 50+) Food Security	AARP Foundation	Evidence-based projects to improve food security among older adults. Direct service (ready to p	Nearly anyone can apply / basically must show evidence of	$50,000 to $250,000	50%	3-May	unknown, but natio	long application and	https://www.aarp.org/aarp-foundation/grants/info-2019/advancing-effective-solutions.html
Health Ed/Programming Only									
Good Sports Grants	Good Sports	Sports equipment for poorer children	schools and 501c3s	no cap listed	5%	rolling	unknown, but available throughout North		https://www.goodsports.org/apply/
organizations/websites to watch:									
https://www.neefusa.org/grants									
https://www.wholekidsfoundation.org/									
https://www.nrpa.org/our-work/Grant-Fundraising-Resources/									
https://flh.fhwa.dot.gov/programs/flap/tn/									
see funding sources for vital signs as action guides become available									
https://www.rwjf.org/en/how-we-work/grants-explorer/funding-opportunities.html									

Local Active Transportation Funding:

Easier wins:

Complete street policies
Repaving policy that requires striping bike lanes where extra lane width allows
Development impact fees that go towards sidewalks and bikeways

Heavier lifts politically, but major options:

Bonds - generally more palatable to the public than others below
Sales taxes - authorized here in TN. 1/2 cent sales taxes are common
Property taxes - less common but seems sensible because they go towards essential services for the property; occurs in Washington
Traffic fines & fees - double them in school zones or sensitive areas; red light cameras; speed enforcement cameras; cons: they don't adjust for income, encourage overpolicing and tickets instead of fixes….not recommended
Ridehailing & shared mobility fees - they are increasing congestion and depressing transit ridership
Targeted district financing - CIDs; TIFs. Both can be controversial but are often used for large un-walkable projects with many negative externalities
Donations and fundraising - particularly useful in smaller communities

Mark Fenton - Funding Sidewalk (and other AT) infrastructure: http://www.markfenton.com/resources/SidewalkFundingSummryFenton.pdf

Efficiency and building in active living opportunities

Opportunistic development - develop while other construction activities are occurring so it costs less
Complete engineering for bike/ped facilities and TDOT will pay for construction/striping in some cases
Have a plan in place so you're ready to move when funding comes along
Require or encourage complete streets and common green space in new developments through zoning codes/municipal regulations
Require multi-modal access on all roads through complete streets policies w/ varying degrees of legal teeth
Develop more densely and encourage mixed use to give more tax dollars per amount of infrastructure built
Remove minimum parking requirements or put parking maximums in place
Repurpose excess lane width for striped bike lanes, or to slow traffic on city streets

Civic service/Community oriented groups:

Lions Club
Kiwanis
Rotary
Jaycees
Boys and Girls Clubs
Religious Institutions (for programs, probably not infrastructure)
Chambers of Commerce
Parent-Teacher Organizations
Local stores, banks and dealerships
Tennessee Tech - help write grants and collect data
Crowdfunding (e.g. GoFundMe)---danger is this can reduce support for blanket public funding for necessary public services in the future (more likely to vote down taxes)
Individual philanthropists
Hospitals - St. Thomas and Cookeville Regional
Community trusts - Monterey and McMinnville

"Time in nature is not leisure time;
it's an essential investment in our health."
– Richard Louv, Last Child in the Woods

TN Department of Environment & Conservation

TN Department of Health

human evolution in nature

5 million years

99.9999%
in nature

0.0001%
in city

According To The Experts

75% of American adults do not engage in the recommended levels of physical activity

