

Supplementary Material

Urban trees and human health: A scoping review

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Table S1: Citations and References for Table 2

All studies included in scoping review are listed by the domains and subdomains of the health outcomes conceptual framework, then sorted by study design. This table corresponds to Table 2 in the manuscript. All 201 studies (in 199 articles) are cited in table, and references follow.

Domain/Subdomain	Study Count	Experiment	Natural/ Quasi- Experiment	Longitudinal/ Cohort	Cross Sectional	Modelling	Time Series
4.1. REDUCING HARM	82	.	.	.	.	.	.
4.1.1 Air Pollutants and Respiratory Condition	14	.	.	.	Lovasi et al. 2008; Wang et al. 2016; Akerman et al. 2003*; Pilat et al. 2012*; Alcock et al. 2017*; Lovasi et al. 2013a**	Tiwary et al. 2009; Nowak et al. 2013, 2014; Donovan et al. 2016; Hirabayashi & Nowak 2016; Rao et al. 2014, 2017; Ratola et al. 2017	.
4.1.2 Tree Pollen and VOCs	40	Song et al. 2016b*	Loureiro 2005*	Cebrino et al. 2017**; Irani et al. 2013**; Weichenthal et al. 2016**	Ishizaki et al. 1987*; Guerra et al. 1995*; Vieira et al. 1998*; Sam et al. 1998*; Harmanci & Mahesh et al. 2010*; Metintas 2000*; Lin et al. 2002*; Armentia et al. 2004*; Sánchez-Mesa et al. 2005*; Fuhrman et al. 2007*; Li et al. 2009*; Sheehan et al. 2010*; Puiggròs et al. 2015*; Sung et al. 2017*; Alcázar et al. 2004**; Diaz de la Guardia et al. 2006**; Motreff et al. 2014**; Kim et al. 2016a**	Cariñanos et al. 2016**, 2017**; Ren et al. 2017**	Celik et al. 2005*; Gonianakis et al. 2006*; Darrow et al. 2012*; Osborne et al. 2017*; Dales et al. 2004**, 2008**; Diaz et al. 2007**; May et al. 2011**; Sheffield et al. 2011**; Cakmak et al. 2012**; Jariwala et al. 2011**, 2014**; Caillaud et al. 2015**; Jeon-Slaughter et al. 2016**
4.1.3 Ultraviolet Radiation	5	.	Boldemann et al. 2004, 2006	.	.	Heisler et al. 2003; Parisi et al. 2000a*, 2000b*	.

Doman/Subdomain	Study Count	Experiment	Natural/ Quasi- Experiment	Longitudinal/ Cohort	Cross Sectional	Modelling	Time Series
4.1.4 Excess Heat and Thermal Comfort	17		Lin et al. 2012, 2013; Zeng & Dong 2015; Jeong et al. 2016; Song & Jeong 2016	Kilbourne et al. 1982; Graham et al. 2016		Johansson & Emmanuel 2006; Stone et al. 2014; de Abreu-Harbich et al. 2015; Klemm et al. 2015; Lee et al. 2016; Sanusi et al. 2016; Wu et al. 2016; Milošević et al. 2017; Kántor et al. 2018; Lin et al. 2010*	
4.1.5 Crime	6		Kuo & Sullivan 2001b; Kondo et al. 2017a*; Kondo et al. 2017b		Troy et al. 2012; Gilstad-Hayden et al. 2015; Donovan & Prestemon 2012*		
4.2. RESTORING CAPACITIES	63						
4.2.1 Cognition and Attention Restoration	13	Gathright et al. 2006 (second study); Berman et al. 2008; Shin et al. 2011; Martinez-Soto et al. 2013; Lin et al. 2014; Takayama et al. 2014; Perkins, et al. 2011*; Gatersleben, et al. 2013*	Kuo 2001; Kuo & Sullivan 2001a; Paddle et al. 2016; Taylor et al. 2002*		Mårtensson et al. 2009		
4.2.2 Mental Health, Anxiety and Mood	15	An et al. 2004; Gathright et al. 2006; Morita et al. 2007; Park et al. 2011; Roe & Aspinall 2011; Shin et al. 2013; Van den Berg et al. 2014; Joung et al. 2015; Wolf et al. 2017; Gathright et al. 2008*; Martens et al. 2011*	Gilchrist et al. 2015		Kühn et al. 2017; Akpınar et al. 2016*; Reid et al. 2017*		

Doman/Subdomain	Study Count	Experiment	Natural/ Quasi- Experiment	Longitudinal/ Cohort	Cross Sectional	Modelling	Time Series
4.2.3 Psychophysiological Stress	25	Hartig et al. 2003; Yamaguchi et al. 2006; Park et al. 2007, 2010; Lee et al. 2009, 2011; Tsunetsugu et al. 2007, 2013; Gatersleben & Andrews 2013 (second study); Horiuchi et al. 2013; Tyrväinen et al. 2014; Kobayashi et al. 2015; Jiang et al. 2016; Yu et al. 2017; Toda et al. 2013*; Horiuchi et al. 2014*; Jiang et al. 2014*; Jung et al. 2015*	Shin 2007; Hauru et al. 2012	Dolling et al. 2017*	Annerstedt et al. 2010; Beyer et al. 2014; Townsend et al. 2016; Egorov et al. 2017	.	.
4.2.4 Clinical Outcomes	10	Kim et al. 2009; Berman et al. 2012; Sonntag-Öström et al. 2014; van den Berg & van den Berg 2011*	Nordh et al. 2009*	Ulrich 1984; Ohtsuka et al. 1998	Li et al. 2008a; Taylor et al. 2015; Wu & Jackson 2017	.	.
4.3. BUILDING CAPACITIES	56	.	.	.	.	.	.
4.3.1 Birth Outcomes	4	.	.	Donovan et al. 2011*; Dadvand et al. 2014a*; Cusack et al. 2017*	Abelt & McLafferty 2017	.	.
4.3.2 Immune System	6	Li et al. 2007, 2008b, 2008c, 2010; Mao et al. 2012b; Seo et al. 2014	.	.	.	.	.

Doman/Subdomain	Study Count	Experiment	Natural/ Quasi- Experiment	Longitudinal/ Cohort	Cross Sectional	Modelling	Time Series
4.3.3 Active Living	19	.	Fjørtoft 2001; Jones 2016	.	Taylor et al. 1998; Takano et al. 2002; Larsen et al. 2009; Tilt, 2010; Lovasi et al. 2011; Nehme et al. 2013; Schipperijn et al. 2013; Eichinger et al. 2015; Janssen & Rosu 2015; Zuniga-Teran, 2017; Lovasi et al. 2013b*; Compernelle et al. 2016*; Costigan et al. 2017*; Markevych et al. 2016*; Mertens et al. 2017*; Wilson et al. 2011**; Fan et al. 2014**	.	.
4.3.4 Weight Status	8	.	.	.	Lovasi et al. 2012, 2013c; Dadvand et al. 2014b; Kim, et al. 2014, 2016b; Tsai et al. 2016; Ulmer et al. 2016; Ghimire et al. 2017	.	.
4.3.5 Cardiovascular Function	16	Park et al. 2009; Li et al. 2011; Matsunaga et al. 2011; Mao et al. 2012a; Lee et al. 2014; Song et al. 2015a, 2017a; Sung et al. 2012*; Song et al. 2013*	Donovan et al. 2013, 2015; Song et al. 2017b; Song et al. 2015b*	.	Kardan et al. 2015; Tarar et al. 2015*; Wu et al. 2018*	.	.
4.3.6 Social Cohesion	3	.	Sullivan et al. 2004	.	Holtan et al. 2015; Piff et al. 2015	.	.
TOTAL STUDIES	201	57	26	12	69	24	13

Notes: *indicates mixed or neutral findings. ** indicates negative findings.

