

PSYCHO-PHYSIOLOGICAL BENEFITS OF MOUNTAIN LANDSCAPE  
ENVIRONMENT AS STIMULUS FOR DIRECTED ATTENTION  
RESTORATION AND STRESS MITIGATION

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To my darling wife, Agnes Ojobo, and wonderful children, St.Luke and Paul Ojobo

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## ABSTRACT

The evolutionary perspective of human-nature synergy maintains that humans evolved in natural environments over a long period. Hence, humans are largely adapted to nature. Several studies evaluating encounters with nature have been supportive of its restorative and therapeutic effects. However, most of the studies carried out in real-site, natural environments have been largely done in forests and wilderness, while mountain environments have merely been mentioned as part of picture slides or video simulations. Additionally, very little research in the assessment of nature and human wellbeing relationships has adopted a synergetic approach of the mix of real-site and psycho-physiological mode of measurement. This study explores the mechanism and intricacies of the link between restorative environments, human response and psycho-physiological wellbeing in Obudu mountain landscape environment in Nigeria. Psychological and physiological experiences were explored using quantitative research method to elicit subjective and objective responses from individuals. A total of 200 adults were engaged in the psychological measures of preference and perception of the environment, while 38 adults participated in the physiological experimental measures. A tripartite data collection strategy was utilised: (1) psychological data were elicited through self-report measures using questionnaires, (2) physiological data were gathered through pre-test and post-test measures of blood pressure, pulse rate and respiratory rate, and (2) physical measurements of the ambient environment conditions were carried out to acquire temperature and humidity data. The data were analysed using inferential and descriptive statistics and content analysis. The results revealed that preference and perceptual patterns were incongruent with evolutionary assertions suggesting that the tendency of human stress mitigation in nature is not shaped by innate or evolutionary factors. Experiential contact with the mountain landscape environment influenced individual's ability to attain a relaxed state through the reduction of their diastolic blood pressure and pulse rate. It was found that tangible psychological and physiological effects can be obtained through short term contact with a multi-stimulus mountain landscape environment. The study concludes that contact with mountain landscape environment promotes spontaneous recovery from stress and restoration of directed attention. Policy makers, designers and developers within the context of creating buildings and cities would eventually refer to this evidence as it pertains to the potential of mountain landscape environments in mental wellbeing promotion.

## ABSTRAK

Perspektif evolusi sinergi fitrah manusia menetapkan bahawa manusia telah berevolusi dalam persekitaran alam semula jadi mengikut tempoh masa yang lama. Justeru itu, sebahagian besar manusia telah beradaptasi dengan alam semula jadi. Beberapa kajian yang menilai interaksi manusia dengan alam semula jadi menyokong kesan pemulihan dan terapeutiknya. Walaubagaimanapun, kebanyakan kajian yang dijalankan di tapak nyata persekitaran semula jadi telah dilakukan di hutan dan taman rimba manakala persekitaran gunung hanya disebut dalam slaid gambar atau simulasi video. Di samping itu, terdapat sangat sedikit kajian tentang penilaian perhubungan antara alam semula jadi dan kesejahteraan manusia yang menggunakan pendekatan sinergi campuran tapak nyata dan cara pengukuran psiko-fisiologi. Kajian ini meneroka mekanisme dan selok-belok hubungan antara persekitaran yang memulihkan, respons manusia dan kesejahteraan psiko-fisiologi mereka di persekitaran landskap gunung Obudu di Nigeria. Pengalaman psikologi dan fisiologi dikaji menggunakan kaedah kajian kuantitatif untuk mendapatkan respons subjektif dan objektif daripada setiap individu. Sebanyak 200 orang dewasa telah terlibat dalam langkah-langkah psikologi keutamaan dan tanggapan terhadap persekitaran, manakala 38 orang dewasa ikut serta dalam pendekatan eksperimen fisiologi. Strategi pengumpulan data secara tripartit telah dilakukan: (1) data psikologi diambil daripada pendekatan laporan sendiri menggunakan soal selidik, (2) data fisiologi dikumpul melalui pendekatan pra-ujian dan post-ujian tekanan darah, kadar denyutan nadi dan kadar respirasi, dan (3) ukuran fizikal keadaan persekitaran ambien telah dijalankan untuk mendapatkan data suhu dan kelembapan. Data dianalisis menggunakan statistik inferens dan deskriptif serta analisis kandungan. Keputusan menunjukkan bahawa terdapat corak keutamaan dan tanggapan yang tak kongruen dengan penegasan evolusi iaitu kebarangkalian pengurangan stres manusia dalam alam semula jadi tidak dibentuk oleh faktor semula jadi atau evolusi. Interaksi eksperiensial dengan persekitaran landskap gunung mempengaruhi kebolehan individu untuk mencapai keadaan rehat melalui pengurangan tekanan darah diastolik dan kadar denyutan nadi. Selain itu, kajian ini turut mendapati bahawa kesan psikologi dan fisiologi yang ketara boleh dicapai melalui interaksi jangka pendek dengan persekitaran landskap gunung yang mempunyai pelbagai rangsangan. Kajian ini menyimpulkan bahawa interaksi dengan persekitaran landskap gunung menggalakkan pemulihan stres secara spontan dan pengembalian tumpuan secara langsung. Pembuat dasar, pereka dan pembina dalam konteks pembinaan bangunan dan bandar raya akan merujuk kepada bukti ini akhirnya kerana ia berkaitan dengan potensi persekitaran landskap gunung untuk mempromosi kesejahteraan mental.

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## LIST OF ABBREVIATION

AAT	-	Aesthetic-Affective Theory
ANOVA	-	Analysis of variance
ART	-	Attention Restoration Theory
bpm	-	Beats per minute
b/m	-	Breaths per minute
BP	-	Blood pressure
BVP	-	Blood volume pulse
DBP	-	Diastolic blood pressure
DA	-	Directed Attention
DAF	-	Directed attention fatigue
EMG	-	Electromyography
ECG	-	Electroencephalography
GAS	-	General adaptation syndrome
HPA	-	Hypothalamic-pituitary-adrenal axis
HUM	-	Humidity
mmHg	-	Millimetre mercury
PSS	-	Perceived Stress Scale
PRS	-	Perceived Restorativeness Scale
PVC	-	Polyvinyl chloride
PR	-	Pulse rate
RR	-	Respiratory rate
SPSS	-	Statistical package for the social sciences
SRT	-	Stress Recovery Theory
SAM	-	Sympathetic adrenomedullary
SNS	-	Sympathetic nervous system
SBP	-	Systolic blood pressure



SNS	-	Sympathetic nervous system
TSR	-	Theory of stress response
TEMP	-	Temperature

**LIST OF SYMBOLS**

$\pm$	-	Plus-minus
$\beta$	-	Beta
%	-	Percent
$^{\circ}\text{C}$	-	Degree centigrade
$\uparrow$	-	Up
$\downarrow$	-	Down

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

The quest for attainment of physical and mental wellbeing through alternative medicine is a universal human goal. Quite a number of research studies have been carried out in the area of effects of nature experience on mental wellbeing (Bratman *et al.*, 2012; Kaplan, 1992; Russell *et al.*, 2013; Ulrich, 1979). However, a key element of the health benefits of nature may be its stress reducing effect. Meanwhile, stress can be accessed from an inexhaustible perspective. From the perspective of Selye (1976), widely regarded as the pioneer researcher on biological effects of exposure to stressful stimuli, stress is the general response of the body to any demand while a stressor is the stress producing agent (Neylan, 1998).

In his research, Neylan (1998) described the chronological development of the response to stressors when their activity is prolonged as the general adaptation syndrome (GAS). According to Selye (1976), GAS consists of the alarm reaction, resistance and exhaustion stage. Also, Burchfield (1979) in establishing the theory of stress response (TSR) stated that all organisms are genetically predisposed to adapt to stress and the physiological pattern of adaptation is similar across species. He viewed stress as anything which enables the transactions of psychological homeostatic processes. He further opined that homeostasis (Goldstein and Kopin, 2007), a complex dynamic state of equilibrium (Chrousos, 2009) is the maintenance of the normal mood state of an individual at rest.

Hobfoll (1989) in his critique described Selyes' perspective of stress as a way of employing illogical deductive reasoning to depict stress as an outcome of one of the phases of the general adaptation sequence. He proposed a testable and comprehensive resource oriented model of stress named model of conservation of resources. The model stipulates that what actually forms a threatening situation in people is the fear of the potential or actual loss of hitherto retained, protected and built resources. Thus, psychological stress is the reaction to the environment which involves either the threat of a total loss of resources, the actual total loss of resources or the absence of resources hitherto gained. This definition tends to situate the subject of stress in terms of the individuals capacity for achieving and maintaining wellbeing. However, there seem to be a general consensus among researchers that mental stress results from interactions between persons and environments that are perceived as straining or exceeding adaptive capacities, hence, threatening wellbeing (Annerstedt *et al.*, 2010).

In healthcare management, stress is vital in considering the etiology of diverse common health challenges which include cardiovascular diseases, anxiety disorders, obesity and depression (Lee and Oh, 2010; Probst, 2013). In landscape studies, stress is viewed in terms of the contribution of urbanization, lifestyle changes and the ameliorating potentials of nature related environments (Hartig *et al.*, 2014). On the whole, researchers have variously tried to conceptualize the negative attributes of stress (e.g. forgetfulness, distractions, mistakes and illness) and also critically assess the positive aspects of restoration linked to nature (e.g. feeling relaxed, effectiveness, productivity and wellbeing) (Bergdahl and Bergdahl, 2002; Kaplan, 2001a; Kaplan and Kaplan, 2011; Tsunetsugu *et al.*, 2013). The apparent detachment of most individuals from nature has however contributed to their diseased state. Hence, the proponents of nature oriented psychotherapy have advanced explanations concerning health effects of natural environments with the intent of linking the man-nature versus wellbeing paradigm.

O'Craven *et al.* (1997) assert that attention enables the processing of vast quantities of information received by the visual system through the selection of subset of the received information for further processing. The selection process depends on

either the properties of the stimulus or on a voluntary choice by the individual. However, directed attention phenomenon as described by Kaplan (1995) plays a major role in human capacity for selectivity in information processing and it is fragile, hence, capable of instigating fatigue. On the other hand, the consequence of fatigue precedes the need for attention restoration in order to facilitate a return to effective functioning state, and this can be achieved through contact with nature (Tennessen and Cimprich, 1995).

The term restoration encompasses the process that facilitates peoples recovery from stress acquired whilst trying to meet demands of everyday life (Hartig *et al.*, 2011). Modern day environments are only created to suite everyday living and working which offer no restorative health benefits (Thompson, 2011). In contrast, nature related environments like forests, wilderness and mountains are considered to possess significantly the possibility of enhancing restoration from stress through passive and active contact. In other words, natural environments play an essential role in human functioning through the process of restorative experiences (Kaplan, 1992; Ulrich, 1979). These experiences can be elicited consciously or unconsciously depending on the active or sensory state of the individual.