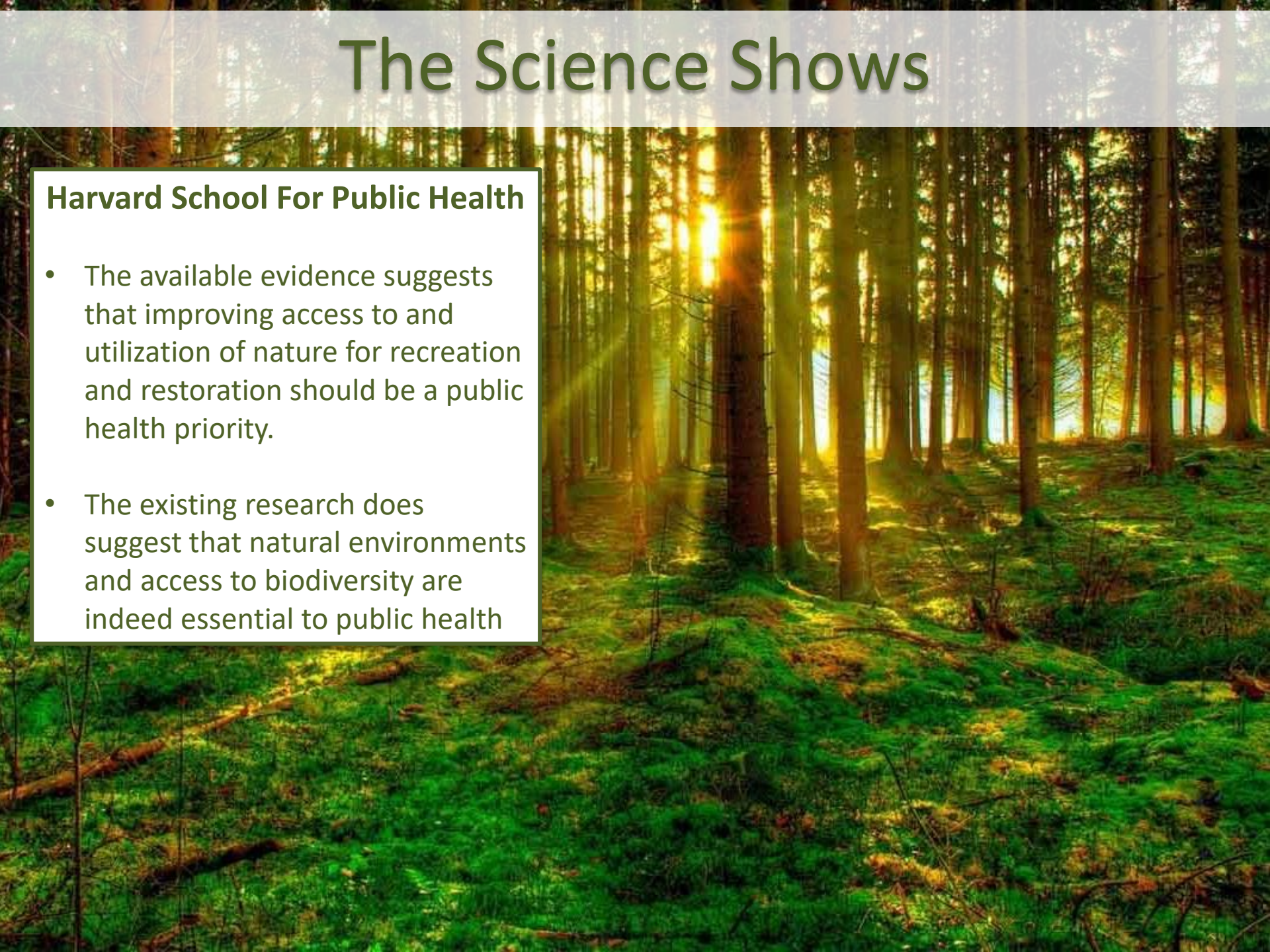
29% engage in no activity at all

=

Increased incidence of:

- Obesity
- High blood pressure
- Diabetes
- Congestive Heart Failure
- Stroke
- Developmental Disorders
- Mental Illness