References

- Abelt K, McLafferty S. 2017. Green streets: Urban green and birth outcomes. *Int J Environ Res Public Health* 14(7):771, <https://doi.org/10.3390/ijerph14070771>.
- Akerman M, Valentine-Maher S, Rao M, Taningco G, Khan R, Tuysugoglu G, Joks R. 2003. Allergen sensitivity and asthma severity at an inner city asthma center. *J Asthma* 40(1):55-62, <https://doi.org/10.1081/JAS-120017207>.
- Akpinar A, Barbosa-Leiker C, Brooks KR. 2016. Does green space matter? Exploring relationships between green space type and health indicators. *Urban For Urban Gree* 20:407-418, <https://doi.org/10.1016/j.ufug.2016.10.013>.
- Alcázar P, Cariñanos P, De Castro C, Guerra F, Moreno C, Dominguez-Vilches E, Galán C. 2004. Airborne plane-tree (*Platanus hispanica*) pollen distribution in the city of Córdoba, southwestern Spain, and possible implications on pollen allergy. *J Investig Allergol Clin Immunol* 14(3):238-243.
- Alcock I, White M, Cherrie M, Wheeler B, Taylor J, McInnes R, Otte Im Kampe E, Vardoulakis S, Sarran C, et al. 2017. Land cover and air pollution are associated with asthma hospitalisations: A cross-sectional study. *Environ Int* 109:29-41, <https://doi.org/10.1016/j.envint.2017.08.009>.
- An KW, Kim EI, Joen KS, Setsu T. 2004. Effects of forest stand density on human's physiopsychological changes. *J Faculty of Agriculture, Kyushu Univ* 49(2):283-291.
- Annerstedt M, Norman J, Boman M, Mattsson L, Grahn P, Währborg P. 2010. Finding stress relief in a forest. *Ecological Bulletins* 53:33-42.
- Armentia A, Asensio T, Subiza J, Arranz ML, Gil F-M, Callejo A. 2004. Living in towers as risk factor of pollen allergy. *Allergy* 59(3):302-305.
- Berman MG, Jonides J, Kaplan S. 2008. The cognitive benefits of interacting with nature. *Psychol Sci* 19(12):1207-1212, <https://doi.org/10.1111/j.1467-9280.2008.02225>.
- Berman MG, Kross E, Krpan KM, Askren MK, Burson A, Deldin PJ, Kaplan S, Sherdell L, Gotlib IH, Jonides J. 2012. Interacting with nature improves cognition and affect for individuals with depression. *J Affect Disord* 140(3):300-305, <https://doi.org/10.1016/j.jad.2012.03.012>.
- Beyer KM, Kaltenbach A, Szabo A, Bogar S, Nieto FJ, Malecki KM. 2014. Exposure to neighbourhood green space and mental health: Evidence from the Survey of the Health of Wisconsin. *Int J Environ Res Public Health* 11(3):3453-3472, <https://doi.org/10.3390/ijerph110303453>.
- Boldemann C, Blennow M, Dal H, Mårtensson F, Raustorp A, Yuen K, Wester U. 2006. Impact of preschool environment upon children's physical activity and sun exposure. *Prev Med* 42(4):301-308, <https://doi.org/10.1016/j.ypmed.2005.12.006>.
- Boldemann C, Dal H, Wester U. 2004. Swedish pre-school children's UVR exposure--a comparison between two outdoor environments. *Photodermatol Photoimmunol Photomed* 20(1):2-8, <https://doi.org/10.1111/j.1600-0781.2004.00069.x>.

- Caillaud DM, Martin S, Ségala C, Vidal P, Lecadet J, Pellier S, Rouzair P, Tridon A, Evrard B. 2015. Airborne pollen levels and drug consumption for seasonal allergic rhinoconjunctivitis: A 10-year study in France. *Allergy* 70(1):99-106, <https://doi.org/10.1111/all.12522>.
- Cakmak S, Dales RE, Coates F. 2012. Does air pollution increase the effect of aeroallergens on hospitalization for asthma? *J Allergy Clin Immunol* 129(1):228-231, <https://doi.org/10.1016/j.jaci.2011.09.025>.
- Cariñanos P, Adinolfi C, Díaz de la Guardia C, De Linares C, Casares-Porcel M. 2016. Characterization of allergen emission sources in urban areas. *J Environ Qual* 45:244-252, <https://doi.org/10.2134/jeq2015.02.0075>.
- Cariñanos P, Casares-Porcel M, Díaz de la Guardia C, Aira MJ, Belmonte J, Boi M, Elvira-Rendueles B, De Linares C, Fernández-Rodríguez S, et al. 2017. Assessing allergenicity in urban parks: A nature-based solution to reduce the impact on public health. *Environ Res* 155:219-227, <https://doi.org/10.1016/j.envres.2017.02.015>.
- Cebrino J, Barasona MJ, Alcázar P, Moreno C, Domínguez-Vilches E, Galán C. 2017. Airborne pollen in Córdoba city (Spain) and its implications for pollen allergy. *Aerobiologia* 33(2):281-291, <https://doi.org/10.1007/s10453-016-9469-8>.
- Celik G, Mungan D, Pinar M, Misirligil Z. 2005. Poplar pollen-related allergy in Ankara, Turkey: How important for patients living in a city with high pollen load? *Allergy Asthma Proc* 26(2):113-9.
- Compernelle S, De Cocker K, Roda C, Oppert JM, Mackenbach JD, Lakerveld J, Glonti K, Bardos H, Rutter H, et al. 2016. Physical environmental correlates of domain-specific sedentary behaviours across five European regions (the SPOTLIGHT Project). *PLoS One* 11(10):e0164812, <https://doi.org/10.1371/journal.pone.0164812>.
- Costigan SA, Veitch J, Crawford D, Carver A, Timperio A. 2017. A cross-sectional investigation of the importance of park features for promoting regular physical activity in parks. *Int J Environ Res Public Health* 14(11): 1335, <https://doi.org/10.3390/ijerph14111335>.
- Cusack L, Larkin A, Carozza SE, Hystad P. 2017. Associations between multiple green space measures and birth weight across two US cities. *Health Place* 47:36-43, <https://doi.org/10.1016/j.healthplace.2017.07.002>.
- Dadvand P, Ostro B, Figueras F, Foraster M, Basagaña X, Valentín A, Martínez D, Beelen R, Cirach M, Hoek G. 2014a. Residential proximity to major roads and term low birth weight: The roles of air pollution, heat, noise, and road-adjacent trees. *Epidemiology* 25(4):518-525, <https://doi.org/10.1097/EDE.000000000000107>.
- Dadvand P, Villanueva CM, Font-Ribera L, Martínez D, Basagaña X, Belmonte J, Vrijheid M, Gražulevičienė R, Kogevinas M, Nieuwenhuijsen MJ. 2014b. Risks and benefits of green spaces for children: A cross-sectional study of associations with sedentary behavior, obesity, asthma, and allergy. *Environ Health Perspect* 122(12):1329-1335, <https://doi.org/10.1289/ehp.1308038>.
- Dales RE, Cakmak S, Judek S, Coates F. 2008. Tree pollen and hospitalization for asthma in urban Canada. *Int Arch Allergy Immunol* 146(3):241-247, <https://doi.org/10.1159/000116360>.