Typically, natural environments are distinct from everyday urban settings and are endowed with attributes like water (Bulut *et al.*, 2010), vegetation, foliage and forests (Hartig, *et al.*, 2011). They are also coherent and rich, having trails to walk, paths for exploration and compatible connections with the settings such as hiking, observation and peaceful meditation (Berto *et al.*, 2010). Our everyday urban settings are almost devoid of such endowments. However, the visual qualities of the undulating mountains, captivating grasslands, riveting waterscapes and prominent forest groves of the Obudu mountain landscape environment, Nigeria, constitute an inspiration in the conceptualization of this study. It is therefore pertinent to ask to what degree the mountain landscape environment would influence recovery from directed attention and stress.

## 1.2 Problem Statement

Several studies evaluating encounters with wilderness and forest environments have been supportive of the restorative and therapeutic effects of nature (Cole and Hall, 2010; Kaplan, 1992; Staats and Hartig, 2004; Tsunetsugu *et al.*, 2013). Most of the previous research aimed at measuring health outcomes of the experience of natural environments involved participants viewing through a window or viewing nature scenes through video, picture slides and simulations. For example, Ulrich (1984) accessed post-surgical patients in a hospital room with a view through the window of natural settings predominantly composed of trees. He investigated whether a view of natural settings have more positive effect on the patient's emotional states and recovery rate than built structures essentially made up of a featureless brick wall. Similarly, Raanaas *et al.* (2012) in a longitudinal quasi-experiment comprising three distinct types of window views from patient's (undergoing rehabilitation) rooms examined the health benefits of a bedroom window view to natural environments. Though their result suggests that view of natural scene have more therapeutic influence on recovery, it was not established whether physical contact with a real-life multi-stimulus natural environment will yield faster recovery time for such patients. Very few of these studies have considered interactive engagements like walking, running, seating and gardening within the natural environments.

Laboratory and quasi experiments have been engaged to explore the suggestion that contact with and experiences of natural environments enhance wellbeing better than experiences of other environments. Ulrich (1979) building on these notion evaluated the effects of visual contact with outdoor environment through an experiment which involved showing color slides of outdoor environments to two groups of mildly stressed subjects. Findings support the opinion that individuals feel significantly better after exposure to nature scenes rather than urban scenes lacking in nature elements. Recently, van den Berg *et al.* (2014) engaged the use of photo/video depictions to examine the restorative effect of different types of urban public spaces with various levels of naturalness. Results show substantial difference in recovery of wellbeing within varying conditions of nature.

However, these studies which have been largely carried out in confined environments in order to control experimental variables focused mainly on the sights and not the multi-sensory aspects. To further lend credence to research in the area of restorative environments, Hartig *et al.* (1997) in a multi-dimensional study provided an insight into the means for measuring psychological factors in favour of restorative experiences. On-site experiences, video simulations of walk through natural and urban settings and photographic slide simulations of different settings were deployed as a multifaceted methodological strategy to ground a dependable perceived restorativeness scale (PRS).

Seemingly following up on past research, Herzog *et al.* (2003) attempted a new approach to the measurement of restorative potentials of environments by creating and validating several Likert-scale items to measure four components of a restorative environment (Kaplan, 1995). In the study, color slides of urban and field environments were employed as stimuli for rating the restorative components of environments. Also, Han (2010) through a study carried out to ascertain the relationship and the differences that exist between scenic beauty, preference and restoration employed the use of landscape slides as visual stimuli. Moreover, natural habitats are rich in sensory attributes and act as a vehicle for information to all human sensory systems-sight, sound, touch, taste and odour (Heerwagen, 2009). Hence, the drawbacks and methodological limitations in these studies are not farfetched as only visually represented landscapes influenced the assessment of researchers.

Very few research in the assessment of nature and human wellbeing relationships have adopted the real site methodology with the combined psychophysiological mode of measurement. A study by Cole and Hall (2010) provided insights into the possibilities of stress reduction and restoration of mental fatigue in wilderness. Using a cross-sectional study design, the study tried to evaluate the effect of congestion and length of time spent in the wilderness. This was based on assessments of how much restoration was experienced and the degree to which components of the environment associated with restoration were experienced. Measured using a four-page questionnaire after wilderness trips, respondents reported substantial reduction in stress and tension coupled with mental restoration.



Building upon existing research on human physiological responses in natural and urban field settings, Hartig *et al.* (2003) compared psycho-physiological stress recovery and directed attention restoration using repeated measures of ambulatory blood pressure (ABP), emotion and attention (Berto, *et al.*, 2010; Herzog *et al.*, 1997; Sahlin *et al.*, 2014; Tennessen and Cimprich, 1995). In order to ascertain the influence of viewing images of natural scenes on individuals, Chang *et al.* (2008) analyzed the psychological and physiological responses of participants while viewing visual stimuli of wild land scenes. Participant's psychological responses were measured by the perceived stress scale (PSS) (Cohen *et al.*, 1983; Lee, 2012; Shosha, 2012) while physiological responses were measured by blood volume pulse (BVP), electromyography (EMG) and electrocephalography (ECG) (Sharma and Gedeon, 2012). Findings suggest that substantial level of agreement exists between the psychological measures of restorativeness and the three physiological responses.

On the whole, the body of knowledge has expanded with researchers exploring more on the psycho-physiological benefits of interacting with varying real forest environments using multiple measures (Horiuchi *et al.*, 2014; Ochiai *et al.*, 2015; Tsunetsugu, *et al.*, 2013). Agreeably, whilst quite a number of studies have been carried out on the restorative benefits of forests and wilderness environments, mountain landscape environments have received little attention. Researchers situating mountain landscape environments as study context have focused more on estimating visual properties and aesthetic values with regards to preference and perception (Beza, 2010; Lindemann-Matthies *et al.*, 2010; Schirpke *et al.*, 2013a; Schirpke *et al.*, 2013b; Tveit, 2009). So far, no previous study has investigated the restorative benefits of contact with mountain landscape environment. Therefore, extensive research remains to be carried out in the investigation of the mechanism and intricacies of the link between restorative environments, human response and wellbeing. Hence, a synergetic approach in the measurement of the psycho-physiological responses of individuals within a real-life multi-stimulus mountain landscape environment is required. This is in order to further extend research in the environment and human well-being domain. The Obudu mountain landscape environment in Nigeria, endowed with rich, multi-stimulus landscape features offers a veritable platform for this study.

### 1.3 Research Gap

In order to make a contribution to research in the area of restorative environments and human response, the gap of this study is formulated from the following:

- I. Previous studies have been done in quasi (confined or laboratory) environments which involved participants viewing through a window or viewing nature scenes through video, slides and simulations. This approach is adopted basically to control experimental variables and focus is mainly on the sense of sight not multi-sensory. Thus, stimulating vital senses (smell, sound, touch, sight) which are likely to act as precedence to mental restoration and a balanced physiological experience have not been adequately considered.
- II. Most of the research carried out on real-site nature related environments has been largely done in forests while mountain environments have merely been mentioned as part of slides or video simulations. In an attempt to situate mountain landscape environment as study context, very few researchers have only investigated its visual properties and aesthetic values. Extensive work remains to be carried out to cover the full range of benefits that exists in the mountain landscape environment in relation to human wellbeing.
- III. Generally, a large volume of studies depended on psychometric self-report measures to determine the magnitude of psychological human response to environmental stimuli. Consequently, these psychometric self-report measures driven by consciousness, observation and mood states may be unable to detect physiological reactions to environmental stimuli (Chang and Chen, 2005). Further, objective measures of physiological responses such as skin temperature, brain waves (EEG, ECG), hand and finger movements, pupil diameter, blood pressure, heart rate and respiratory rate are likely to reduce the chances of subjective bias in the perception and reporting of events.

**Table 1.1:** Evaluation of some studies, environments and methods employed

Author/Year of publication	Research environments	Environmental Stimuli	Measurements
Ochiai <i>et al.</i> (2015)	Real site	Forest bathing	Blood pressure, urinary adrenaline, serum cortisol, Profile of mood states (POMS), Total mood disturbance (TMD)
van den Berg <i>et al.</i> (2014)	Laboratory	Picture/video presentations of urban green spaces	Profile of mood states (POMS)
Tsunetsugu <i>et al.</i> (2013)	Real site	4 forested and 4 urban locations	Profiles of mood states scale (POMS). Blood pressure (BP) and Heart rate (HR)
White <i>et al.</i> (2013b)	Laboratory	Slide show with virtual reality forest.	electrocardiogram (EKG), blood (BP), heart rate (HR) and the respiratory sinus arrhythmia (RSA)
Martens <i>et al.</i> (2011)	Real site	Wild and tended urban forests.	Multidimensional scales in a pre-post-treatment setting using questionnaires
Annerstedt <i>et al.</i> (2010)	Real site	Broad leaved and coniferous forests	Mail administered survey questionnaire
Berto <i>et al.</i> (2010)	Laboratory	Picture slide of natural and built environments.	Sustained attention task. (SART), Posner's attention-orienting paradigm, Incidental memory task
Bulut <i>et al.</i> (2010)	Quasi	Photographs of waterscapes.	Scenic beauty estimation (SBE)
Cole and Hall (2010)	Real site	Wilderness	Questionnaire based items
Han (2010)	Laboratory	Landscape slides as visual stimuli.	Revised perceived restorativeness scale (RPRS), Short version Revised perceived restorativeness scale (SRPRS)
Van den Berg <i>et al.</i> (2010)	Laboratory	Individual level data on health and social demographics	Dutch national survey of general complaints. National land cover classification data base. General health questionnaire. (GHQ)
Berman <i>et al.</i> (2008)	Real site/Quasi	Walk in the park/pictures slides of urban and natural sites	Digit Span Task, Attention network task, Positive and Negative Affect Schedule (PANAS)
Chang <i>et al.</i> (2008)	Laboratory	Viewing visual slides of wild land scenes as stimuli	Perceived stress scale, blood volume pulse (BVP), electromyography (EMG) and electroencephalography (EEG)

IV. Finally, very few research in the assessment of nature and human wellbeing relationships have adopted a synergetic approach of the mix of real site and psycho-physiological mode of measurement. Evaluation of some studies, research settings, environmental stimuli and methods employed is shown in Table 1.1. Only five out of thirteen studies were carried out in real site research environments. Whereas one study was carried out using a combination of real and quasi research environment, seven studies were laboratory or quasi based.

Only three of the studies involved physiological measures while ten utilized psychological self-report measures. In addition, the table also shows that the environmental stimuli mainly involved forest, wilderness, urban green spaces and water. No study was found on the restorative benefits of contact with mountain landscape environment.

#### **1.4 Research Aim**

The aim of this study is to examine the mechanism and intricacies of the link between restorative environments, human response and wellbeing in a mountain landscape environment. Therefore, mountain landscape environments are regarded as restorative in terms of the enhancement of wellbeing.

#### **1.5 Research Objectives**

- 1) To identify the feature(s) of the mountain landscape environment potentially influential to human perception and psychological response;
- 2) To investigate the magnitude to which mountain landscape environments can stimulate human psychological and physiological well-being; and
- 3) To determine the significance of the ambient mountain landscape environment conditions on human physiological wellbeing.

#### **1.6 Research Questions**

- 1) What feature of the mountain landscape environment yield higher restorative benefits in terms of psychological wellbeing?
- 2) What degree would the mountain landscape environment influence recovery from directed attention and stress?