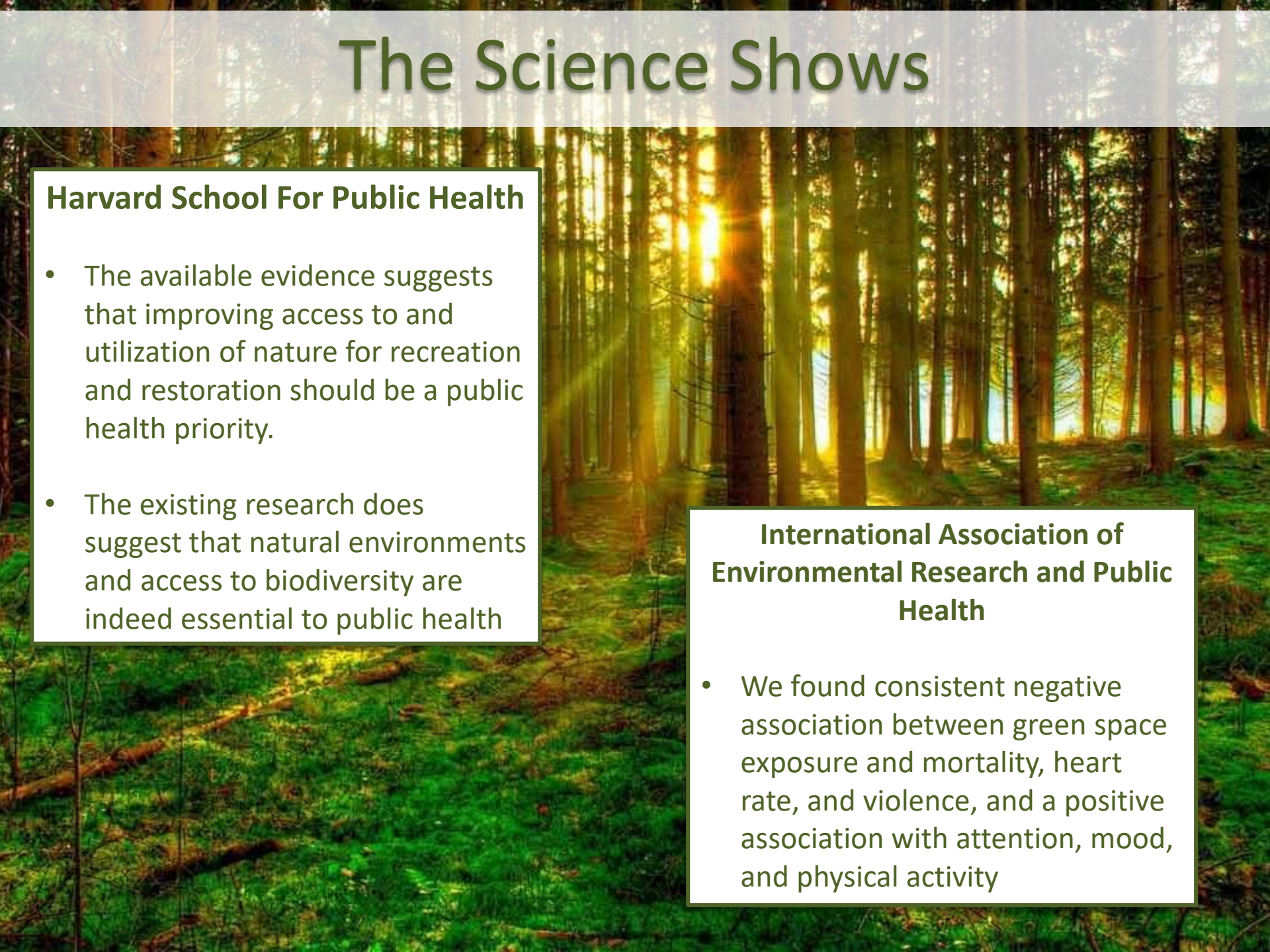
The Science Shows



Harvard School For Public Health

- The available evidence suggests that improving access to and utilization of nature for recreation and restoration should be a public health priority.
- The existing research does suggest that natural environments and access to biodiversity are indeed essential to public health

The Science Shows



Harvard School For Public Health

- The available evidence suggests that improving access to and utilization of nature for recreation and restoration should be a public health priority.
- The existing research does suggest that natural environments and access to biodiversity are indeed essential to public health

International Association of Environmental Research and Public Health

- We found consistent negative association between green space exposure and mortality, heart rate, and violence, and a positive association with attention, mood, and physical activity

The Science Shows

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University of East Anglia - Norway

- Study that involved over 290 million people.
- Exposure to greenspace reduces the risk of type II diabetes, cardiovascular disease, premature death, preterm birth, stress, and high blood pressure, among other benefits

lic Health

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The Science Shows

Harvard School For Public Health

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Peninsula College of Medicine - UK

- Compared with exercising indoors, exercising in natural environments was associated with greater feelings of revitalization and positive engagement, decreases in tension, confusion, anger, depression, and increased energy. Participants reported greater enjoyment and satisfaction with outdoor activity and declared a greater intent to repeat the activity at a later date.

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University of Illinois

- Study focused on ADHD and Nature
- Outdoor activities reduced symptoms significantly more than did activities conducted in other settings.
- Findings were consistent across age, gender, income groups, community types, geographic regions, and diagnoses

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Department of Hygiene and Public Health - Tokyo, Japan

- Subjects experienced a 3day/2night trip to the forest
- Blood and urine were sampled on days 2, 3, 7, and 30 after the trip to measure levels of Natural Killer (NK) enzymes.
- NK enzymes were significantly higher on forest days than control days. Urban subjects had no increase.
- Increased NK levels lasted more than 30 days after the trip

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Students test scores and behavior are shown to improve with increased outdoor exposure during the school day.