- Dales RE, Cakmak S, Judek S, Dann T, Coates F, Brook JR, Burnett RT. 2004. Influence of outdoor aeroallergens on hospitalization for asthma in Canada. *J Allergy Clin Immunol* 113(2):303-306, <https://doi.org/10.1016/j.jaci.2003.11.016>.
- Darrow LA, Hess J, Rogers CA, Tolbert PE, Klein M, Sarnat SE. 2012. Ambient pollen concentrations and emergency department visits for asthma and wheeze. *J Allergy Clin Immunol* 130(3):630-638.e4, <https://doi.org/10.1016/j.jaci.2012.06.020>.
- de Abreu-Harbach LV, Labaki LC, Matzarakis A. 2015. Effect of tree planting design and tree species on human thermal comfort in the tropics. *Landsc Urban Plan* 138:99-109, <https://doi.org/10.1016/j.landurbplan.2015.02.008>.
- Diaz de la Guardia C, Alba F, de Linares C, Nieto-Lugilde D, López Caballero J. 2006. Aerobiological and allergenic analysis of Cupressaceae pollen in Granada (southern Spain). *J Investig Allergol Clin Immunol* 16(1):24-33.
- Díaz J, Linares C, Tobâias A. 2007. Short-term effects of pollen species on hospital admissions in the city of Madrid in terms of specific causes and age. *Aerobiologia* 23(4):231-238, <https://doi.org/10.1007/s10453-007-9067-x>.
- Dolling A, Nilsson H, Lundell Y. 2017. Stress recovery in forest or handicraft environments--an intervention study. *Urban Forestry & Urban Greening* 27:162-172 *Urban For Urban Gree* 27:162-172, <https://doi.org/10.1016/j.ufug.2017.07.006>.
- Donovan GH, Butry DT, Michael YL, Prestemon JP, Liebhold AM, Gatzolis D, Mao MY. 2013. The relationship between trees and human health: Evidence from the spread of the emerald ash borer. *Am J Prev Med* 44(2):139-145, <https://doi.org/10.1016/j.amepre.2012.09.066>.
- Donovan GH, Jovan SE, Gatzolis D, Burstyn I, Michael YL, Amacher MC, Monleon VJ. 2016. Using an epiphytic moss to identify previously unknown sources of atmospheric cadmium pollution. *Sci Total Environ* 559:84-93, <https://doi.org/10.1016/j.scitotenv.2016.03.182>.
- Donovan GH, Michael YL, Butry DT, Sullivan AD, Chase JM. 2011. Urban trees and the risk of poor birth outcomes. *Health Place* 17(1):390-393, <https://doi.org/10.1016/j.healthplace.2010.11.004>.
- Donovan GH, Michael YL, Gatzolis D, Prestemon JP, Whitsel EA. 2015. Is tree loss associated with cardiovascular-disease risk in the women's health initiative? A natural experiment. *Health Place* 36:1-7, <https://doi.org/10.1016/j.healthplace.2015.08.007>.
- Donovan GH, Prestemon JP. 2012. The effect of trees on crime in Portland, Oregon. *Environ Behav* 44(1):3-30, <https://doi.org/10.1177/0013916510383238>.
- Egorov AI, Griffin SM, Converse RR, Styles JN, Sams EA, Wilson A, Jackson LE, Wade TJ. 2017. Vegetated land cover near residence is associated with reduced allostatic load and improved biomarkers of neuroendocrine, metabolic and immune functions. *Environ Res* 158:508-521, <https://doi.org/10.1016/j.envres.2017.07.009>.

- Eichinger M, Titze S, Haditsch B, Dorner TE, Stronegger WJ. 2015. How are physical activity behaviors and cardiovascular risk factors associated with characteristics of the built and social residential environment? *PLoS One* 10(6):e0126010, <https://doi.org/10.1371/journal.pone.0126010>.
- Fan JX, Wen M, Kowaleski-Jones L. 2014. An ecological analysis of environmental correlates of active commuting in urban U.S. *Health Place* 30:242-250, <https://doi.org/10.1016/j.healthplace.2014.09.014>.
- Fjørtoft I. 2001. The natural environment as a playground for children: The impact of outdoor play activities in pre-primary school children. *Early Child Educ J* 29(2):111-117, <https://doi.org/10.1023/A:1012576913074>.
- Fuhrman C, Sarter H, Thibaudon M, Delmas MC, Zeghnoun A, Lecadet J, Caillaud D. 2007. Short-term effect of pollen exposure on antiallergic drug consumption. *Ann Allergy Asthma Immunol* 99(3):225-231, [https://doi.org/10.1016/S1081-1206\(10\)60657-6](https://doi.org/10.1016/S1081-1206(10)60657-6).
- Gatersleben B, Andrews M. 2013. When walking in nature is not restorative - the role of prospect and refuge. *Health Place* 20:91-101, <https://doi.org/doi:10.1016/j.healthplace.2013.01.001>.
- Gathright J, Yamada Y, Morita M. 2006. Comparison of the physiological and psychological benefits of tree and tower climbing. *Urban For Urban Gree* 5(3):141-149, <https://doi.org/10.1016/j.ufug.2005.12.003>.
- Gathright J, Yamada Y, Morita M. 2008. Tree-assisted therapy: Therapeutic and societal benefits from purpose-specific technical recreational tree-climbing programs. *Arboric Urban For* 34(4):222-229.
- Ghimire R, Ferreira S, Green GT, Poudyal NC, Cordell HK, Thapa JR. 2017. Green space and adult obesity in the United States. *Ecol Econ* 136:201-212, <https://doi.org/10.1016/j.ecolecon.2017.02.002>.
- Gilchrist K, Brown C, Montarzino A. 2015. Workplace settings and wellbeing: Greenspace use and views contribute to employee wellbeing at peri-urban business sites. *Landsc Urban Plan* 138:32-40, <https://doi.org/10.1016/j.landurbplan.2015.02.004>.
- Gilstad-Hayden K, Wallace LR, Carroll-Scott A, Meyer SR, Barbo S, Murphy-Dunning C, Ickovics JR. 2015. Greater tree canopy cover is associated with lower rates of both violent and property crime in New Haven, CT. *Landsc Urban Plan* 143:248-253, <https://doi.org/10.1016/j.landurbplan.2015.08.005>.
- Gonianakis MI, Baritaki MA, Neonakis IK, Gonianakis IM, Kypriotakis Z, Darivianaki E, Bouros D, Kontou-Filli K. 2006. A 10-year aerobiological study (1994-2003) in the Mediterranean island of Crete, Greece: Trees, aerobiologic data, and botanical and clinical correlations. *Allergy Asthma Proc* 27(5):371-377, <http://doi.org/10.2500/aap.2006.27.2911>.
- Graham DA, Vanos JK, Kenny NA, Brown RD. 2016. The relationship between neighbourhood tree canopy cover and heat-related ambulance calls during extreme heat events in Toronto, Canada. *Urban For Urban Gree* 20:180-186, <https://doi.org/10.1016/j.ufug.2016.08.005>.
- Guerra F, Galán Carmen C, Daza JC, Miguel R, Moreno C, González J, Domínguez E. 1995. Study of sensitivity to the pollen of *Fraxinus* spp. (Oleaceae) in Cordoba, Spain. *J Investig Allergol Clin Immunol* 5(3):166-70.
- Harmanci E, Metintas E. 2000. The type of sensitization to pollens in allergic patients in Eskisehir (Anatolia), Turkey. *Allergol Immunopathol (Madr)* 28(2):63-66.