- 3) What aspects of the ambient mountain landscape environment conditions combine to elicit human physiological wellbeing?

### **1.7 Research Scope and Limitations**

The focus of this study is on the psycho-physiological benefits of mountain landscape environment as stimulus for restoration of directed attention and stress mitigation. The Obudu Mountain landscape environment with its characteristic plant materials, non-threatening wildlife (birds, squirrels, and butterflies), sights and sounds of moving water, views to the horizon and fountains influenced its choice as study environment. To ascertain its restorative potentials the mountain landscape environment is compared with the urban environment where the study respondents originated from. This comparison involves the interactive engagement of respondents with both environments within a 7-day experimental period. However, the use of a real mountain landscape environment instead of quasi, though novel is a courageous attempt given the procedural complexities and resources involved. The study engaged measures that involve the psycho-physiological processes underlying the pathways linking the potential benefits of restorative environments and human response.

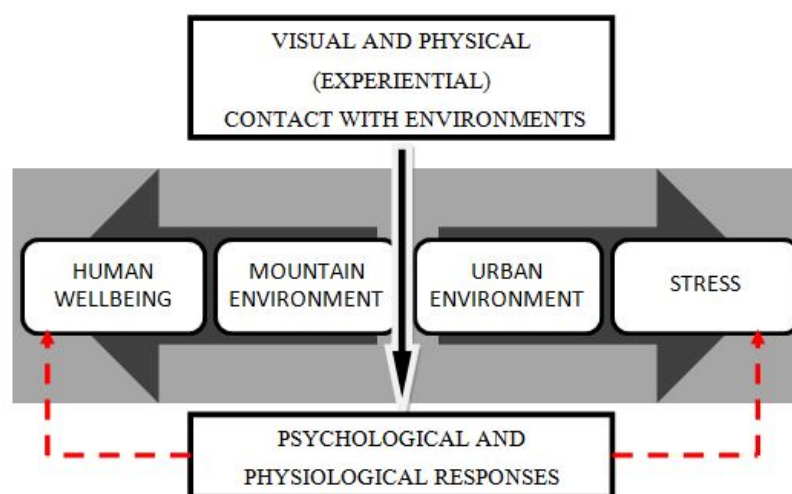
### **1.8 Significance of the Research**

With regards to the problem statement and research gap, research into the psycho-physiological factors affecting stress and wellbeing have been actively conducted mainly in countries within the global north such as the United States of America and Europe (Andreou *et al.*, 2011; Herzog *et al.*, 2009; Honold *et al.*, 2015; Kaplan, 1995; Sahlin, 2014). The global south especially Africa have recorded quite a few number of research in this context (Chang, *et al.*, 2008; Sarkar and Mukhopadhyay, 2008; Takayama *et al.*, 2014). Hence, the necessity to experiment with samples from this region in order to add to the existing body of knowledge which supports the link between restorative environments, human response and wellbeing. This would further substantiate claims of the universality of restorative responses.

In addition, a large percentage of these studies have been carried out within a small scope of landscape types. Given the multi-stimulus nature of Obudu mountain landscape environment, engaging samples using objective measures of psycho-physiological wellbeing like blood pressure, pulse rate and respiratory rate offer enough justification for landscape planners and architects for further nature related interventions. Policy makers, designers and developers within the locus of creating buildings and cities would eventually refer to available evidence pertaining to the potentials of mountain landscape environments as a promoter of mental wellbeing.

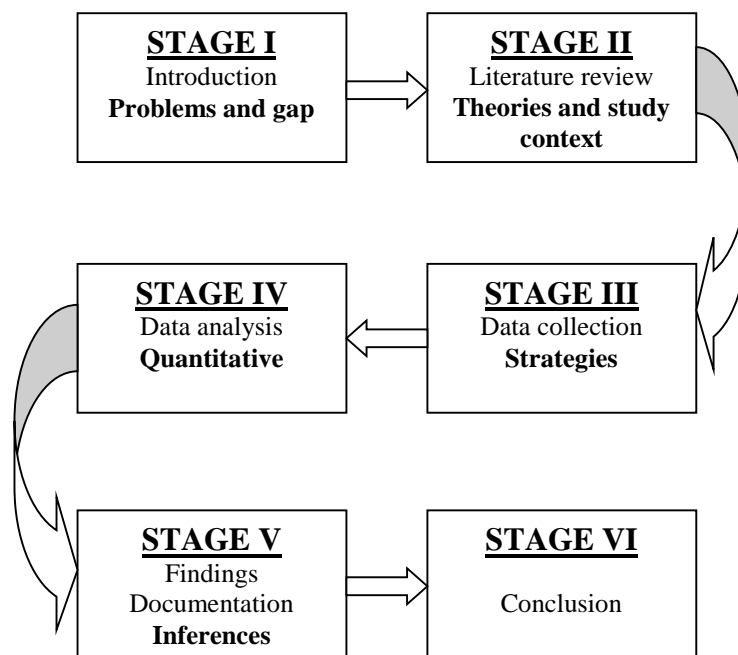
### 1.9 Conceptual Framework and Research Methodology Outline

With regards to the link between nature experience and wellbeing, the benefits of contact with the mountain landscape environment on psycho-physiological states are explored. A basic assumption guiding research in this area relates to how cumulative effects of contact with environments having restorative qualities can enhance human wellbeing more than those without restorative qualities (Hartig, *et al.*, 2011). Therefore, aspects of this assumption in relation to mountain landscape environments involves visual and physical interaction, psycho-physiological response and the span of time required for cumulative effects of restorative experience to manifest. The conceptual framework of the study is shown in Figure 1.1.



**Figure 1.1:** The conceptual framework of the study

The study is made up of multiple inter-related research design in order to address the research problem and achieve the objectives. A quantitative methodological approach was employed to explore the full range of psychological and physiological aspects of human wellbeing. It involved cross-sectional and interrupted time-series between group experimental surveys. This was based on a cause and effect phenomenon comparing contact with the urban and mountain landscape environment. Respondents comprising samples from the urban population co-opted through random convenience method were engaged in both the cross-sectional and interrupted time-series within group experimental survey. The study utilized psychometric questionnaires, physical measures of physiological indices and instrumented measures of ambient environment conditions to elicit data. The data obtained was analysed using descriptive and inferential statistics. Findings from the three dimensional data was triangulated and presented in the form of narrative including tables and figures. A summary of the research methodology outline is as shown in Figure 1.2.



**Figure 1.2:** Research methodology outline

## 1.10 Thesis Structure

The thesis is structured into seven chapters as follows:

**Chapter 1** commenced with the research background, problems statement as well as highlights of the gaps identified in the area of restorative environments, human response and wellbeing. It also highlighted the research aim, objectives and questions established to guide the direction of the study. Other sections in the chapter include, scope and limitation of the study, significance of the study, conceptual framework and research methodology outline. The overall thesis structure is presented at the end of the chapter.

**Chapter 2** reviews the background of theories concerned with restorative environments and their link to human response and wellbeing. The review heralds the presentation of the research underpinnings which include Stress Recovery Theory (SRT), Aesthetic-Affective Theory (AAT) and Attention Restoration Theory ART). Further, a review of literature from the perspectives of medical geography and environmental psychology is established with regards to studies pertaining to restoration of wellbeing. In addition, this chapter explains the meaning of restorative environment and the different study sites used in the study of restoration.

**Chapter 3** reviews the relationship between health, mental wellbeing and stress. It assessed the influence of the environment with regards to health and mental wellbeing. Also, the meaning and types of stress as well as its sources are established in this chapter. Additionally, a literature on stress response and the concept of homeostasis in human beings forms part of the chapter. Furthermore, human responses are highlighted based on the components of psychological and physiological stress response system.

**Chapter 4** presents the research methodology approach utilized in examining the restorative benefits of contact with the mountain landscape environment. The chapter explains the study design, parameters, unit of analysis and sampling strategy.



Additionally, the study locations, data collection procedure and validity and reliability assessment are elucidated.

**Chapter 5** discusses the results in relation to the findings of the study. The chapter is divided into three main sections. First, the results and findings on the features of the mountain landscape environment potentially influential to human perception and psychological response are interpreted. Next, results and findings pertaining to the magnitude of mountain landscape environment stimulation on human psychological and physiological wellbeing are discussed in detail. And lastly, results and findings of the effect of the urban and mountain landscape ambient environment conditions are articulated and discussed.

**Chapter 6** concludes the thesis with a discussion on the overall findings including the theoretical and policy implications of the body of work. Additionally, the study limitations and suggestions for further research are outlined.

## REFERENCES

- Abdulla, K. and Taka, M. (1988). Climatic effects on blood pressure in normotensive and hypertensive subjects. *Postgraduate medical journal*. 64(747), 23-26.
- Abraham, A., Sommerhalder, K. and Abel, T. (2010). Landscape and well-being: a scoping study on the health-promoting impact of outdoor environments. *International Journal of Public Health*. 55(1), 59-69.
- Adevi, A. A. (2012). Supportive nature-and stress. *University of Swedish Agricultural Science*.
- Aldwin, C. M. (2007). *Stress, coping, and development: An integrative perspective*. New York: Guilford Press.
- Almusaed, A. (2011). Socio and Healthy Human Psychology upon Biophilic Architecture. *Biophilic and Bioclimatic Architecture* (pp. 173-186) Springer.
- Alvarsson, J. J., Wiens, S. and Nilsson, M. E. (2010). Stress recovery during exposure to nature sound and environmental noise. *International journal of environmental research and public health*. 7(3), 1036-1046.
- Andreou, E., Alexopoulos, E. C., Lionis, C., Varvogli, L., Gnardellis, C., Chrousos, G. P. and Darviri, C. (2011). Perceived stress scale: reliability and validity study in Greece. *International journal of environmental research and public health*. 8(8), 3287-3298.
- Annerstedt, M., Norman, J., Boman, M., Mattsson, L., Grahn, P. and Währborg, P. (2010). Finding stress relief in a forest. *Ecological Bulletins*. 53, 33-42.
- Ansa, V., Ekott, J., Essien, I. and Basse, E. (2008). Seasonal variation in admission for heart failure, hypertension and stroke in Uyo, South-Eastern Nigeria. *Annals of African medicine*. 7(2), 62.
- Arriaza, M., Canas-Ortega, J., Canas-Madueno, J. and Ruiz-Aviles, P. (2004). Assessing the visual quality of rural landscapes. *Landscape and urban planning*. 69(1), 115-125.

