

Nature contact, psychological well-being, and physiological stress reactivity and recovery: A multi-study report of cross-sectional and randomized controlled experimental findings

Sara P. Perrins¹, Hector A. Olvera-Alvarez², Jie Yin³, Gregory N. Bratman⁴

¹Seattle Children's Research Institute, Seattle Children's Hospital, Seattle, WA, USA, SaraParkPerrins@gmail.com, ²School of Nursing, Oregon Health & Science University, Portland, OR, USA, ³College of Architecture and Urban Planning, Tongji University, Shanghai, China, ⁴School of Environmental and Forest Sciences, University of Washington, Seattle, WA, USA

Abstract

Urban nature and psychological well-being services

Urban forests and greenspaces provide ecosystem services such as storm water mitigation, cooling effects, and noise reduction. However, time spent in these spaces can also confer improved psychological well-being. To date, multiple psychological well-being benefits have been associated with nature contact, but the dominance of observational designs hampers the strength of the evidence. **We need more robust study designs and objective assessments** of outcomes to bolster the promising findings from existing studies.

Study main objectives and scope

Stress reduction is associated with nature contact, yet **few studies have assessed psychophysiological correlates of autonomic nervous system responses**, and **no study to date continuously assessed acute stress response** within randomly assigned environmental conditions (e.g., nature versus urban) to test whether natural areas may buffer from the immediate negative effects of stress. In this multi-study report, N = 96 participants first completed a cross-sectional survey (Study 1) on self-reported average weekly nature visitation, and affective, depressive symptom, anxiety and stress-related well-being.

Then, a subset of participants (N= 56; a smaller-than-intended sample due to COVID-19) completed a randomized controlled experimental procedure (Study 2). Participants wore discrete, mobile psychophysiology equipment and sat in a nature (with views of predominantly evergreen conifers and magnolias), urban, or laboratory site. Continuous assessments of autonomic activity were recorded through an induced stressor task, as well as recovery afterward.

Results

Cross-sectional survey results showed more time spent in nature was associated with more positive affect and less depression.

In the randomized controlled experiment, results suggest faster stress recovery (i.e., steeper downward Heart Rate slope) after an induced stressor in the nature condition, after controlling for noise, temperature, baseline stress levels, trait nature relatedness, sex, and race/ethnicity.

These findings provide empirical support for **the use of urban natural areas to promote stress reduction**, assessed through innovative experimental methodology and robust study design.



Can urban forests reduce stress and improve psychological well-being?

- Cross-sectional results showed more time spent in nature was associated with **more positive affect** ($B = 0.12$, 95%CI = 0.002, 0.24, $p = 0.046$) and **less depressive symptoms** ($B = -1.48$, 95% CI = -2.78, -0.18, $p = 0.026$)
- Results of the randomized controlled experiment showed **faster stress recovery** ($B = -0.075$, 95%CI = -0.13, -0.02, $p = 0.009$) in more natural environments after an induced stressor
- First empirical study to date measuring both acute stress response and recovery in contrasting environmental conditions

Why it matters

- Natural environments may provide **upstream, preventative health services** for urban populations at increased risk for chronic stress and related poor health outcomes (cancer, diabetes, cardiovascular disease, etc.)
- 140+ million acres of America's forests are in urban areas
- Empirical studies are needed to understand how urban forests can confer human health benefits to promote resilience and well-being
- Findings can motivate land use and public health policies to protect and expand forests

Study Design

Cross-sectional survey (N = 96)

Random assignment experiment (N = 56)

Nature Urban Control (Lab)



Continuous assessment of autonomic stress response

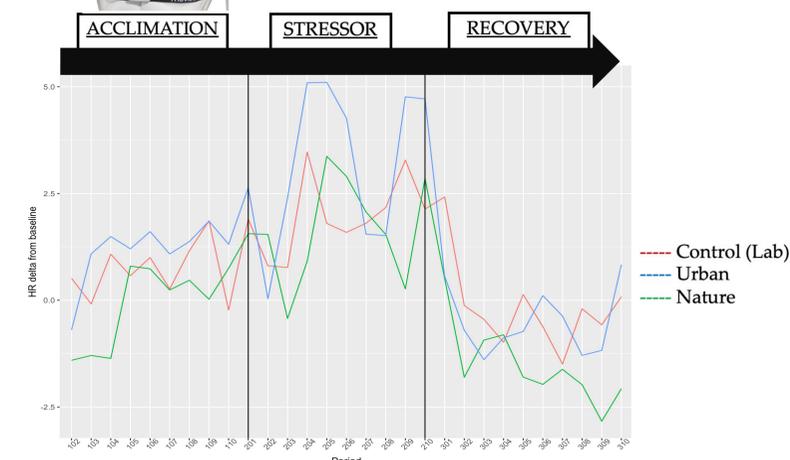


Figure above shows heart rate changes (from baseline levels) across acclimation, induced stressor task, and recovery periods for the 3 experimental condition groups; the recovery slope for the nature group was significantly faster (i.e., suggesting faster stress recovery) compared to the urban group