- Hartig T, Evans GW, Jamner LD, Davis DS, Gärling T. 2003. Tracking restoration in natural and urban field settings. *J Environ Psychol* 23(2):109-123, [https://doi.org/10.1016/S0272-4944\(02\)00109-3](https://doi.org/10.1016/S0272-4944(02)00109-3).
- Hauru K, Lehvävirta S, Korpela K, Kotze DJ. 2012. Closure of view to the urban matrix has positive effects on perceived restorativeness in urban forests in Helsinki, Finland. *Landsc Urban Plan* 107:361-369, <https://doi.org/10.1016/j.landurbplan.2012.07.002>.
- Heisler GM, Grant RH, Gao W. 2003. Individual-and scattered-tree influences on ultraviolet irradiance. *Agric For Meteorol* 120(1-4):113-126, <https://doi.org/10.1016/j.agrformet.2003.08.024>.
- Hirabayashi S, Nowak DJ. 2016. Comprehensive national database of tree effects on air quality and human health in the United States. *Environ Pollut* 215:48-57, <https://doi.org/10.1016/j.envpol.2016.04.068>.
- Holtan MT, Dieterlen SL, Sullivan WC. 2015. Social life under cover: Tree canopy and social capital in Baltimore, Maryland. *Environ Behav* 47(5):502-525, <https://doi.org/10.1177%2F0013916513518064>.
- Horiuchi M, Endo J, Akatsuka S, Uno T, Hasegawa T, Seko Y. 2013. Influence of forest walking on blood pressure, profile of mood states, and stress markers from the viewpoint of aging. *J Aging Gerontol* 1:9-17.
- Horiuchi M, Endo J, Takayama N, Murase K, Nishiyama N, Saito H, Fujiwara A. 2014. Impact of viewing vs. not viewing a real forest on physiological and psychological responses in the same setting. *Int J Environ Res Public Health* 11(10):10883-10901, <https://doi.org/10.3390/ijerph111010883>.
- Irani I, Karam K, Baz B, Maatouk M, Zaitoun Z. 2013. Airborne pollen concentrations and the incidence of allergic asthma and rhinoconjunctivitis in Lebanon. *Revue Francaise d'Allergologie* 53(5):441-445, <https://doi.org/10.1016/j.reval.2012.12.002>.
- Ishizaki T, Koizumi K, Ikemori R, Ishiyama Y, Kushibiki E. 1987. Studies of prevalence of Japanese cedar pollinosis among the residents in a densely cultivated area. *Ann Allergy* 58(4):265-70.
- Janssen I, Rosu A. 2015. Undeveloped green space and free-time physical activity in 11 to 13-year-old children. *Int J Behav Nutr Phys Act* 12(26):7, <https://doi.org/10.1186/s12966-015-0187-3>.
- Jariwala S, Toh J, Shum M, de Vos G, Zou K, Sindher S, Patel P, Geevarghese A, Tavdy A, Rosenstreich D. 2014. The association between asthma-related emergency department visits and pollen and mold spore concentrations in the Bronx, 2001-2008. *J Asthma* 51(1):79-83, <https://doi.org/10.3109/02770903.2013.853779>.
- Jariwala SP, Kurada S, Moday H, Thanjan A, Bastone L, Khananashvili M, Fodeman J, Hudes G, Rosenstreich D. 2011. Association between tree pollen counts and asthma ED visits in a high-density urban center. *J Asthma* 48(5):442-448, <https://doi.org/10.3109/02770903.2011.567427>.
- Jeon-Slaughter H, Claassen CA, Khan DA, Mihalakos P, Lee KB, Brown ES. 2016. Temporal association between nonfatal self-directed violence and tree and grass pollen counts. *J Clin Psychiatry* 77(9):1160-1167, <https://doi.org/10.4088/JCP.15m09864>.
- Jeong M, Park S, Song G. 2016. Comparison of human thermal responses between the urban forest area and the central building district in Seoul, Korea. *Urban For Urban Gree* 15:133-148, <https://doi.org/10.1016/j.ufug.2015.12.005>.

- Jiang B, Chang C-Y, Sullivan WC. 2014. A dose of nature: Tree cover, stress reduction, and gender differences. *Landsc Urban Plan* 132:26-36, <https://doi.org/10.1016/j.landurbplan.2014.08.005>.
- Jiang B, Li D, Larsen L, Sullivan WC. 2016. A dose-response curve describing the relationship between urban tree cover density and self-reported stress recovery. *Environ Behav* 48(4):607-629, <https://doi.org/10.1177/0013916514552321>.
- Johansson E, Emmanuel R. 2006. The influence of urban design on outdoor thermal comfort in the hot, humid city of Colombo, Sri Lanka. *Int J Biometeorol* 51(2):119-133, <https://doi.org/10.1007/s00484-006-0047-6>.
- Jones BA. 2016. Work more and play less? Time use impacts of changing ecosystem services: The case of the invasive emerald ash borer. *Ecol Econ* 124:49-58, <https://doi.org/10.1016/j.ecolecon.2016.02.003>.
- Joung D, Kim G, Choi Y, Lim H, Park S, Woo J-M, Park B-J. 2015. The prefrontal cortex activity and psychological effects of viewing forest landscapes in autumn season. *Int J Environ Res Public Health* 12(7):7235-7243, <https://doi.org/10.3390/ijerph120707235>.
- Jung WH, Woo J, Ryu JS. 2015. Effect of a forest therapy program and the forest environment on female workers' stress. *Urban For Urban Gree* 14(2):274-281, <https://doi.org/10.1016/j.ufug.2015.02.004>.
- Kántor N, Chen L, Gál CV. 2018. Human-biometeorological significance of shading in urban public spaces - summertime measurements in Pécs, Hungary. *Landsc Urban Plan* 170:241-255, <https://doi.org/10.1016/j.landurbplan.2017.09.030>.
- Kardan O, Gozdyra P, Misic B, Moola F, Palmer LJ, Paus T, Berman MG. 2015. Neighbourhood greenspace and health in a large urban center. *Sci Rep* 5:11610, <https://doi.org/10.1038/srep11610>.
- Kilbourne EM, Choi K, Jones S. 1982. Risk factors for heatstroke. A case-control study. *JAMA* 247:3332-3336, <https://doi.org/10.1001/jama.1982.03320490030031>.
- Kim DH, Park YS, Jang HJ, Kim JH, Lim DH. 2016a. Prevalence and allergen of allergic rhinitis in Korean children. *Am J Rhinol Allergy* 30(3):72-78, <https://doi.org/10.2500/ajra.2013.27.4317>.
- Kim J-H, Lee C, Olvara NE, Ellis CD. 2014. The role of landscape spatial patterns on obesity in Hispanic children residing in inner-city neighbourhoods. *J Phys Act Health* 11:1449-1457, <https://doi.org/10.1123/jpah.2012-0503>.
- Kim JH, Lee C, Sohn W. 2016b. Urban natural environments, obesity, and health-related quality of life among Hispanic children living in inner-city neighbourhoods. *Int J Environ Res Public Health* 13(1), <https://doi.org/10.3390/ijerph13010121>.
- Kim W, Lim SK, Chung EJ, Woo JM. 2009. The effect of cognitive behavior therapy-based psychotherapy applied in a forest environment on physiological changes and remission of major depressive disorder. *Psychiatry Investig* 6(4):245-254, <https://doi.org/10.4306/pi.2009.6.4.245>.
- Klemm W, Heusinkveld BG, Lenzholzer S, Jacobs MH, Van Hove B. 2015. Psychological and physical impact of urban green spaces on outdoor thermal comfort during summertime in the Netherlands. *Build Environ* 83:120-128, <https://doi.org/10.1016/j.buildenv.2014.05.013>.

- Kobayashi H, Song C, Ikei H, Kagawa T, Miyazaki Y. 2015. Analysis of individual variations in autonomic responses to urban and forest environments. *Evid Based Complement Alternat Med* 2015:61094, <https://doi.org/http://dx.doi.org/10.1155/2015/671094>.
- Kondo MC, Han S, Donovan GH, MacDonald JM. 2017a. The association between urban trees and crime: Evidence from the spread of the emerald ash borer in Cincinnati. *Landsc Urban Plan* 157:193-199, <https://doi.org/10.1016/j.landurbplan.2016.07.003>.
- Kondo MC, South EC, Branas CC, Richmond TS, Wiebe DJ. 2017b. The association between urban tree cover and gun assault: A case-control and case-crossover study. *Am J Epidemiol* 186(3):289-296, <https://doi.org/10.1093/aje/kwx096>.
- Kühn S, Düzel S, Eibich P, Krekel C, Wüstemann H, Kolbe J, Martensson J, Goebel J, Gallinat J, Wagner GG. 2017. In search of features that constitute an “enriched environment” in humans: Associations between geographical properties and brain structure. *Sci Rep* 7:11920, <https://doi.org/10.1038/s41598-017-12046-7>.
- Kuo FE 2001. Coping with poverty: Impacts of environment and attention in the inner city. *Environ Behav* 33(1):5-34, <https://doi.org/10.1177/00139160121972846>.
- Kuo FE, Sullivan WC. 2001a. Aggression and violence in the inner city: Effects of environment via mental fatigue. *Environ Behav* 33(4):543-571, <https://doi.org/10.1177/00139160121973124>.
- Kuo FE, Sullivan WC. 2001b. Environment and crime in the inner city: Does vegetation reduce crime? *Environ Behav* 33(3):343-367, <https://doi.org/10.1177/0013916501333002>.
- Larsen K, Gilliland J, Hess P, Tucker P, Irwin J, He M. 2009. The influence of the physical environment and sociodemographic characteristics on children's mode of travel to and from school. *Am J Public Health* 99(3):520-526, <https://doi.org/10.2105/AJPH.2008.135319>.
- Lee H, Mayer H, Chen L. 2016. Contribution of trees and grasslands to the mitigation of human heat stress in a residential district of Freiburg, southwest Germany. *Landsc Urban Plan* 148:37-50, <https://doi.org/10.1016/j.landurbplan.2015.12.004>.
- Lee J, Park BJ, Tsunetsugu Y, Kagawa T, Miyazaki Y. 2009. Restorative effects of viewing real forest landscapes, based on a comparison with urban landscapes. *Scand J For Res* 24(3):227-234, <https://doi.org/10.1080/02827580902903341>.
- Lee J, Park BJ, Tsunetsugu Y, Ohira 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, <https://doi.org/10.1016/j.puhe.2010.09.005>.
- Lee J, Tsunetsugu Y, Takayama N, Park B-J, Li Q, Song C, Komatsu M, Ikei H, Tyrväinen L, Kagawa T. 2014. Influence of forest therapy on cardiovascular relaxation in young adults. *J Evid Based Complementary Altern Med* 2014:834360, <http://dx.doi.org/10.1155/2014/834360>.
- Li J, Sun B, Huang Y, Lin X, Zhao D, Tan G, Wu J, Zhao H, Cao L, et al. 2009. A multicentre study assessing the prevalence of sensitizations in patients with asthma and/or rhinitis in China. *Allergy* 64(7):1083-1092, <https://doi.org/10.1111/j.1398-9995.2009.01967.x>.