- Balling, J. D. and Falk, J. H. (1982). Development of visual preference for natural environments. *Environment and Behavior*. 14(1), 5-28.
- Barkow, J. H., Cosmides, L. and Tooby, J. (1995). *The adapted mind: Evolutionary psychology and the generation of culture*. Oxford University Press.
- Bates, S. C. and Marquit, J. (2011). Space psychology: natural elements in habitation design. *Personal and Ubiquitous Computing*. 15(5), 519-523.
- Baum, A., Singer, J. E. and Baum, C. S. (1981). Stress and the environment. *Journal of Social Issues*. 37(1), 4-35.
- Becker, C. M., Glascoff, M. A. and Felts, W. M. (2010). Salutogenesis 30 Years Later: Where Do We Go from here? *International Electronic Journal of Health Education*. 13, 25-32.
- Beil, K. and Hanes, D. (2013). The influence of urban natural and built environments on physiological and psychological measures of stress—A pilot study. *International journal of environmental research and public health*. 10(4), 1250-1267.
- Bell, P. A., Green, T., Fisher, J. D. and Baum, A. (1978). *Environmental Psychology*. (2<sup>nd</sup> ed) New York: CBS College Publishing.
- Bell, S. L., Phoenix, C., Lovell, R. and Wheeler, B. W. (2015). Seeking everyday wellbeing: the coast as a therapeutic landscape. *Social Science & Medicine*.
- Benetos, A., Zureik, M., Morcet, J., Thomas, F., Bean, K., Safar, M., Ducimetière, P. and Guize, L. (2000). A decrease in diastolic blood pressure combined with an increase in systolic blood pressure is associated with a higher cardiovascular mortality in men. *Journal of the American College of Cardiology*. 35(3), 673-680.
- Bengston, D. N. (1994). Changing forest values and ecosystem management. *Society & Natural Resources*. 7(6), 515-533.
- Bengtsson, A. and Grahn, P. (2014). Outdoor environments in healthcare settings: A quality evaluation tool for use in designing healthcare gardens. *Urban Forestry & Urban Greening*. 13(4), 878-891.
- Berg, A. E. v. d. (1999). Individual differences in the aesthetic evaluation of natural landscapes.
- Bergdahl, J. and Bergdahl, M. (2002). Perceived stress in adults: prevalence and association of depression, anxiety and medication in a Swedish population. *Stress and Health*. 18(5), 235-241.

- Berman, M. G., Jonides, J. and Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological science*. 19(12), 1207-1212.
- Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of environmental psychology*. 25(3), 249-259.
- Berto, R. (2007). Assessing the restorative value of the environment: A study on the elderly in comparison with young adults and adolescents. *International Journal of Psychology*. 42(5), 331-341.
- Berto, R. (2014). The role of nature in coping with psycho-physiological stress: a literature review on restorativeness. *Behavioral Sciences*. 4(4), 394-409.
- Berto, R., Baroni, M. R., Zainaghi, A. and Bettella, S. (2010). An exploratory study of the effect of high and low fascination environments on attentional fatigue. *Journal of Environmental Psychology*. 30(4), 494-500.
- Berto, R., Massaccesi, S. and Pasini, M. (2008). Do eye movements measured across high and low fascination photographs differ? Addressing Kaplan's fascination hypothesis. *Journal of Environmental Psychology*. 28(2), 185-191.
- Beza, B. B. (2010). The aesthetic value of a mountain landscape: A study of the Mt. Everest Trek. *Landscape and Urban Planning*. 97(4), 306-317.
- Biaggioni, I. (2008). Circadian clocks, autonomic rhythms, and blood pressure dipping. *Hypertension*. 52(5), 797-798.
- Bortkiewicz, A., Gadzicka, E., Szymczak, W., Szyjkowska, A., Koszada-Włodarczyk, W. and Makowiec-Dąbrowska, T. (2006). Physiological reaction to work in cold microclimate. *International journal of occupational medicine and environmental health*. 19(2), 123-131.
- Bowler, D. E., Buyung-Ali, L. M., Knight, T. M. and Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*. 10(1), 456.
- Brady, S. S. and Matthews, K. A. (2006). Chronic stress influences ambulatory blood pressure in adolescents. *Annals of Behavioral Medicine*. 31(1), 80-88.
- Bratman, G. N., Daily, G. C., Levy, B. J. and Gross, J. J. (2015). The benefits of nature experience: Improved affect and cognition. *Landscape and Urban Planning*. 138, 41-50.
- Bratman, G. N., Hamilton, J. P. and Daily, G. C. (2012). The impacts of nature experience on human cognitive function and mental health. *Annals of the New York Academy of Sciences*. 1249(1), 118-136.

- Braubach, M. (2007). Preventive applications of the therapeutic landscapes concept in urban residential settings: a quantitative application. *Therapeutic landscapes*. 111.
- Brown, D. K., Barton, J. L. and Gladwell, V. F. (2013). Viewing nature scenes positively affects recovery of autonomic function following acute-mental stress. *Environmental science & technology*. 47(11), 5562-5569.
- Brown, T., McLafferty, S. and Moon, G. (2009). *A companion to health and medical geography*. John Wiley & Sons.
- Bulut, Z., Karahan, F. and Sezen, I. (2010). Determining visual beauties of natural waterscapes: A case study for Tortum Valley (Erzurum/Turkey). *Scientific Research and Essay*. 5(2), 170-182.
- Burchfield, S. R. (1979). The stress response: a new perspective. *Psychosomatic Medicine*. 41(8), 661-672.
- Burton, A. (2014). Gardens that take care of us. *The Lancet Neurology*. 13(5), 447-448.
- Cairns Jr, J., McCormick, P. V. and Niederlehner, B. (1993). A proposed framework for developing indicators of ecosystem health. *Hydrobiologia*. 263(1), 1-44.
- Calabrese, F., Molteni, R., Racagni, G. and Riva, M. A. (2009). Neuronal plasticity: a link between stress and mood disorders. *Psychoneuroendocrinology*. 34, S208-S216.
- Campbell, J. and Ehlert, U. (2012). Acute psychosocial stress: does the emotional stress response correspond with physiological responses? *Psychoneuroendocrinology*. 37(8), 1111-1134.
- Chang, C.-Y., Hammitt, W. E., Chen, P.-K., Machnik, L. and Su, W.-C. (2008). Psychophysiological responses and restorative values of natural environments in Taiwan. *Landscape and Urban Planning*. 85(2), 79-84.
- Charach, G., Shochat, M., Argov, O., Weintraub, M., Charach, L., Rabinovich, A., Ayzenberg, O. and George, J. (2013). Seasonal changes in blood pressure: cardiac and cerebrovascular morbidity and mortality. *World J Hypertens*. 3(1), 1-8.
- Chaudhuri, A. and Behan, P. O. (2004). Fatigue in neurological disorders. *The Lancet*. 363(9413), 978-988.
- Chen, Q., Wang, J., Tian, J., Tang, X., Yu, C., Marshall, R. J., Chen, D., Cao, W., Zhan, S. and Lv, J. (2013). Association between ambient temperature and

- blood pressure and blood pressure regulators: 1831 Hypertensive patients followed up for three years. *PloS one*. 8(12), e84522.
- Chifamba, J., Mufunda, J., Sigola, L., Matenga, J. and Sparks, H. (1998). Effect of variation in environmental temperature on blood pressure: is it important? *The Central African journal of medicine*. 44(2), 37-40.
- Chrousos, G. P. (1998). Stressors, stress, and neuroendocrine integration of the adaptive response: the 1997 Hans Selye Memorial Lecture. *Annals of the New York Academy of Sciences*. 851(1), 311-335.
- Chrousos, G. P. (2009). Stress and disorders of the stress system. *Nature Reviews Endocrinology*. 5(7), 374-381.
- Cimprich, B. (1993). Development of an intervention to restore attention in cancer patients. *Cancer nursing*. 16(2), 83-92.
- Cohen, S., Kamarck, T. and Mermelstein, R. (1983). A global measure of perceived stress. *Journal of health and social behavior*. 385-396.
- Cohen, S., Miller, G. E. and Rabin, B. S. (2001). Psychological stress and antibody response to immunization: a critical review of the human literature. *Psychosomatic medicine*. 63(1), 7-18.
- Cohen, S. and Spacapan, S. (1978). The aftereffects of stress: An attentional interpretation. *Environmental Psychology and Nonverbal Behavior*. 3(1), 43-57.
- Colarelli, S. M. and Dettmann, J. R. (2003). Intuitive evolutionary perspectives in marketing practices1. *Psychology & Marketing*. 20(9), 837-865.
- Cole, D. N. and Hall, T. E. (2010). Experiencing the restorative components of wilderness environments: Does congestion interfere and does length of exposure matter? *Environment and Behavior*.
- Cosmides, L. and Tooby, J. (1994). Better than rational: Evolutionary psychology and the invisible hand. *The American Economic Review*. 327-332.
- Cresswell, T. (2013). *Place: A short introduction*. John Wiley & Sons.
- Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative*. (4th ed.)Prentice Hall.
- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Creswell, J. W. and Clark, V. L. P. (2007). *Designing and conducting mixed methods research*.

- Cretikos, M. A., Bellomo, R., Hillman, K., Chen, J., Finfer, S. and Flabouris, A. (2008). Respiratory rate: the neglected vital sign. *Medical Journal of Australia*. 188(11), 657.
- Curtis, S. (2010). *Space, place and mental health*. Ashgate Publishing, Ltd.
- Daniel, R. M. (2014). *The Effects of the Natural Environment on Attention Restoration*, Appalachian State University.
- Daniel, W. W. and Cross, C. L. (2010). *Biostatistics: basic concepts and methodology for the health sciences*. John Wiley & Sons New York.
- De Greeff, A., Lorde, I., Wilton, A., Seed, P., Coleman, A. and Shennan, A. (2010). Calibration accuracy of hospital-based non-invasive blood pressure measuring devices. *Journal of human hypertension*. 24(1), 58-63.
- De Vente, W., Olf, M., Van Amsterdam, J., Kamphuis, J. and Emmelkamp, P. (2003). Physiological differences between burnout patients and healthy controls: blood pressure, heart rate, and cortisol responses. *Occupational and environmental medicine*. 60(suppl 1), i54-i61.
- Depledge, M., Stone, R. and Bird, W. J. (2011). Can natural and virtual environments be used to promote improved human health and wellbeing? *Environmental science & technology*. 45(11), 4660-4665.
- Diette, G. B., Lechtzin, N., Haponik, E., Devrotes, A. and Rubin, H. R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy: A complementary approach to routine analgesia. *Chest Journal*. 123(3), 941-948.
- Dimitrov, D. M. and Rumrill, P. D. (2003). Pretest-posttest designs and measurement of change. *WORK-ANDOVER MEDICAL PUBLISHERS INCORPORATED THEN IOS PRESS*. 20(2), 159-165.
- Dinan, T. G. (2004). Stress and the genesis of diabetes mellitus in schizophrenia. *The British Journal of Psychiatry*. 184(47), s72-s75.
- Dutton, D. (2003). Aesthetics and evolutionary psychology. *The oxford handbook for aesthetics*. 693-705.
- Elliott, A. C. and Woodward, W. A. (2007). *Statistical analysis quick reference guidebook: With SPSS examples*. Sage.
- Epstein, P. R., Chivian, E. and Frith, K. (2003). Emerging diseases threaten conservation. *Environmental Health Perspectives*. 111(10), A506.
- Evans, G. W. (1984). *Environmental stress*. CUP Archive.