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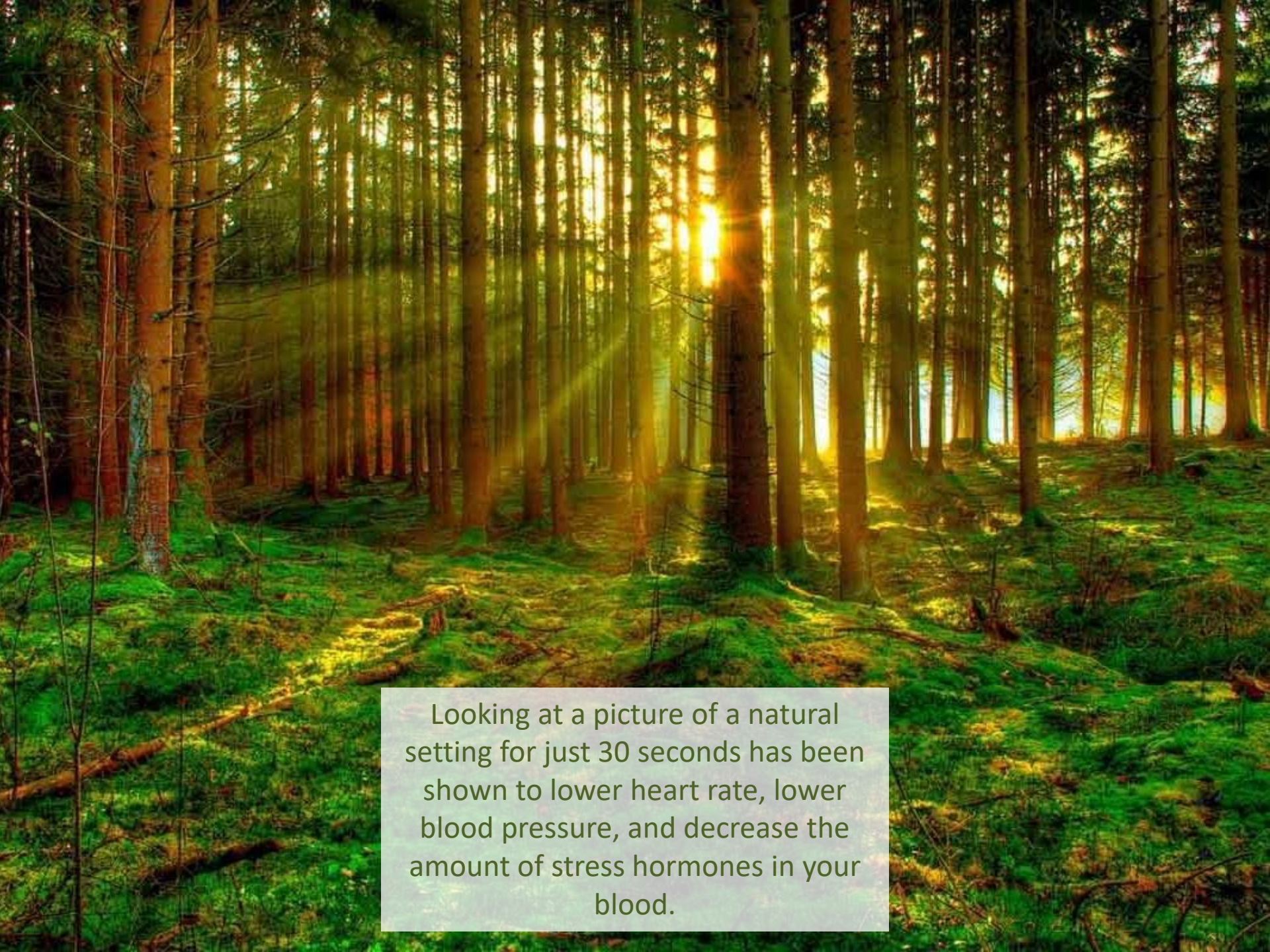
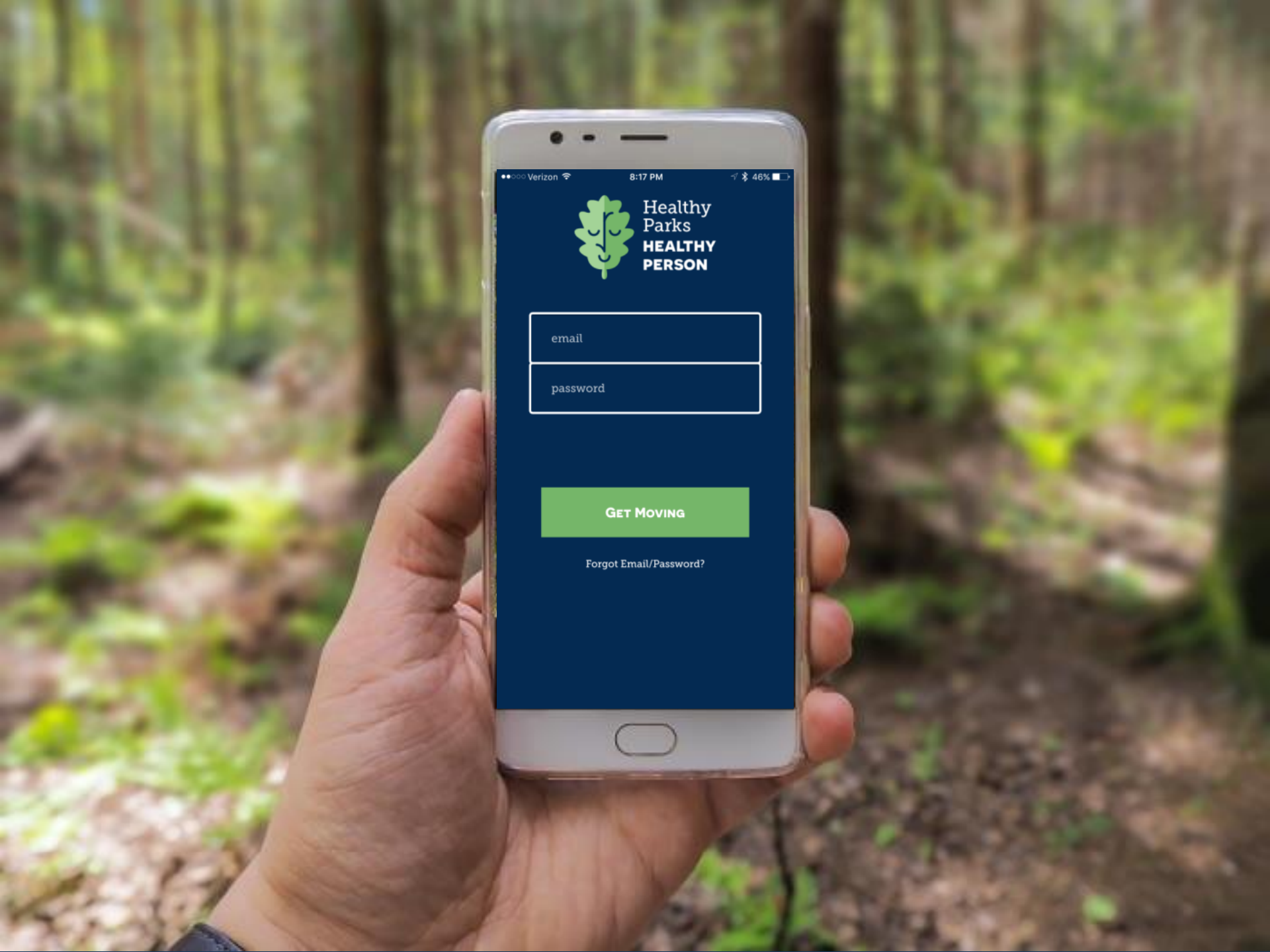

Looking at a picture of a natural setting for just 30 seconds has been shown to lower heart rate, lower blood pressure, and decrease the amount of stress hormones in your blood.