- Li Q, Kobayashi M, Inagaki H, Hirata Y, Li YJ, Hirata K, Shimizu T, Suzuki H, Katsumata M, et al. 2010. A day trip to a forest park increases human natural killer activity and the expression of anti-cancer proteins in male subjects. *J Biol Regul Homeost Agents* 24(2):157-166.
- Li Q, Kobayashi M, Kawada T. 2008a. Relationships between percentage of forest coverage and standardized mortality ratios (SMR) of cancers in all prefectures in Japan. *Open Public Health J* 1:1-7.
- Li Q, Morimoto K, Kobayashi M, Inagaki H, Katsumata M, Hirata Y, Hirata K, Shimizu T, Li YJ, et al. 2008b. A forest bathing trip increases human natural killer activity and expression of anti-cancer proteins in female subjects. *J Biol Regul Homeost Agents* 22(1):45-55.
- Li Q, Morimoto K, Kobayashi M, Inagaki H, Katsumata M, Hirata Y, Hirata K, Suzuki H, Li YJ, et al. 2008c. Visiting a forest, but not a city, increases human natural killer activity and expression of anti-cancer proteins. *Int J Immunopathol Pharmacol* 21(1):117-127, <https://doi.org/10.1177%2F039463200802100113>.
- Li Q, Morimoto K, Nakadai A, Inagaki H, Katsumata M, Shimizu T, Hirata Y, Hirata K, Suzuki H, et al. 2007. Forest bathing enhances human natural killer activity and expression of anti-cancer proteins. *Int J Immunopathol Pharmacol* 20(2 Suppl 2):3-8, <https://doi.org/10.1177%2F03946320070200S202>.
- Li Q, Otsuka T, Kobayashi M, Wakayama Y, Inagaki H, Katsumata M, Hirata Y, Li YJ, Hirata K, et al. 2011. Acute effects of walking in forest environments on cardiovascular and metabolic parameters. *Eur J Appl Physiol* 111(11):2845-2853, <https://doi.org/10.1007/s00421-011-1918-z>.
- Lin RY, Clauss AE, Bennett ES. 2002. Hypersensitivity to common tree pollens in New York City patients. *Allergy Asthma Proc* 23(4):253-8.
- Lin T, Matzarakis A, Hwang R. 2010. Shading effect on long-term outdoor thermal comfort. *Build Environ* 45(1):213-221, <https://doi.org/10.1016/j.buildenv.2009.06.002>.
- Lin T, Tsai K, Hwang R, Matzarakis A. 2012. Quantification of the effect of thermal indices and sky view factor on park attendance. *Landsc Urban Plan* 107(2):137-146, <https://doi.org/10.1016/j.landurbplan.2012.05.011>.
- Lin T, Tsai K, Liao C, Huang Y. 2013. Effects of thermal comfort and adaptation on park attendance regarding different shading levels and activity types. *Build Environ* 59:599-611, <https://doi.org/10.1016/j.buildenv.2012.10.005>.
- Lin YH, Tsai CC, Sullivan WC, Chang PJ, Chang CY. 2014. Does awareness effect the restorative function and perception of street trees? *Front Psychol* 5:906, <https://doi.org/10.3389/fpsyg.2014.00906>.
- Loureiro G, Rabaca M-, Blanco B, Andrade S, Chieira C, Pereira C. 2005. Urban versus rural environment--any differences in aeroallergens sensitization in an allergic population of Cova da Beira, Portugal? *Eur Ann Allergy Clin Immunol* 37(5):187-193.
- Lovasi GS, Bader MD, Quinn J, Neckerman K, Weiss C, Rundle A. 2012. Body mass index, safety hazards, and neighbourhood attractiveness. *Am J Prev Med* 43(4):378-384, <https://doi.org/10.1016/j.amepre.2012.06.018>.

- Lovasi GS, Jacobson JS, Quinn JW, Neckerman KM, Ashby-Thompson MN, Rundle A. 2011. Is the environment near home and school associated with physical activity and adiposity of urban preschool children? *J Urban Health* 88(6):1143-1157, <https://doi.org/10.1007/s11524-011-9604-3>.
- Lovasi GS, O'Neil-Dunne JP, Lu JW, Sheehan D, Perzanowski MS, MacFaden SW, King KL, Matte T, Miller RL, Hoepner LA. 2013a. Urban tree canopy and asthma, wheeze, rhinitis, and allergic sensitization to tree pollen in a New York City birth cohort. *Environ Health Perspect* 121(4):494-500, <https://doi.org/10.1289/ehp.1205513>.
- Lovasi GS, Quinn JW, Neckerman KM, Perzanowski MS, Rundle A. 2008. Children living in areas with more street trees have lower prevalence of asthma. *J Epidemiol Community Health* 62:647-649, <https://doi.org/10.1136/jech.2007.071894>.
- Lovasi GS, Schwartz-Soicher O, Neckerman KM, Konty K, Kerker B, Quinn J, Rundle A. 2013b. Aesthetic amenities and safety hazards associated with walking and bicycling for transportation in New York City. *Ann Behav Med* 45 Suppl 1:S76-S85, <https://doi.org/10.1007/s12160-012-9416-z>.
- Lovasi GS, Schwartz-Soicher O, Quinn JW, Berger DK, Neckerman KM, Jaslow R, Lee KK, Rundle A. 2013c. Neighbourhood safety and green space as predictors of obesity among preschool children from low-income families in New York City. *Prev Med* 57(3):189-193, <https://doi.org/10.1016/j.ypmed.2013.05.012>.
- 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. 2012a. Therapeutic effect of forest bathing on human hypertension in the elderly. *J Cardiol* 60(6):495-502, <https://doi.org/10.1016/j.jjcc.2012.08.003>.
- Mao GX, Lan XG, Cao YB, Chen ZM, He ZH, Lv YD, Wang YZ, Hu XL, Wang GF, Yan J. 2012b. Effects of short-term forest bathing on human health in a broad-leaved evergreen forest in Zhejiang Province, China. *Biomed Environ Sci* 25(3):317-324, <https://doi.org/10.3967/0895-3988.2012.03.010>.
- Markevych I, Smith MP, Jochner S, Standl M, Brüske I, von Berg A, Bauer CP, Fuks K, Koletzko S, et al. 2016. Neighbourhood and physical activity in German adolescents: GINIplus and LISAPLUS. *Environ Res* 147:284-293, <https://doi.org/10.1016/j.envres.2016.02.023>.
- Martens D, Gutscher H, Bauer N. 2011. Walking in "wild" and "tended" urban forests: The impact on psychological well-being. *J Environ Psychol* 31(1):36-44, <https://doi.org/10.1016/j.jenvp.2010.11.001>.
- Mårtensson F, Boldemann C, Söderström M, Blennow M, Englund JE, Grahn P. 2009. Outdoor environmental assessment of attention promoting settings for preschool children. *Health Place* 15(4):1149-57, <https://doi.org/10.1016/j.healthplace.2008.11.001>.
- Martínez-Soto J, Gonzales-Santos L, Pasaye E, Barrios FA. 2013. Exploration of neural correlates of restorative environment exposure through functional magnetic resonance. *Intelligent Buildings International* 5(sup1):10-28, <https://doi.org/10.1080/17508975.2013.807765>.
- Matsunaga K, Park B-J, Kobayashi H, Miyazaki Y. 2011. Physiologically relaxing effect of a hospital rooftop forest on older women requiring care. *J Am Geriatr Soc* 59(11):2162-2163, <https://doi.org/10.1111/j.1532-5415.2011.03651.x>.