- Evans, G. W., Hygge, S. and Bullinger, M. (1995). Chronic noise and psychological stress. *Psychological Science*. 333-338.
- Falk, J. H. and Balling, J. D. (2009). Evolutionary influence on human landscape preference. *Environment and Behavior*.
- Finlay, J., Franke, T., McKay, H. and Sims-Gould, J. (2015). Therapeutic landscapes and wellbeing in later life: Impacts of blue and green spaces for older adults. *Health & place*. 34, 97-106.
- Folkman, S., Lazarus, R. S., Gruen, R. J. and DeLongis, A. (1986). Appraisal, coping, health status, and psychological symptoms. *Journal of personality and social psychology*. 50(3), 571.
- Francis, C. and Cooper Marcus, C. (1991). Places people take their problems. *Proceedings of the 1991 EDRA*, 178-184.
- Galindo, M. P. and Hidalgo, M. C. (2005). Aesthetic preferences and the attribution of meaning: Environmental categorization processes in the evaluation of urban scenes. *International Journal of Psychology*. 40(1), 19-27.
- Gesler, W. (1996). Lourdes: healing in a place of pilgrimage. *Health & Place*. 2(2), 95-105.
- Gesler, W. M. (1992a). *The cultural geography of health care*. University of Pittsburgh Pre.
- Gesler, W. M. (1992b). Therapeutic landscapes: medical issues in light of the new cultural geography. *Social science & medicine*. 34(7), 735-746.
- Gesler, W. M. (1993). Therapeutic landscapes: theory and a case study of Epidauros, Greece. *Environment and Planning D*. 11, 171-171.
- Gesler, W. M. (2003). *Healing places*. Rowman & Littlefield Publishers.
- Gibson, J. J. (2014). *The Ecological Approach to Visual Perception: Classic Edition*. Psychology Press.
- Gifford, R. (2007). *Environmental psychology: Principles and practice*. Optimal books Colville, WA.
- Gladwell, V., Brown, D., Barton, J. L., Tarvainen, M., Kuoppa, P., Pretty, J., Suddaby, J. and Sandercock, G. (2012). The effects of views of nature on autonomic control. *European journal of applied physiology*. 112(9), 3379-3386.
- Goenjian, A. K., Steinberg, A. M., Najarian, L. M., Fairbanks, L. A., Tashjian, M. and Pynoos, R. S. (2014). Prospective study of posttraumatic stress, anxiety, and



- depressive reactions after earthquake and political violence. *American Journal of Psychiatry*.
- Goldstein, D. S. and Kopin, I. J. (2007). Evolution of concepts of stress. *Stress*. 10(2), 109-120.
- Goldstein, J. M., Jerram, M., Abbs, B., Whitfield-Gabrieli, S. and Makris, N. (2010). Sex differences in stress response circuitry activation dependent on female hormonal cycle. *The Journal of Neuroscience*. 30(2), 431-438.
- Grandjean, E. (1979). Fatigue in industry. *British Journal of Industrial Medicine*. 36(3), 175-186.
- Gravelyn, T. R. and Weg, J. G. (1980). Respiratory rate as an indicator of acute respiratory dysfunction. *Jama*. 244(10), 1123-1125.
- Grillon, C., Quispe-Escudero, D., Mathur, A. and Ernst, M. (2015). Mental fatigue impairs emotion regulation. *Emotion*. 15(3), 383.
- Grinde, B. and Patil, G. G. (2009). Biophilia: does visual contact with nature impact on health and well-being? *International Journal of Environmental Research and Public Health*. 6(9), 2332-2343.
- Groat, L. and Wang, D. (2002). Architectural research methods. *New York*.
- Gullone, E. (2000). The biophilia hypothesis and life in the 21st century: Increasing mental health or increasing pathology? *Journal of Happiness Studies*. 1(3), 293-322.
- Gulwadi, G. B. (2006). Seeking Restorative Experiences Elementary School Teachers' Choices for Places That Enable Coping With Stress. *Environment and Behavior*. 38(4), 503-520.
- Hall, R. (2012). Mixed methods: In search of a paradigm. *Vortrag. Download (am 10.01. 2013) unter: [http://www.auamii.com/proceedings\\_Phuket\\_2012/Hall.pdf](http://www.auamii.com/proceedings_Phuket_2012/Hall.pdf)*.
- Halonen, J. I., Zanobetti, A., Sparrow, D., Vokonas, P. S. and Schwartz, J. (2011). Relationship between outdoor temperature and blood pressure. *Occupational and environmental medicine*. 68(4), 296-301.
- Han, K.-T. (2007). Responses to Six Major Biomes in Terms of Scenic Beauty, Preference, and Restorativeness. *Environment and Behavior*.
- Han, K.-T. (2010). An exploration of relationships among the responses to natural scenes scenic beauty, preference, and restoration. *Environment and Behavior*. 42(2), 243-270.

- Hansmann, R., Hug, S.-M. and Seeland, K. (2007). Restoration and stress relief through physical activities in forests and parks. *Urban Forestry & Urban Greening*. 6(4), 213-225.
- Hargrove, M. B., Quick, J. C., Nelson, D. L. and Quick, J. D. (2011). The theory of preventive stress management: a 33-year review and evaluation. *Stress and Health*. 27(3), 182-193.
- Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S. and Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of environmental psychology*. 23(2), 109-123.
- Hartig, T., Korpela, K., Evans, G. W. and Gärling, T. (1996). *Validation of a measure of perceived environmental restorativeness*. University of Göteborg, Department of Psychology.
- Hartig, T., Korpela, K., Evans, G. W. and Gärling, T. (1997). A measure of restorative quality in environments. *Scandinavian Housing and Planning Research*. 14(4), 175-194.
- Hartig, T., Mang, M. and Evans, G. W. (1991). Restorative effects of natural environment experiences. *Environment and behavior*. 23(1), 3-26.
- Hartig, T. and Marcus, C. C. (2006). Essay: Healing gardens—places for nature in health care. *The Lancet*. 368, S36-S37.
- Hartig, T., Maris, E. and Staats, H. (1998). On relations between environmental preference and well-being. *Proceedings of the 1998 15th IAPS conference*, 14-17.
- Hartig, T., Mitchell, R., De Vries, S. and Frumkin, H. (2014). Nature and health. *Annual Review of Public Health*. 35, 207-228.
- Hartig, T. and Staats, H. (2006). The need for psychological restoration as a determinant of environmental preferences. *Journal of Environmental Psychology*. 26(3), 215-226.
- Hartig, T., van den Berg, A. E., Hagerhall, C. M., Tomalak, M., Bauer, N., Hansmann, R., Ojala, A., Syngollitou, E., Carrus, G. and van Herzele, A. (2011). Health benefits of nature experience: Psychological, social and cultural processes. In Nilsson, K., Sangster, M., Gallis, C., Hartig, T., De Vries, S., Seeland, K. & Schpperrijn, J. (Eds.) *Forests, trees and human health* (pp. 127-168)Springer.

- Hartmann, P. and Apaolaza-Ibanez, V. (2010). Beyond savanna: An evolutionary and environmental psychology approach to behavioral effects of nature scenery in green advertising. *Journal of Environmental Psychology*. 30(1), 119-128.
- Hartmann, P. and Apaolaza-Ibáñez, V. (2012). Emotional responses to nature in advertising and real nature *Advances in Advertising Research (Vol. III)* (pp. 17-28)Springer.
- Hashim, I. H. and Zhiliang, Y. (2003). Cultural and gender differences in perceiving stressors: a cross-cultural investigation of African and Western students in Chinese colleges. *Stress and Health*. 19(4), 217-225.
- Heale, R. and Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence Based Nursing*. ebnurs-2015-102129.
- Heerwagen, J. (2009). Biophilia, health and well-being. *Restorative Commons: Creating Health and Well-being through Urban Landscapes, USDA Forest Service, Pennsylvania*. 39-57.
- Herzog, T. R., Black, A. M., Fountaine, K. A. and Knotts, D. J. (1997). Reflection and attentional recovery as distinctive benefits of restorative environments. *Journal of environmental psychology*. 17(2), 165-170.
- Herzog, T. R., Hayes, L. J., Applin, R. C. and Weatherly, A. M. (2009). Compatibility: An experimental demonstration. *Environment and Behavior*.
- Herzog, T. R., Hayes, L. J., Applin, R. C. and Weatherly, A. M. (2010). Incompatibility and mental fatigue. *Environment and Behavior*.
- Herzog, T. R. and Kropscott, L. S. (2004). Legibility, mystery, and visual access as predictors of preference and perceived danger in forest settings without pathways. *Environment and behavior*. 36(5), 659-677.
- Herzog, T. R., Maguire, P. and Nebel, M. B. (2003). Assessing the restorative components of environments. *Journal of Environmental Psychology*. 23(2), 159-170.
- Herzog, T. R. and Shier, R. L. (2000). Complexity, age, and building preference. *Environment and Behavior*. 32(4), 557-575.
- Hey, S. and Sghir, H. (2011). Psycho-physiological stress monitoring using mobile and continous pulse transit time measurement. *Proceedings of the 2011 eTELEMED 2011, The Third International Conference on eHealth, Telemedicine, and Social Medicine*, 126-129.

- Hidalgo, M. C., Berto, R., Galindo, M. P. and Getrevi, A. (2006). Identifying attractive and unattractive urban places: categories, restorativeness and aesthetic attributes. *Medio Ambiente y Comportamiento Humano*. 7(2), 115-133.
- Hinojosa-Laborde, C., Chapa, I., Lange, D. and Haywood, J. R. (1999). Gender differences in sympathetic nervous system regulation. *Clinical and Experimental Pharmacology and Physiology*. 26(2), 122-126.
- Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American psychologist*. 44(3), 513.
- Holbrook, A. (2009). *The Green We Need: An Investigation of the Benefits of Green Life and Green Spaces for Urban-dwellers' Physical, Mental and Social Health*. Nursery and Garden Industry Australia and SORTI, The University of Newcastle.
- Hong, W., Earnest, A., Sultana, P., Koh, Z., Shahidah, N. and Ong, M. E. H. (2013). How accurate are vital signs in predicting clinical outcomes in critically ill emergency department patients. *European Journal of Emergency Medicine*. 20(1), 27-32.
- Honold, J., Lakes, T., Beyer, R. and van der Meer, E. (2015). Restoration in Urban Spaces Nature Views From Home, Greenways, and Public Parks. *Environment and Behavior*. 0013916514568556.
- Horiuchi, M., Endo, J., Takayama, N., Murase, K., Nishiyama, N., Saito, H. and Fujiwara, A. (2014). Impact of Viewing vs. Not Viewing a Real Forest on Physiological and Psychological Responses in the Same Setting. *International journal of environmental research and public health*. 11(10), 10883-10901.
- Hozawa, A., Kuriyama, S., Shimazu, T., Ohmori-Matsuda, K. and Tsuji, I. (2011). Seasonal variation in home blood pressure measurements and relation to outside temperature in Japan. *Clinical and experimental hypertension*. 33(3), 153-158.
- Hughes, A. M., Volante, W. G., Stowers, K., Leyva, K., Oglesby, J. M., Bisbey, T., Salas, E., Knott, B. A. and Vidulich, M. A. (2014). Cognition and Physiological Response Towards a Model of Validated Physiological Measurement. *Proceedings of the 2014 Proceedings of the Human Factors and Ergonomics Society Annual Meeting*: SAGE Publications, 1009-1013.