Healthy Parks
HEALTHY PERSON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Healthy Parks HEALTHY PERSON
email
password
GET MOVING
Forgot Email/Password?

The Hat

Vitamin N

Do you suffer from;

- Obesity
- Chronic Disease
- Autism Spectrum Disorder
- Attention Deficit Disorder
- Cancer or Cancer Treatment
- Depression
- Mental Illness
- Stress
- Overworked
- Low Test Scores
- A Lack Of Creativity
- Bad Behavior
- Near Sightedness

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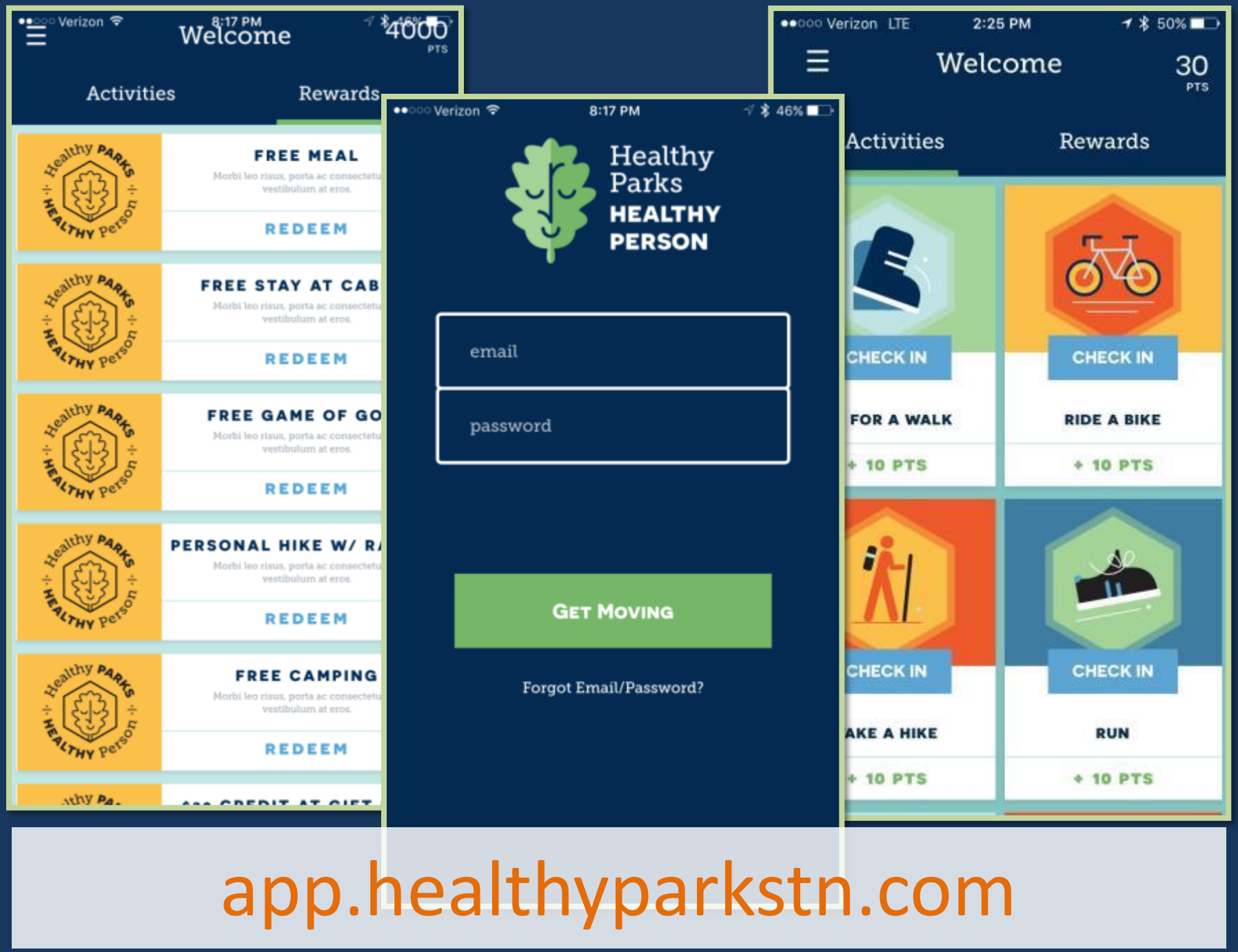
If so, ask your doctor if Nature is right for you!