- May L, Carim M, Yadav K. 2011. Adult asthma exacerbations and environmental triggers: A retrospective review of ED visits using an electronic medical record. *Am J Emerg Med* 29(9):1074-1082, <https://doi.org/10.1016/j.ajem.2010.06.034>.
- Mertens L, Compernelle S, Deforche B, Mackenbach JD, Lakerveld J, Brug J, Roda C, Feuillet T, Opper JM, et al. 2017. Built environmental correlates of cycling for transport across Europe. *Health Place* 44:35-42, <https://doi.org/10.1016/j.healthplace.2017.01.007>.
- Milošević DD, Bajšanski IV, Savić SM. 2017. Influence of changing trees locations on thermal comfort on street parking lot and footways. *Urban For Urban Gree* 23:113-124, <https://doi.org/10.1016/j.ufug.2017.03.011>.
- Morita E, Fukuda S, Nagano J, Hamajima N, Yamamoto H, Iwai Y, Nakashima T, Ohira H, Shirakawa T. 2007. Psychological effects of forest environments on healthy adults: Shinrin-yoku (forest-air bathing, walking) as a possible method of stress reduction. *Public Health* 121(1):54-63, <https://doi.org/10.1016/j.puhe.2006.05.024>.
- Motreff Y, Golliot F, Calleja M, Le Pape A, Fuhrman C, Farrera I, Plaisant I. 2014. Short-term effect of pollen exposure on drug consumption for allergic rhinitis and conjunctivitis. *Aerobiologia* 30(1):35-44, <https://doi.org/10.1007/s10453-013-9307-1>.
- Nehme EK, Oluyomi AO, Calise TV, Kohl HW. 2016. Environmental correlates of recreational walking in the neighbourhood. *Am J Health Promot* 30(3):139-148, <https://doi.org/10.4278/ajhp.130531-QUAN-281>.
- Nordh H, Grahn P, Währborg P. 2009. Meaningful activities in the forest, a way back from exhaustion and long-term sick leave. *Urban For Urban Gree* 8(3):207-219, <https://doi.org/10.1016/j.ufug.2009.02.005>.
- Nowak DJ, Hirabayashi S, Bodine A, Greenfield E. 2014. Tree and forest effects on air quality and human health in the United States. *Environ Pollut* 193:119-129, <https://doi.org/10.1016/j.envpol.2014.05.028>.
- Nowak DJ, Hirabayashi S, Bodine A, Hoehn R. 2013. Modeled PM_{2.5} removal by trees in ten U.S. cities and associated health effects. *Environ Pollut* 178:395-402, <https://doi.org/10.1016/j.envpol.2013.03.050>.
- Ohtsuka Y, Yabunaka N, Takayama S. 1998. Shinrin-yoku (forest-air bathing and walking) effectively decreases blood glucose levels in diabetic patients. *Int J Biometeorol* 41(3):125-127, <https://doi.org/10.1007/s004840050064>.
- Osborne NJ, Alcock I, Wheeler BW, Hajat S, Sarran C, Clewlow Y, McInnes RN, Hemming D, White M, Vardoulakis S, Fleming LE. 2017. Pollen exposure and hospitalization due to asthma exacerbations: Daily time series in a European city. *Int J Biometeorol* 61(10):1837-1848, <https://doi.org/10.1007/s00484-017-1369-2>.
- Paddle E, Gilliland J. 2016. Orange is the new green: Exploring the restorative capacity of seasonal foliage in schoolyard trees. *Int J Environ Res Public Health* 13(5):e18, <https://doi.org/10.3390/ijerph13050497>.
- Parisi AV, Kimlin MG, Wong JCF, Lester R, Turnbull D. 2000a. Reduction in the personal annual solar erythemal ultraviolet exposure provided by Australian gum trees. *Radiat Prot Dosimetry* 92(4):307-312, <https://doi.org/10.1093/oxfordjournals.rpd.a033297>.

- Parisi AV, Kimlin MG, Wong JCF, Wilson M. 2000b. Personal exposure distribution of solar erythemal ultraviolet radiation in tree shade over summer. *Phys Med Biol* 45(2):349, <http://doi.org/10.1088/0031-9155/45/2/307>.
- Park B-J, Furuya K, Kasetani T, Takayama N, Kagawa T, Miyazaki Y. 2011. Relationship between psychological responses and physical environments in forest settings. *Landsc Urban Plan* 102(1):24-32, <https://doi.org/10.1016/j.landurbplan.2011.03.005>.
- Park B-J, Tsunetsugu Y, Kasetani T, Hirano H, Kagawa T, Sato M, Miyazaki Y. 2007. Physiological effects of shinrin-yoku (taking in the atmosphere of the forest)-using salivary cortisol and cerebral activity as indicators. *J Physiol Anthropol* 26(2):123-128, <https://doi.org/10.2114/jpa2.26.123>.
- 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. *Environ Health Prev Med* 15(1):18-26, <https://doi.org/10.1007/s12199-009-0086-9>.
- Park B-J, Tsunetsugu Y, Kasetani T, Morikawa T, Kagawa T, Miyazaki Y. 2009. Physiological effects of forest recreation in a young conifer forest in Hinokage Town, Japan. *Silva Fennica* 43(2):291-301.
- Perkins S, Searight HR, Ratwik S. 2011. Walking in a natural winter setting to relieve attention fatigue: A pilot study. *Psychology* 2(8):777-780, <https://doi.org/10.4236/psych.2011.28119>.
- Piff PK, Dietze P, Feinberg M, Stancato DM, Keltner D. 2015. Awe, the small self, and prosocial behavior. *J Pers Soc Psychol* 108(6):883-899, <https://doi.org/10.1037/pspi0000018>.
- Pilat MA, McFarland A, Snelgrove A, Collins K, Waliczek TM, Zajicek J. 2012. The effect of tree cover and vegetation on incidence of childhood asthma in Metropolitan Statistical Areas of Texas. *HortTechnology* 22(5):631-637, <https://doi.org/10.21273/HORTTECH.22.5.631>.
- Puiggròs A, Muñoz-Cano R, Roger Reig A, Raga E, Belmonte J, Valero A. 2015. Prevalence of sensitization to pollen from trees planted in Barcelona City. *J Investig Allergol Clin Immunol* 25(2):150-1.
- Rao M, George LA, Rosenstiel TN, Shandas V, Dinno A. 2014. Assessing the relationship among urban trees, nitrogen dioxide, and respiratory health. *Environ Pollut* 194:96-104, <https://doi.org/10.1016/j.envpol.2014.07.011>.
- Rao M, George LA, Shandas V, Rosenstiel TN. 2017. Assessing the potential of land use modification to mitigate ambient NO₂ and its consequences for respiratory health. *Int J Environ Res Public Health* 14(7), <https://doi.org/10.3390/ijerph14070750>.
- Ratola N, Jiménez-Guerrero P. 2017. Modelling benzo[a]pyrene in air and vegetation for different land uses and assessment of increased health risk in the Iberian Peninsula. *Environ Sci Pollut Res Int* 24(13):11901-11910, <https://doi.org/10.1007/s11356-015-5394-6>. Ren Y, Qu Z, Du Y, Xu R, Ma D,
- Reid CE, Clougherty JE, Shmool JLC, Kubzansky LD. 2017. Is all urban green space the same? A comparison of the health benefits of trees and grass in New York City. *Int J Environ Res Public Health* 14(11) :1411; <https://doi.org/10.3390/ijerph14111411>.