- Jamaludin, A. A., Hussein, H., Daud, N. K., Ariffin, M. and Rosemary, A. (2013). Living behaviour assessment at residential college building with bioclimatic design strategies.
- James, G. D. (1991). Blood pressure response to the daily stressors of urban environments: Methodology, basic concepts, and significance. *American Journal of Physical Anthropology*. 34(S13), 189-210.
- Jänig, W. (2006). *Integrative action of the autonomic nervous system: Neurobiology of homeostasis*. Cambridge University Press.
- Jansen, P., Leineweber, M. and Thien, T. (2001). The effect of a change in ambient temperature on blood pressure in normotensives. *Journal of human hypertension*. 15(2), 113-117.
- Jiang, B., Chang, C.-Y. and Sullivan, W. C. (2014). A dose of nature: Tree cover, stress reduction, and gender differences. *Landscape and Urban Planning*. 132, 26-36.
- Jiang, S. (2014). Therapeutic landscapes and healing gardens: A review of Chinese literature in relation to the studies in western countries. *Frontiers of Architectural Research*. 3(2), 141-153.
- Joye, Y., Pals, R., Steg, L. and Evans, B. L. (2013). New methods for assessing the fascinating nature of nature experiences. *PloS one*. 8(7).
- Joye, Y. and van den Berg, A. (2011). Is love for green in our genes? A critical analysis of evolutionary assumptions in restorative environments research. *Urban Forestry & Urban Greening*. 10(4), 261-268.
- Kaczorowski, J., Dawes, M. and Gelfer, M. (2007). Measurement of blood pressure: New developments and challenges. *Blood pressure*. 7.
- Kajantie, E. and Phillips, D. I. (2006). The effects of sex and hormonal status on the physiological response to acute psychosocial stress. *Psychoneuroendocrinology*. 31(2), 151-178.
- Kampmann, B. and Bröde, P. (2009). Physiological Responses to Temperature and Humidity compared with Predictions of PHS and WBGT. *Environmental Ergonomics XIII, University of Wollongong, Wollongong*. 54-58.
- Kaplan, R. (2001a). The nature of the view from home psychological benefits. *Environment and behavior*. 33(4), 507-542.
- Kaplan, R. and Kaplan, S. (1989). *The experience of nature: A psychological perspective*. CUP Archive.

- Kaplan, R. and Kaplan, S. (2011). Well-being, Reasonableness, and the Natural Environment. *Applied Psychology: Health and Well-Being*. 3(3), 304-321.
- Kaplan, R., Kaplan, S. and Ryan, R. (1998). *With people in mind: Design and management of everyday nature*. Island Press.
- Kaplan, S. (1987). Aesthetics, affect, and cognition environmental preference from an evolutionary perspective. *Environment and behavior*. 19(1), 3-32.
- Kaplan, S. (1992). The restorative environment: nature and human experience. In Diane, R. (Ed.) *Role of Horticulture in Human Well-being and Social Development* (pp. 134-142). Arlinton, Virginia: Timber press.
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of environmental psychology*. 15(3), 169-182.
- Kaplan, S. (2001b). Meditation, restoration, and the management of mental fatigue. *Environment and Behavior*. 33(4), 480-506.
- Kaplan, S. and Berman, M. G. (2010). Directed attention as a common resource for executive functioning and self-regulation. *Perspectives on Psychological Science*. 5(1), 43-57.
- Kaplan, S. and Talbot, J. F. (1983). Psychological benefits of a wilderness experience *Behavior and the natural environment* (pp. 163-203)Springer.
- Karoly, P. (1993). Mechanisms of self-regulation: A systems view. *Annual review of psychology*. 44(1), 23-52.
- Kato, Y., Endo, H. and Kizuka, T. (2009). Mental fatigue and impaired response processes: event-related brain potentials in a Go/NoGo task. *International Journal of Psychophysiology*. 72(2), 204-211.
- Kaymaz, I. C. (2012a). Landscape perception. *Landscape Planning, In ech, Croatia*. 251-276.
- Kaymaz, I. C. (2012b). *Landscape perception*. INTECH Open Access Publisher.
- Kearns, R. and Moon, G. (2002). From medical to health geography: novelty, place and theory after a decade of change. *Progress in Human Geography*. 26(5), 605-625.
- Kellert, S. R. (1995). *The biophilia hypothesis*. Island Press.
- Keniger, L. E., Gaston, K. J., Irvine, K. N. and Fuller, R. A. (2013). What are the Benefits of Interacting with Nature? *International Journal of Environmental Research and Public Health*. 10(3), 913-935.

- Kent, S. T., Howard, G., Crosson, W. L., Prineas, R. J. and McClure, L. A. (2011). The association of remotely-sensed outdoor temperature with blood pressure levels in REGARDS: a cross-sectional study of a large, national cohort of African-American and white participants. *Environmental Health*. 10(7).
- Kinnafick, F.-E. and Thøgersen-Ntoumani, C. (2014). The effect of the physical environment and levels of activity on affective states. *Journal of Environmental Psychology*. 38, 241-251.
- Koolhaas, J., Bartolomucci, A., Buwalda, B., De Boer, S., Flügge, G., Korte, S., Meerlo, P., Murison, R., Olivier, B. and Palanza, P. (2011). Stress revisited: a critical evaluation of the stress concept. *Neuroscience & Biobehavioral Reviews*. 35(5), 1291-1301.
- Korpela, K. and Hartig, T. (1996). Restorative qualities of favorite places. *Journal of environmental psychology*. 16(3), 221-233.
- Krauss, S. E. (2005). Research paradigms and meaning making: A primer. *The qualitative report*. 10(4), 758-770.
- Kret, M. E. and De Gelder, B. (2012). A review on sex differences in processing emotional signals. *Neuropsychologia*. 50(7), 1211-1221.
- Kroh, D. P. and Gimblett, R. H. (1992). Comparing live experience with pictures in articulating landscape preference. *Landscape Research*. 17(2), 58-69.
- Ku, C.-H. and Smith, M. J. (2010). Organisational factors and scheduling in locomotive engineers and conductors: Effects on fatigue, health and social well-being. *Applied ergonomics*. 41(1), 62-71.
- Kudielka, B. M. and Wüst, S. (2009). Human models in acute and chronic stress: assessing determinants of individual hypothalamus-pituitary-adrenal axis activity and reactivity. *Stress: The International Journal on the Biology of Stress*. 13(1), 1-14.
- Kudielka, B. M. and Wüst, S. (2010). Human models in acute and chronic stress: assessing determinants of individual hypothalamus-pituitary-adrenal axis activity and reactivity. *Stress*. 13(1), 1-14.
- Kunutsor, S. K. and Powles, J. W. (2010). The effect of ambient temperature on blood pressure in a rural West African adult population: a cross-sectional study: cardiovascular topics. *Cardiovascular journal of Africa*. 21(1), 17-20.

- Kuo, F. E. and Faber Taylor, A. (2004). A potential natural treatment for attention-deficit/hyperactivity disorder: evidence from a national study. *American journal of public health*. 94(9), 1580-1586.
- Laforteza, R., Carrus, G., Sanesi, G. and Davies, C. (2009). Benefits and well-being perceived by people visiting green spaces in periods of heat stress. *Urban Forestry & Urban Greening*. 8(2), 97-108.
- Lanninger, S. and Langarová, K. (2010). Landscape and Identity—Theoretical Considerations for the Advancement of Landscape Assessment. *GAIA—Ecological Perspectives for Science and Society*. 19(2), 129-139.
- Lather, P. (1992). Critical frames in educational research: Feminist and post-structural perspectives. *Theory into practice*. 31(2), 87-99.
- Laumann, K., Gärling, T. and Stormark, K. M. (2001). Rating scale measures of restorative components of environments. *Journal of Environmental Psychology*. 21(1), 31-44.
- Laumann, K., Gärling, T. and Stormark, K. M. (2003). Selective attention and heart rate responses to natural and urban environments. *Journal of environmental psychology*. 23(2), 125-134.
- Lawton, M. P., Van Haitsma, K. and Klapper, J. (1996). Observed affect in nursing home residents with Alzheimer's disease. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*. 51(1), P3-P14.
- Le Fevre, M., Matheny, J. and Kolt, G. S. (2003). Eustress, distress, and interpretation in occupational stress. *Journal of Managerial Psychology*. 18(7), 726-744.
- Lee, E.-H. (2012). Review of the psychometric evidence of the perceived stress scale. *Asian Nursing Research*. 6(4), 121-127.
- Lee, H.-Y. and Oh, B.-H. (2010). Aging and arterial stiffness. *Circulation Journal*. 74(11), 2257-2262.
- Lee, J., Park, B.-J., Tsunetsugu, Y., Kagawa, T. and 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.
- Lee, J., Park, B.-J., Tyrväinen, L., Li, Q., Kagawa, T., Miyazaki, Y. and Tsunetsugu, Y. (2012). *Nature therapy and preventive medicine*. INTECH Open Access Publisher.
- Lee, J., Tsunetsugu, Y., Takayama, N., Park, B.-J., Li, Q., Song, C., Komatsu, M., Ikei, H., Tyrväinen, L. and Kagawa, T. (2014). Influence of forest therapy on



- cardiovascular relaxation in young adults. *Evidence-Based Complementary and Alternative Medicine*. 2014.
- Lee, M.-s., Park, B.-j., Lee, J., Park, K.-t., Ku, J.-h., Lee, J.-w., Oh, K.-o. and Miyazaki, Y. (2013). Physiological relaxation induced by horticultural activity: transplanting work using flowering plants. *Journal of physiological anthropology*. 32(1), 15.
- Lengen, C. and Kistemann, T. (2012). Sense of place and place identity: Review of neuroscientific evidence. *Health & place*. 18(5), 1162-1171.
- Li, Q. (2010). Effect of forest bathing trips on human immune function. *Environmental health and preventive medicine*. 15(1), 9-17.
- Li, Q. (2012). *Forest medicine*. Nova Science Publishers New York, NY.
- Li, Q., Otsuka, T., Kobayashi, M., Wakayama, Y., Inagaki, H., Katsumata, M., Hirata, Y., Li, Y., Hirata, K. and Shimizu, T. (2011). Acute effects of walking in forest environments on cardiovascular and metabolic parameters. *European journal of applied physiology*. 111(11), 2845-2853.
- Lin, H. P., Lin, H. Y., Lin, W. L. and Huang, A. C. W. (2011). Effects of stress, depression, and their interaction on heart rate, skin conductance, finger temperature, and respiratory rate: sympathetic-parasympathetic hypothesis of stress and depression. *Journal of clinical psychology*. 67(10), 1080-1091.
- Lin, N. and Lai, G. (1995). Urban stress in China. *Social Science & Medicine*. 41(8), 1131-1145.
- Lindemann-Matthies, P., Briegel, R., Schüpbach, B. and Junge, X. (2010). Aesthetic preference for a Swiss alpine landscape: The impact of different agricultural land-use with different biodiversity. *Landscape and Urban Planning*. 98(2), 99-109.
- Lindh, W., Pooler, M., Tamparo, C., Dahl, B. and Morris, J. (2013). *Delmar's comprehensive medical assisting: administrative and clinical competencies*. Cengage Learning.
- Lohr, V. I. and Pearson-Mims, C. H. (2006). Responses to scenes with spreading, rounded, and conical tree forms. *Environment and Behavior*. 38(5), 667-688.
- Lückmann, K., Lagemann, V. and Menzel, S. (2011). Landscape Assessment and Evaluation of Young People: Comparing Nature-Orientated Habitat and Engineered Habitat Preferences. *Environment and Behavior*. 0013916511411478.