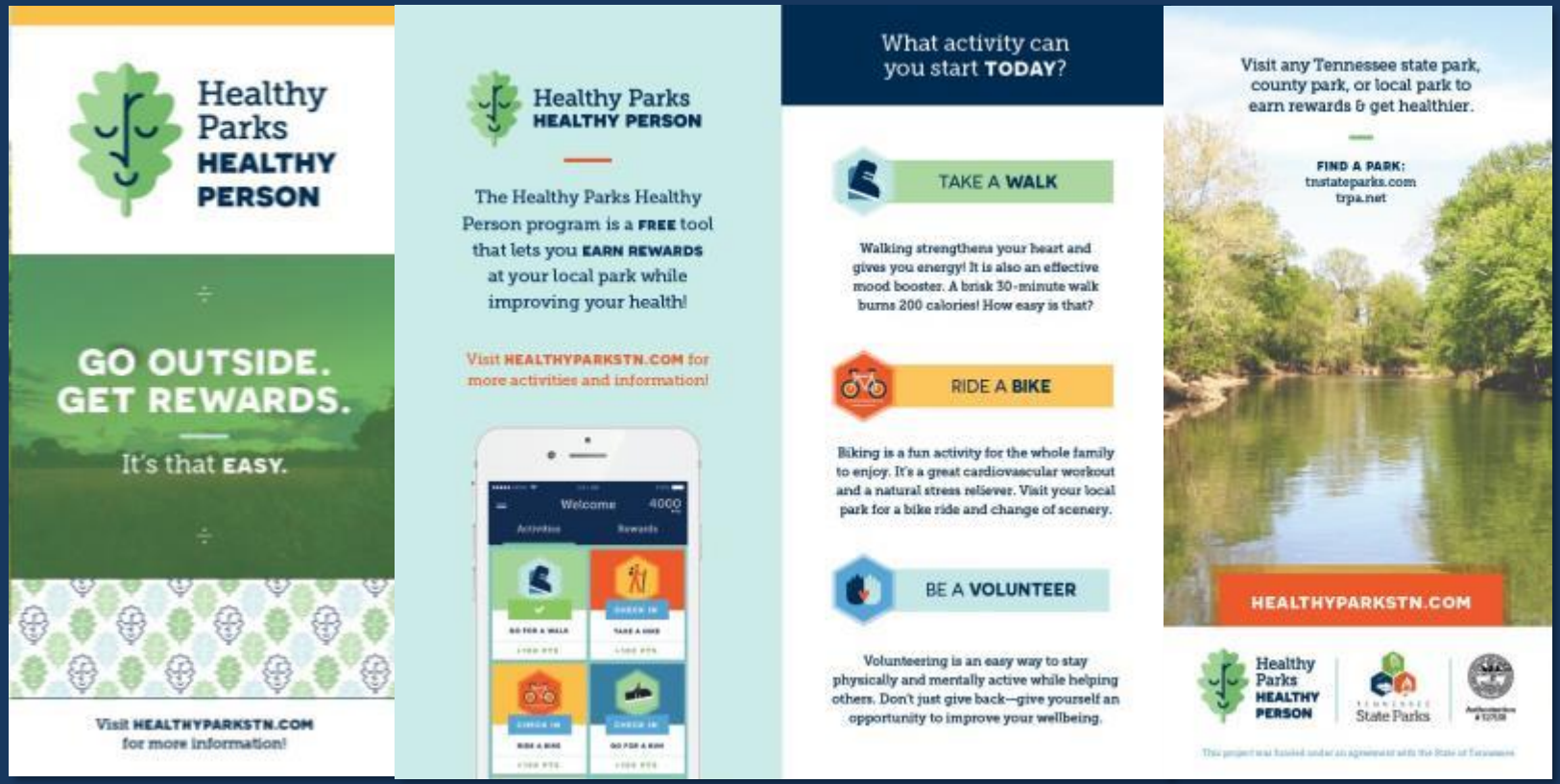
app.healthyparkstn.com


Healthy Parks
HEALTHY PERSON


Healthy Parks
HEALTHY PERSON


Healthy Parks
HEALTHY PERSON


Heal
HEALT


Healthy Parks HEALTHY PERSON
GO OUTSIDE. GET REWARDS.
It's that EASY.
Visit HEALTHYPARKSTN.COM for more information!
Healthy Parks HEALTHY PERSON
The Healthy Parks Healthy Person program is a FREE tool that lets you EARN REWARDS at your local park while improving your health!
Visit HEALTHYPARKSTN.COM for more activities and information!
Welcome
What activity can you start TODAY?
TAKE A WALK
Walking strengthens your heart and gives you energy! It is also an effective mood booster. A brisk 30-minute walk burns 200 calories! How easy is that?
RIDE A BIKE
Biking is a fun activity for the whole family to enjoy. It's a great cardiovascular workout and a natural stress reliever. Visit your local park for a bike ride and change of scenery.
BE A VOLUNTEER
Volunteering is an easy way to stay physically and mentally active while helping others. Don't just give back—give yourself an opportunity to improve your wellbeing.
Visit any Tennessee state park, county park, or local park to earn rewards & get healthier.
FIND A PARK:
tnstateparks.com
trpa.net
HEALTHYPARKSTN.COM
Healthy Parks HEALTHY PERSON
State Parks

Brochures

Support Posters

Outdoor Signs

Park Prescriptions are designed for healthcare providers to write referrals for their patients to get outdoors and improve their health.