- Ren Y, Qu Z, Du Y, Xu R, Ma D, Yang G, Shi Y, Fan X, Tani A, et al. 2017. Air quality and health effects of biogenic volatile organic compounds emissions from urban green spaces and the mitigation strategies. *Environ Pollut* 230:849-861, <https://doi.org/10.1016/j.envpol.2017.06.049>.
- Roe J, Aspinall P. 2011. The restorative outcomes of forest school and conventional school in young people with good and poor behaviour. *Urban For Urban Gree* 10:205-212. <https://doi.org/10.1016/j.ufug.2011.03.003>.
- Sam CK, Soon SC, Liam CK, Padmaja K, Cheng HM. 1998. An investigation of aeroallergens affecting urban Malaysian asthmatics. *Asian Pac J Allergy Immunol* 16(1):17-20.
- Sánchez-Mesa JA, Serrano P, Cariñanos P, Prieto-Baena JC, Moreno C, Guerra F, Galan C. 2005. Pollen allergy in Cordoba city: Frequency of sensitization and relation with antihistamine sales. *J Investig Allergol Clin Immunol* 15(1):50-56.
- Sanusi R, Johnstone D, May P, Livesley SJ. 2016. Street orientation and side of the street greatly influence the microclimatic benefits street trees can provide in summer. *J Environ Qual* 45(1):167-174, <https://doi.org/10.2134/jeq2015.01.0039>.
- Schipperijn J, Bentsen P, Troelsen J, Toftager M, Stigsdotter UK. 2013. Associations between physical activity and characteristics of urban green space. *Urban For Urban Gree* 12(1):109-116, <https://doi.org/10.1016/j.ufug.2012.12.002>.
- Seo SC, Park SJ, Park C-W, Yoon WS, Choung JT, Yoo Y. 2014. Clinical and immunological effects of a forest trip in children with asthma and atopic dermatitis. *Iran J Allergy Asthma Immunol* 14(1):28-36.
- Sheehan WJ, Rangsithienchai PA, Baxi SN, Gardynski A, Bharmanee A, Israel E, Phipatanakul W. 2010. Age-specific prevalence of outdoor and indoor aeroallergen sensitization in Boston. *Clin Pediatr (Phila)* 49(6):579-585, <https://doi.org/10.1177/0009922809354326>.
- Sheffield PE, Weinberger KR, Ito K, Matte TD, Mathes RW, Robinson GS, Kinney PL. 2011. The association of tree pollen concentration peaks and allergy medication sales in New York City: 2003-2008. *ISRN Allergy* 2011:537194.
- Shin WS. 2007. The influence of forest view through a window on job satisfaction and job stress. *Scand J For Res* 22(3):248-253, <https://doi.org/10.1080/02827580701262733>.
- Shin WS, Shin CS, Yeoun PS, Kim JJ. 2011. The influence of interaction with forest on cognitive function. *Scand J For Res* 26(6):595-598, <https://doi.org/10.1080/02827581.2011.585996>.
- Shin Y-K, Kim DJ, Jung-Choi K, Son Y-J, Koo J-W, Min J-A, Chae J-H. 2013. Differences of psychological effects between meditative and athletic walking in a forest and gymnasium. *Scand J For Res* 28(1):64-72, <https://doi.org/10.1080/02827581.2012.706634>.
- Song C, Ikei H, Kobayashi M, Miura T, Li Q, Kagawa T, Kumeda S, Imai M, Miyazaki Y. 2017a. Effects of viewing forest landscape on middle-aged hypertensive men. *Urban For Urban Gree* 21:247-252, <https://doi.org/10.1016/j.ufug.2016.12.010>.

- Song C, Ikei H, Kobayashi M, Miura T, Taue M, Kagawa T, Li Q, Kumeda S, Imai M, Miyazaki Y. 2015a. Effect of forest walking on autonomic nervous system activity in middle-aged hypertensive individuals: A pilot study. *Int J Environ Res Public Health* 12(3):2687-2699.
- Song C, Ikei H, Lee J, Park B-J, Kagawa T, Miyazaki Y. 2013. Individual differences in the physiological effects of forest therapy based on type A and type B behavior patterns. *J Physiol Anthropol* 32:14.
- Song C, Ikei H, Miyazaki Y. 2015. Elucidation of a physiological adjustment effect in a forest environment: A pilot study. *Int J Environ Res Public Health* 12(4):4247-4255, <https://doi.org/10.3390/ijerph120404247>.
- Song C, Ikei H, Miyazaki Y. 2017b. Sustained effects of a forest therapy program on the blood pressure of office workers. *Urban For Urban Gree* 27:246-252, <https://doi.org/10.1016/j.ufug.2017.08.015>.
- Song GS, Jeong MA. 2016. Morphology of pedestrian roads and thermal responses during summer, in the urban area of Bucheon City, Korea. *Int J Biometeorol* 60(7):999-1014, <https://doi.org/10.1007/s00484-015-1092-9>.
- Song X, Li H, Li C, Xu J, Hu D. 2016. Effects of VOCs from leaves of *Acer truncatum Bunge* and *Cedrus deodara* on human physiology and psychology. *Urban For Urban Gree* 19:29-34, <https://doi.org/10.1016/j.ufug.2016.06.021>.
- Sonntag-Öström E, Nordin M, Lundell Y, Dolling A, Wiklund U, Karlsson M, Carlberg B, Slunga Järvholm L. 2014. Restorative effects of visits to urban and forest environments in patients with exhaustion disorder. *Urban For Urban Gree* 13(2):344-354, <https://doi.org/10.1016/j.ufug.2013.12.007>.
- Stone B, Vargo J, Liu P, Habeeb D, DeLucia A, Trail M, Hu Y, Russell A. 2014. Avoided heat-related mortality through climate adaptation strategies in three US cities. *PLoS One* 9(6):e100852, <https://doi.org/10.1371/journal.pone.0100852>.
- Sullivan WC, Kuo FE, DePooter S. 2004. The fruit of urban nature: Vital neighborhood spaces. *Environ Behav* 36(5):678-700, <https://doi.org/10.1177/0193841X04264945>.
- Sung M, Kim SW, Kim JH, Lim DH. 2017. Regional difference of causative pollen in children with allergic rhinitis. *J Korean Med Sci* 32(6):926-932, <https://doi.org/10.3346/jkms.2017.32.6.926>.
- Sung J, Woo JM, Kim W, Lim SK, Chung EJ. 2012. The effect of cognitive behavior therapy-based “forest therapy” program on blood pressure, salivary cortisol level, and quality of life in elderly hypertensive patients. *Clin Exp Hypertens* 34(1):1-7, <https://doi.org/10.3109/10641963.2011.618195>.
- Takano T, Nakamura K, Watanabe M. 2002. Urban residential environments and senior citizens' longevity in megacity areas: The importance of walkable green spaces. *J Epidemiol Community Health* 56(12):913-916, <https://doi.org/10.1136/jech.56.12.913>.
- Takayama N, Korpela K, Lee J, Morikawa T, Tsunetsugu Y, Park B-J, Li Q, Tyrväinen L, Miyazaki Y, Kagawa T. 2014. Emotional, restorative and vitalizing effects of forest and urban environments at four sites in Japan. *Int J Environ Res Public Health* 11(7):7207-7230.