- Lundberg, U. (2005). Stress hormones in health and illness: the roles of work and gender. *Psychoneuroendocrinology*. 30(10), 1017-1021.
- Maantay, J. and Ziegler, J. (2006). GIS for the urban environment.
- Macintyre, S., Ellaway, A. and Cummins, S. (2002). Place effects on health: how can we conceptualise, operationalise and measure them? *Social science & medicine*. 55(1), 125-139.
- Madsen, C. and Nafstad, P. (2006). Associations between environmental exposure and blood pressure among participants in the Oslo Health Study (HUBRO). *European journal of epidemiology*. 21(7), 485-491.
- Marazziti, D., Di Muro, A. and Castrogiovanni, P. (1992). Psychological stress and body temperature changes in humans. *Physiology & behavior*. 52(2), 393-395.
- Marcus, C. C. and Barnes, M. (1999). *Healing gardens: Therapeutic benefits and design recommendations*. John Wiley & Sons.
- Martens, D., Gutscher, H. and Bauer, N. (2011). Walking in “wild” and “tended” urban forests: The impact on psychological well-being. *Journal of Environmental Psychology*. 31(1), 36-44.
- Maulan, S., Shariff, M., Kamal, M. and Miller, P. A. (2006). Landscape Preference and Human Well-Being. *ALAM CIPTA, International Journal on Sustainable Tropical Design Research & Practice*. 1(1), 25-30.
- Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E. and Dolliver, K. (2008). Why is nature beneficial? The role of connectedness to nature. *Environment and Behavior*.
- McAdoo, W. G., Weinberger, M. H., Miller, J. Z., Fineberg, N. S. and Grim, C. E. (1990). Race and gender influence hemodynamic responses to psychological and physical stimuli. *Journal of hypertension*. 8(10), 961-967.
- McEwen, B. S. (2007). Physiology and neurobiology of stress and adaptation: central role of the brain. *Physiological reviews*. 87(3), 873-904.
- McEwen, B. S. (2008). Central effects of stress hormones in health and disease: Understanding the protective and damaging effects of stress and stress mediators. *European journal of pharmacology*. 583(2), 174-185.
- McFadden, J., Price, R., Eastwood, H. and Briggs, R. (1982). Raised respiratory rate in elderly patients: a valuable physical sign. *BMJ*. 284(6316), 626-627.

- McGregor, S. L. and Murnane, J. A. (2010). Paradigm, methodology and method: Intellectual integrity in consumer scholarship. *International Journal of Consumer Studies*. 34(4), 419-427.
- McMahan, E. A. and Estes, D. (2015). The effect of contact with natural environments on positive and negative affect: A meta-analysis. *The Journal of Positive Psychology*. (ahead-of-print), 1-13.
- Miller, D. (2001). A method for estimating changes in the visibility of land cover. *Landscape and Urban Planning*. 54(1), 93-106.
- Miller, W. L. and Crabtree, B. F. (2005). Healing landscapes: patients, relationships, and creating optimal healing places. *Journal of Alternative & Complementary Medicine*. 11(supplement 1), s-41-s-49.
- Milligan, C., Gatrell, A. and Bingley, A. (2004). 'Cultivating health': therapeutic landscapes and older people in northern England. *Social science & medicine*. 58(9), 1781-1793.
- Mitchell, M. and Jolley, J. (2012). *Research design explained*. Cengage Learning.
- Mitchell, R. (2013). Is physical activity in natural environments better for mental health than physical activity in other environments? *Social Science & Medicine*. 91, 130-134.
- Modesti, P. A., Morabito, M., Bertolozzi, I., Massetti, L., Panci, G., Lumachi, C., Giglio, A., Bilo, G., Caldara, G. and Lonati, L. (2006). Weather-related changes in 24-hour blood pressure profile effects of age and implications for hypertension management. *Hypertension*. 47(2), 155-161.
- Morita, E., Fukuda, S., Nagano, J., Hamajima, N., Yamamoto, H., Iwai, Y., Nakashima, T., Ohira, H. and 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.
- Motamedzade, M. and Azari, M. R. (2006). Heat stress evaluation using environmental and biological monitoring. *Pak J Biol Sci*. 9(3), 457-459.
- Murakami, S., Otsuka, K., Kono, T., Soyama, A., Umeda, T., Yamamoto, N., Morita, H., Yamanaka, G. and Kitaura, Y. (2011). Impact of outdoor temperature on prewaking morning surge and nocturnal decline in blood pressure in a Japanese population. *Hypertension Research*. 34(1), 70-73.

- Nassauer, J. I. (1995). Messy ecosystems, orderly frames. *Landscape journal*. 14(2), 161-170.
- Nater, U. M., Rohleder, N., Gaab, J., Berger, S., Jud, A., Kirschbaum, C. and Ehlert, U. (2005). Human salivary alpha-amylase reactivity in a psychosocial stress paradigm. *International Journal of Psychophysiology*. 55(3), 333-342.
- Neylan, T. C. (1998). Hans Selye and the field of stress research. *J Neuropsychiatry Clin Neurosci*. 10(2), 230-231.
- Nightingale, F. (1859). Notes on Nursing: What It Is and What It Isn't. *Harrison and Sons, London*.
- Nisbet, E. K. and Zelenski, J. M. (2011). Underestimating nearby nature affective forecasting errors obscure the happy path to sustainability. *Psychological science*. 22(9), 1101-1106.
- Nordh, H., Hartig, T., Hagerhall, C. and Fry, G. (2009). Components of small urban parks that predict the possibility for restoration. *Urban Forestry & Urban Greening*. 8(4), 225-235.
- O'Brien, E., Asmar, R., Beilin, L., Imai, Y., Mallion, J.-M., Mancia, G., Mengden, T., Myers, M., Padfield, P. and Palatini, P. (2003). European Society of Hypertension recommendations for conventional, ambulatory and home blood pressure measurement. *Journal of hypertension*. 21(5), 821-848.
- O'Craven, K. M., Rosen, B. R., Kwong, K. K., Treisman, A. and Savoy, R. L. (1997). Voluntary attention modulates fMRI activity in human MT-MST. *Neuron*. 18(4), 591-598.
- Ochiai, H., Ikei, H., Song, C., Kobayashi, M., Takamatsu, A., Miura, T., Kagawa, T., Li, Q., Kumeda, S. and Imai, M. (2015). Physiological and Psychological Effects of Forest Therapy on Middle-Aged Males with High-Normal Blood Pressure. *International journal of environmental research and public health*. 12(3), 2532-2542.
- Ode, Å., Fry, G., Tveit, M. S., Messenger, P. and Miller, D. (2009). Indicators of perceived naturalness as drivers of landscape preference. *Journal of environmental management*. 90(1), 375-383.
- Ogunseitan, O. A. (2005). Topophilia and the quality of life. *Environmental Health Perspectives*. 113(2), 143.

- Ojanuga, A. and Ekwoanya, M. (1994). Temporal changes in land use pattern in the Benue River floodplain and adjoining uplands at Makurdi, Nigeria. *University of Agriculture, Makurdi, Nigeria*.
- Ojobo, H. I., Mohamad, S. and Said, I. (2014). Validating the Measures of Perceived Restorativeness in Obudu Mountain Resort, Cross River State, Nigeria. *Open Journal of Social Sciences*. 2(11), 1.
- Okada, M. and Kakehashi, M. (2014). Effects of outdoor temperature on changes in physiological variables before and after lunch in healthy women. *International journal of biometeorology*. 58(9), 1973-1981.
- Olds, A. R. (1989). Nature as healer. *Children's Environments Quarterly*.
- Onwuegbuzie, A. J. and Collins, K. M. (2007). A typology of mixed methods sampling designs in social science research. *The qualitative report*. 12(2), 281-316.
- Ottosson, J. and Grahn, P. (2005). A comparison of leisure time spent in a garden with leisure time spent indoors: on measures of restoration in residents in geriatric care. *Landscape Research*. 30(1), 23-55.
- Pan, R.-C., Chen, B. and Li, J.-J. (1993). Noninvasive monitoring of autonomic cardiovascular control during stress. *Proceedings of the 1993 Bioengineering Conference, 1993., Proceedings of the 1993 IEEE Nineteenth Annual Northeast: IEEE*, 187-188.
- Pandharipande, P. P., Girard, T. D., Jackson, J. C., Morandi, A., Thompson, J. L., Pun, B. T., Brummel, N. E., Hughes, C. G., Vasilevskis, E. E. and Shintani, A. K. (2013). Long-term cognitive impairment after critical illness. *New England Journal of Medicine*. 369(14), 1306-1316.
- Park, B.-J., Tsunetsugu, Y., Ishii, H., Furuhashi, S., Hirano, H., Kagawa, T. and Miyazaki, Y. (2008). Physiological effects of Shinrin-yoku (taking in the atmosphere of the forest) in a mixed forest in Shinano Town, Japan. *Scandinavian Journal of Forest Research*. 23(3), 278-283.
- Park, B.-J., Tsunetsugu, Y., Kasetani, T., Hirano, H., Kagawa, T., Sato, M. and Miyazaki, Y. (2007). Physiological effects of Shinrin-yoku (taking in the atmosphere of the forest)-using salivary cortisol and cerebral activity as indicators. *Journal of Physiological Anthropology*. 26(2), 123-128.
- Park, B.-J., Tsunetsugu, Y., Kasetani, T., Morikawa, T., Kagawa, T. and Miyazaki, Y. (2009a). Physiological effects of forest recreation in a young conifer forest in Hinokage town, Japan. *Silva Fennica*. 43(2), 291-301.

- Park, B.-J., Tsunetsugu, Y., Kasetani, T., Morikawa, T., Kagawa, T. and Miyazaki, Y. (2009b). Physiological effects of forest recreation in a young conifer forest in Hinokage Town, Japan. *Silva Fenn.* 43(2), 291-301.
- Park, B. J., Tsunetsugu, Y., Kasetani, T., Kagawa, T. and 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 preventive medicine.* 15(1), 18-26.
- Payne, S. R. (2013). The production of a perceived restorativeness soundscape scale. *Applied Acoustics.* 74(2), 255-263.
- Pazhouhanfar, M. and Kamal, M. (2014). Effect of predictors of visual preference as characteristics of urban natural landscapes in increasing perceived restorative potential. *Urban Forestry & Urban Greening.* 13(1), 145-151.
- Pfefferbaum, B., Gurwitch, R. H., McDonald, N. B., Leftwich, M. J., Sconzo, G. M., Messenbaugh, A. K. and Schultz, R. A. (2014). Posttraumatic stress among young children after the death of a friend or acquaintance in a terrorist bombing. *Psychiatric Services.*
- Pickering, T. G., Hall, J. E., Appel, L. J., Falkner, B. E., Graves, J., Hill, M. N., Jones, D. W., Kurtz, T., Sheps, S. G. and Roccella, E. J. (2005). Recommendations for blood pressure measurement in humans and experimental animals part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. *Hypertension.* 45(1), 142-161.
- Pitt, D. G. and Zube, E. H. (1987). Management of natural environments. *Handbook of environmental psychology.* 2, 1009-1042.
- Plarre, K., Raij, A., Hossain, S. M., Ali, A. A., Nakajima, M., al'Absi, M., Ertin, E., Kamarck, T., Kumar, S. and Scott, M. (2011). Continuous inference of psychological stress from sensory measurements collected in the natural environment. *Proceedings of the 2011 Information Processing in Sensor Networks (IPSN), 2011 10th International Conference on: IEEE,* 97-108.
- Porteous, J. (1997). Environmental Aesthetics. Ideas, Politics and Planning. *Environment International.* 1(23), 142.