Park Prescriptions

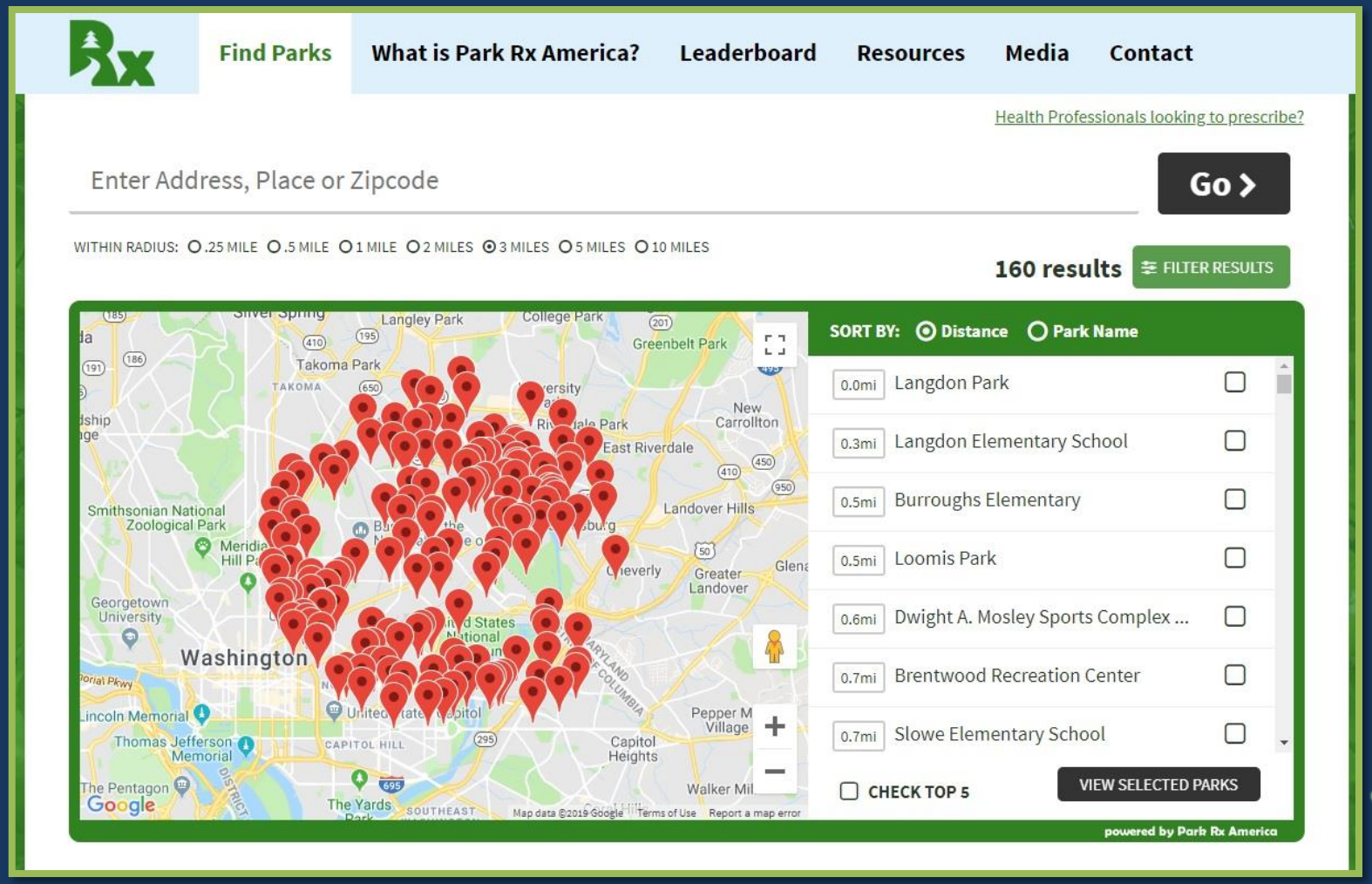
Making a Difference

TDOH Commissioner's Award

2018 SHIFT Award Selection

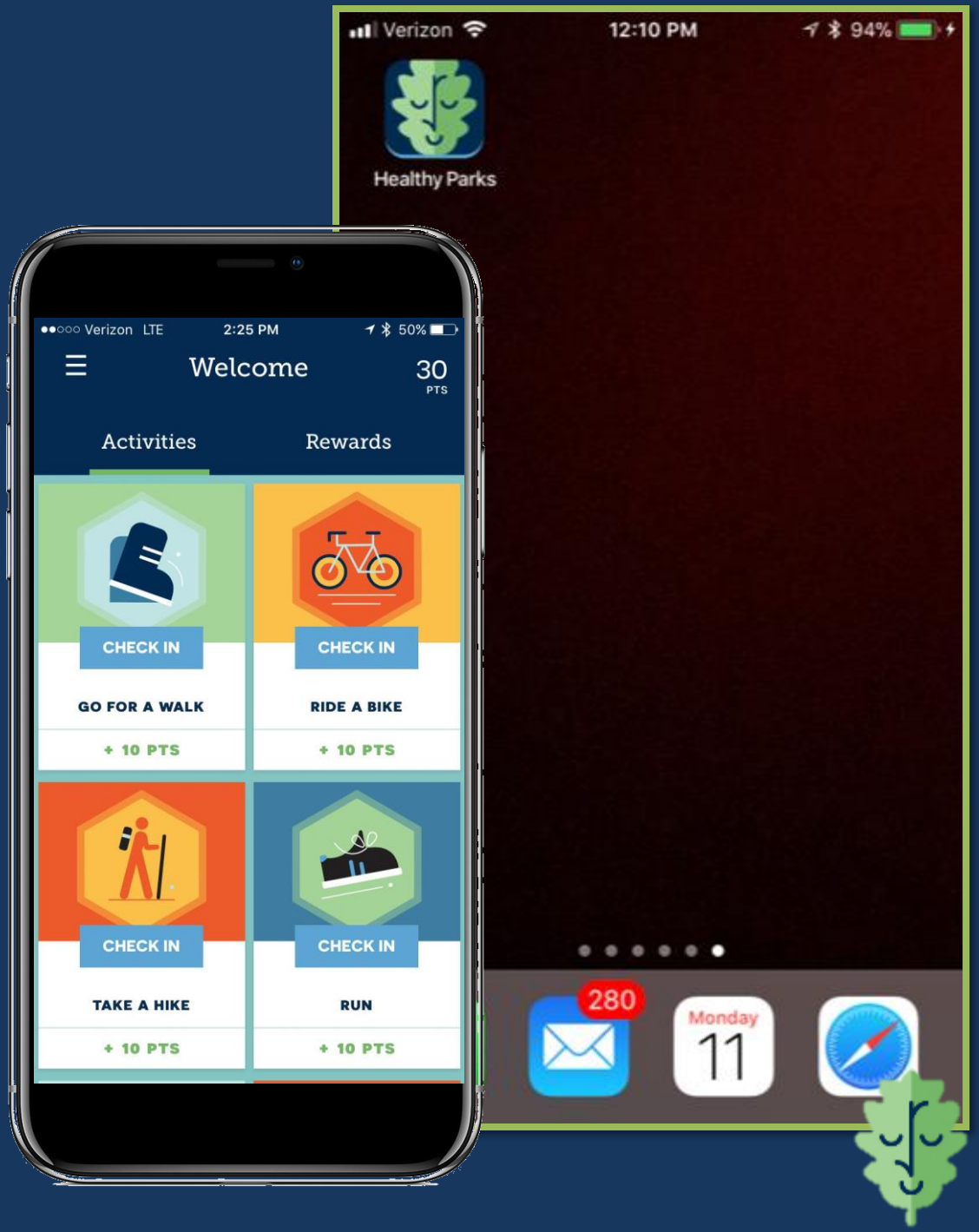
The Future

- Park Finder with Park Rx America



The Future

- Park Finder with Park Rx America
- Self contained application



The Future

- Park Finder with Park Rx America
- Self contained application
- User alerts and reminders

The Future

- Park Finder with Park Rx America
- Self contained application
- User alerts and reminders
- Biotrackers

The Future

- Park Finder with Park Rx America
- Self contained application
- User alerts and reminders
- Biotrackers
- Physician workflow integration


Conservation is the application of common sense to the common problems for the common good.
-Gifford Pinchot

Without relevance, these public outdoor spaces will never be fully protected.


Healthy Parks
HEALTHY PERSON

Healthy Parks
HEALTHY PERSON

If you are interested in learning more about Healthy Parks Healthy Person TN please contact:

Ryan Jenkins, Park Manager

Henry Horton State Park

Ryan.jenkins@tn.gov

Office - 931-364-7724

Cell - 615-585-4904

healthyparkstn.com

TN Department of Environment & Conservation

TN Department of Health

APPENDIX C

BILL 58

SB0058 000817 **by *Gilmore, Akbari** (HB0094 000817 by *Halford, Cooper, Clemmons, Chism)

Education - As enacted, establishes a task force regarding the creation of the Tennessee outdoor education and recreation grant program. - Amends TCA Title 4; Title 11; Title 49 and Title 70.

(SB0058) 5/1/2019 - Effective date(s) 04/23/2019

(HB0094) 5/1/2019 - Comp. became Pub. Ch. 172

BILL SUMMARY

SB0058/HB0094

Subject to available funds, this bill requires the commissioner of education, with input from the executive director of the wildlife resources agency, to create and administer a grant program for outdoor environmental, ecological, agricultural, or other natural resource-based education and recreation programs. The opportunity to receive grants from an account, established by this bill and described below, will be available to public agencies, private nonprofit organizations, formal school programs, nonformal after-school programs, and community-based programs. This bill requires:

(1) The commissioner to set priorities and develop criteria for awarding grants, including priorities and criteria listed in the bill;
(2) That programs that provide outdoor education opportunities to schools be fully aligned with the state's academic standards to be eligible for a grant;
(3) That the grant program be phased in, beginning with the schools and students with the greatest needs; and
(4) That the grant program focus on students who qualify for free and reduced-price lunches who are more academically at risk or more likely to drop out of school.

This bill establishes a separate account within the state treasury to be known as the outdoor education and recreation program account. This account is to be composed of:

(1) Funds appropriated by the general assembly for the account; and
(2) Gifts, grants, and other donations received by the department of education for the account.

This bill requires the commissioner to use funds in the account solely for the program's purpose, including the administration of the program; provided, however, the commissioner must not expend more than 5 percent of the total amount appropriated for the program in any fiscal year on the administration of the program. The bill requires the state treasurer to invest funds in the account, to the extent practical and in accordance with policy guidelines approved by the state funding board, for the sole benefit of the account. This bill authorizes the commissioner of finance and administration to carry forward any amounts remaining in the account or transfer any part of the account to the revenue fluctuation reserve.

This bill will take effect January 1, 2020.