- Tarar G, Etheredge CL, McFarland A, Snelgrove A, Waliczek TM, Jajicek JM. 2015. The effect of urban tree canopy cover and vegetation levels on incidence of stress-related illnesses in humans in Metropolitan Statistical Areas of Texas. *HortTechnology* 25(1):76-84, <https://doi.org/10.21273/HORTTECH.25.1.76>.
- Taylor AF, Kuo FE, Sullivan WC. 2002. Views of nature and self-discipline: Evidence from inner city children. *J Environ Psychol* 22(1-2):49-63, <https://doi.org/10.1006/jevp.2001.0241>.
- Taylor AF, Wiley A, Kuo FE, Sullivan WC. 1998. Growing up in the inner city: Green spaces as places to grow. *Environ Behav* 30(1):3-27, <https://doi.org/10.1177/0013916598301001>.
- Taylor MS, Wheeler BW, White MP, Economou T, Osborne NJ. 2015. Urban street tree density and antidepressant prescription rates—A cross-sectional study in London, UK. *Landsc Urban Plan* 136:174-179, <https://doi.org/10.1016/j.landurbplan.2014.12.005>.
- Tilt JH. 2010. Walking trips to parks: Exploring demographic, environmental factors, and preferences for adults with children in the household. *Prev Med* 50 Suppl 1:S69-S73, <https://doi.org/10.1016/j.ypmed.2009.07.026>.
- Tiwary A, Sinnott D, Peachey C, Chalabi Z, Vardoulakis S, Fletcher T, Leonardi G, Grundy C, Azapagic A, Hutchings TR. 2009. An integrated tool to assess the role of new planting in PM10 capture and the human health benefits: A case study in London. *Environ Pollut* 157(10):2645-2653, <https://doi.org/10.1016/j.envpol.2009.05.005>.
- Toda M, Den R, Hasegawa-Ohira M, Morimoto K. 2013. Effects of woodland walking on salivary stress markers cortisol and chromogranin A. *Complement Ther Med* 21(1):29-34, <https://doi.org/10.1016/j.ctim.2012.11.004>.
- Townsend JB, Ilvento TW, Barton SS. 2016. Exploring the relationship between trees and human stress in the urban environment. *Arb UF* 42(3):146-159.
- Troy A, Grove MJ, O'Neil-Dunne J. 2012. The relationship between tree canopy and crime rates across an urban--rural gradient in the greater Baltimore region. *Landsc Urban Plan* 106(3):262-270, <https://doi.org/10.1016/j.landurbplan.2012.03.010>.
- Tsai WL, Floyd MF, Leung YF, McHale MR, Reich BJ. 2016. Urban vegetative cover fragmentation in the U.S.: Associations with physical activity and BMI. *Am J Prev Med* 50(4):509-517, <https://doi.org/10.1016/j.amepre.2015.09.022>.
- Tsunetsugu Y, Lee J, Park B-J, Tyrväinen L, Kagawa T, Miyazaki Y. 2013. Physiological and psychological effects of viewing urban forest landscapes assessed by multiple measurements. *Landsc Urban Plan* 113:90-93, <https://doi.org/10.1016/j.landurbplan.2013.01.014>.
- Tsunetsugu Y, Park BJ, Ishii H, Hirano H, Kagawa T, Miyazaki Y. 2007. Physiological effects of shinrin-yoku (taking in the atmosphere of the forest) in an old-growth broadleaf forest in Yamagata Prefecture, Japan. *J Physiol Anthropol* 26(2):135-142, <https://doi.org/10.2114/jpa2.26.135>.
- Tyrväinen L, Ojala A, Korpela K, Lanki T, Tsunetsugu Y, Kagawa T. 2014. The influence of urban green environments on stress relief measures: A field experiment. *J Environ Psychol* 38:1 - 9, <https://doi.org/10.1016/j.jenvp.2013.12.005>.

- Ulmer JM, Wolf KL, Backman DR, Tretheway RL, Blain CJ, O'Neil-Dunne JP, Frank LD. 2016. Multiple health benefits of urban tree canopy: The mounting evidence for a green prescription. *Health Place* 42:54-62, <https://doi.org/10.1016/j.healthplace.2016.08.011>.
- Ulrich RS. 1984. View through a window may influence recovery from surgery. *Science* 224(4647):420-421, <https://doi.org/10.1126/science.6143402>.
- Van den Berg AE, Jorgensen A, Wilson ER. 2014. Evaluating restoration in urban green spaces: Does setting type make a difference? *Landscape and Urban Planning* 127:173-181, <https://doi.org/10.1016/j.landurbplan.2014.04.012>.
- Van den Berg AE, Van den Berg CG. 2011. A comparison of children with ADHD in a natural and built setting. *Child Care Health Dev* 37(3):430-439, <https://doi.org/10.1111/j.1365-2214.2010.01172.x>.
- Vieira FA, Ferreira EN, Cruz AA. 1998. Grass allergy increases the risk of tree pollen sensitization: a warning to urban planners. *J Allergy Clin Immunol* 102(4 Pt 1):700-1, [https://doi.org/10.1016/S0091-6749\(98\)70293-3](https://doi.org/10.1016/S0091-6749(98)70293-3).
- Wang L, Zhao X, Xu W, Tang J, Jiang X. 2016. Correlation analysis of lung cancer and urban spatial factor: Based on survey in Shanghai. *J Thorac Dis* 8(9):2626-2637, <https://doi.org/10.21037/jtd.2016.09.10>.
- Weichenthal S, Lavigne E, Villeneuve PJ, Reeves F. 2016. Airborne pollen concentrations and emergency room visits for myocardial infarction: A multicity case-crossover study in Ontario, Canada. *Am J Epidemiol* 183(7):613-621, <https://doi.org/10.1093/aje/kwv252>.
- Wilson LA, Giles-Corti B, Burton NW, Giskes K, Haynes M, Turrell G. 2011. The association between objectively measured neighbourhood features and walking in middle-aged adults. *Am J Health Promot* 25(4):e12-21, <https://doi.org/10.1080/13549839.2011.646965>.
- Wolf LJ, Zu Ermgassen S, Balmford A, White M, Weinstein N. 2017. Is variety the spice of life? An experimental investigation into the effects of species richness on self-reported mental well-being. *PLoS One* 12(1):e0170225, <https://doi.org/10.1371/journal.pone.0170225>.
- Wu J, Jackson L. 2017. Inverse relationship between urban green space and childhood autism in California elementary school districts. *Environ Int* 107:140-146, <https://doi.org/10.1016/j.envint.2017.07.010>.
- Wu J, Rappazzo KM, Simpson RJ, Joodi G, Pursell IW, Mounsey JP, Cascio WE, Jackson LE. 2018. Exploring links between greenspace and sudden unexpected death: A spatial analysis. *Environ Int* 113:114-121, <https://doi.org/10.1016/j.envint.2018.01.021>.
- Wu Z, Kong F, Wang Y, Sun R, Chen L. 2016. The impact of greenspace on thermal comfort in a residential quarter of Beijing, China. *Int J Environ Res Public Health* 13(12):17, <https://doi.org/10.3390/ijerph13121217>.
- Yamaguchi M, Deguchi M, Miyazaki Y. 2006. The effects of exercise in forest and urban environments on sympathetic nervous activity of normal young adults. *J Int Med Res* 34(2):152-159, <https://doi.org/10.1177/147323000603400204>.

Yu CP, Lin CM, Tsai MJ, Tsai YC, Chen CY. 2017. Effects of short forest bathing program on autonomic nervous system activity and mood states in middle-aged and elderly individuals. *Int J Environ Res Public Health* 14:897, <https://doi.org/10.3390/ijerph14080897>.

Zeng Y, Dong L. 2015. Thermal human biometeorological conditions and subjective thermal sensation in pedestrian streets in Chengdu, China. *Int J Biometeorol* 59(1):99-108, <https://doi.org/10.1007/s00484-014-0883-8>.

Zuniga-Teran AA, Orr BJ, Gimblett RH, Chalfoun NV, Guertin DP, Marsh SE. 2017. Neighbourhood design, physical activity, and wellbeing: Applying the walkability model. *Int J Environ Res Public Health* 14(1):76, <https://doi.org/10.3390/ijerph14010076>.