- Pretty, J., Peacock, J., Sellens, M. and Griffin, M. (2005). The mental and physical health outcomes of green exercise. *International journal of environmental health research*. 15(5), 319-337.
- Probst, T. M. (2013). Conducting Effective Stress Intervention Research: Strategies for Achieving an Elusive Goal. *Stress and Health*. 29(1), 1-4.
- Purcell, T., Peron, E. and Berto, R. (2001). Why do preferences differ between scene types? *Environment and Behavior*. 33(1), 93-106.
- Quick, J. C., Nelson, D. L., Quick, J. D. and Orman, D. K. (2001). An isomorphic theory of stress: the dynamics of person–environment fit. *Stress and Health*. 17(3), 147-157.
- Raanaas, R. K., Patil, G. G. and Hartig, T. (2012). Health benefits of a view of nature through the window: a quasi-experimental study of patients in a residential rehabilitation center. *Clinical rehabilitation*. 26(1), 21-32.
- Ramsay, C. R., Matowe, L., Grilli, R., Grimshaw, J. M. and Thomas, R. E. (2003). Interrupted time series designs in health technology assessment: lessons from two systematic reviews of behavior change strategies. *International journal of technology assessment in health care*. 19(04), 613-623.
- Regan, C. L. and Horn, S. A. (2005). To nature or not to nature: associations between environmental preferences, mood states and demographic factors. *Journal of Environmental Psychology*. 25(1), 57-66.
- Roe, J. (2008). *The restorative power of natural and built environments*, Heriot-Watt University.
- Roe, J. J., Thompson, C. W., Aspinall, P. A., Brewer, M. J., Duff, E. I., Miller, D., Mitchell, R. and Clow, A. (2013). Green space and stress: Evidence from cortisol measures in deprived urban communities. *International journal of environmental research and public health*. 10(9), 4086-4103.
- Rothbart, M. K. and Posner, M. I. (1985). Temperament and the development of self-regulation *The neuropsychology of individual differences* (pp. 93-123)Springer.
- Russ, T. C., Stamatakis, E., Hamer, M., Starr, J. M., Kivimäki, M. and Batty, G. D. (2012). Association between psychological distress and mortality: individual participant pooled analysis of 10 prospective cohort studies. *BMJ*. 345, e4933.
- Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological review*. 110(1), 145.

- Russell, R., Guerry, A. D., Balvanera, P., Gould, R. K., Basurto, X., Chan, K. M., Klain, S., Levine, J. and Tam, J. (2013). Humans and nature: how knowing and experiencing nature affect well-being. *Annual Review of Environment and Resources*. 38, 473-502.
- Ryan, R. L. (1998). Local perceptions and values for a midwestern river corridor. *Landscape and Urban Planning*. 42(2), 225-237.
- Sahlin, E. (2014). *To stress the importance of nature-Nature based therapy for the rehabilitation and prevention of stress related disorders*, Swedish University of Agricultural Sciences, Alnarp.
- Sahlin, E., Lindegård, A., Hadzibajramovic, E., Grahn, P., Vega Matuszczyk, J. and Ahlborg Jr, G. (2014). The Influence of the Environment on Directed Attention, Blood Pressure and Heart Rate—An Experimental Study Using a Relaxation Intervention. *Landscape research*. (ahead-of-print), 1-19.
- Sapolsky, R. M., Romero, L. M. and Munck, A. U. (2000). How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions 1. *Endocrine reviews*. 21(1), 55-89.
- Sarkar, S. and Mukhopadhyay, B. (2008). Perceived psychosocial stress and cardiovascular risk: observations among the Bhutias of Sikkim, India. *Stress and Health*. 24(1), 23-34.
- Schirpke, U., Hölzler, S., Leitinger, G., Bacher, M., Tappeiner, U. and Tasser, E. (2013a). Can We Model the Scenic Beauty of an Alpine Landscape? *Sustainability*. 5(3), 1080-1094.
- Schirpke, U., Tasser, E. and Tappeiner, U. (2013b). Predicting scenic beauty of mountain regions. *Landscape and Urban Planning*. 111, 1-12.
- Scopelliti, M. and Giuliani, M. V. (2004). Choosing restorative environments across the lifespan: A matter of place experience. *Journal of Environmental Psychology*. 24(4), 423-437.
- Scopelliti, M. and Vittoria Giuliani, M. (2004). Choosing restorative environments across the lifespan: A matter of place experience. *Journal of Environmental Psychology*. 24(4), 423-437.
- Scott, M. and Canter, D. V. (1997). Picture or place? A multiple sorting study of landscape. *Journal of environmental psychology*. 17(4), 263-281.



- Segerstrom, S. C. and Miller, G. E. (2004). Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychological bulletin*. 130(4), 601.
- Selye, H. (1964). From Dream to Discovery-On Being a Scientist. *Academic Medicine*. 39(10), 978.
- Selye, H. (1976). Forty years of stress research: principal remaining problems and misconceptions. *Canadian Medical Association Journal*. 115(1), 53.
- Sevenant, M. and Antrop, M. (2009). Cognitive attributes and aesthetic preferences in assessment and differentiation of landscapes. *Journal of Environmental Management*. 90(9), 2889-2899.
- Sharma, N. and Gedeon, T. (2012). Objective measures, sensors and computational techniques for stress recognition and classification: A survey. *Computer methods and programs in biomedicine*. 108(3), 1287-1301.
- Shin, W. S., Yeoun, P. S., Yoo, R. W. and Shin, C. S. (2010). Forest experience and psychological health benefits: the state of the art and future prospect in Korea. *Environmental health and preventive medicine*. 15(1), 38-47.
- Shosha, G. M. A. (2012). Application of the perceived stress scale in health care studies. an analysis of literature. *International Journal of Academic Research*. 4(4).
- Simonic, T. (2006). Urban landscape as a restorative environment: preferences and design considerations. *Acta agriculturae Slovenica*. 87, 325-332.
- Simonič, T. (2003). Preference and perceived naturalness in visual perception of naturalistic landscapes. *Zb Bioteh Fak Univ Ljublj Kmet*. 81, 369-387.
- Sitiza, J. (2009). How valid and reliable are patient satisfaction data. *An analysis of*. 195, 319-328.
- Sjödín, F., Kjellberg, A., Knutsson, A., Landström, U. and Lindberg, L. (2012). Noise and stress effects on preschool personnel. *Noise and Health*. 14(59), 166.
- Skřivanová, Z. and Kalivoda, O. (2010). Perception and assessment of landscape aesthetic values in the Czech Republic—a literature review. *Journal of Landscape Studies*. 3, 211-220.
- Sluiter, J. K., Frings-Dresen, M. H., Meijman, T. F. and van der Beek, A. J. (2000). Reactivity and recovery from different types of work measured by catecholamines and cortisol: a systematic literature overview. *Occupational and Environmental Medicine*. 57(5), 298-315.

- Smyth, F. (2005). Medical geography: therapeutic places, spaces and networks. *Progress in Human Geography*. 29(4), 488-495.
- Snyder, J. and Allen, N. W. (1975). Photography, vision, and representation. *Critical Inquiry*. 2(1), 143-169.
- Song, C., Ikei, H., Kobayashi, M., Miura, T., Taue, M., Kagawa, T., Li, Q., Kumeda, S., Imai, M. and Miyazaki, Y. (2015a). Effect of Forest Walking on Autonomic Nervous System Activity in Middle-Aged Hypertensive Individuals: A Pilot Study. *International journal of environmental research and public health*. 12(3), 2687-2699.
- Song, C., Ikei, H., Lee, J., Park, B.-J., Kagawa, T. and Miyazaki, Y. (2013). Individual differences in the physiological effects of forest therapy based on Type A and Type B behavior patterns. *Journal of physiological anthropology*. 32(1), 14.
- Song, C., Ikei, H. and Miyazaki, Y. (2015b). Elucidation of a Physiological Adjustment Effect in a Forest Environment: A Pilot Study. *International journal of environmental research and public health*. 12(4), 4247-4255.
- Srivastava, R., Kumar, M., Shinghal, R. and Sahay, A. (2010). Influence of age and gender on cold pressor response in Indian population.
- Staats, H. and Hartig, T. (2004). Alone or with a friend: A social context for psychological restoration and environmental preferences. *Journal of Environmental Psychology*. 24(2), 199-211.
- Staats, H., Kieviet, A. and Hartig, T. (2003). Where to recover from attentional fatigue: An expectancy-value analysis of environmental preference. *Journal of environmental psychology*. 23(2), 147-157.
- Steptoe, A. and Brydon, L. (2009). Emotional triggering of cardiac events. *Neuroscience & Biobehavioral Reviews*. 33(2), 63-70.
- Stigsdotter, U. A. and Grahn, P. (2003). Experiencing a garden: a healing garden for people suffering from burnout diseases. *Journal of therapeutic horticulture*. 14, 38-49.
- Stigsdotter, U. K., Palsdottir, A. M., Burls, A., Chermaz, A., Ferrini, F. and Grahn, P. (2011). Nature-based therapeutic interventions *Forests, trees and human health* (pp. 309-342)Springer.
- Stokols, D. (2013). *Perspectives on environment and behavior: theory, research, and applications*. Springer Science & Business Media.

- Stoll-Kleemann, S. (2015). *Local Perceptions and Preferences for Landscape and Land Use in the Fischland-Darß-Zingst Region, German Baltic Sea*. Institut für Geographie und Geologie.
- Takayama, N., Korpela, K., Lee, J., Morikawa, T., Tsunetsugu, Y., Park, B.-J., Li, Q., Tyrväinen, L., Miyazaki, Y. and Kagawa, T. (2014). Emotional, Restorative and Vitalizing Effects of Forest and Urban Environments at Four Sites in Japan. *International journal of environmental research and public health*. 11(7), 7207-7230.
- Tang, I.-C., Sullivan, W. C. and Chang, C.-Y. (2015). Perceptual Evaluation of Natural Landscapes The Role of the Individual Connection to Nature. *Environment and Behavior*. 47(6), 595-617.
- Tennessen, C. M. and Cimprich, B. (1995). Views to nature: Effects on attention. *Journal of environmental psychology*. 15(1), 77-85.
- Theorell, T., Knox, S., Svensson, J. and Waller, D. (1985). Blood pressure variations during a working day at age 28: effects of different types of work and blood pressure level at age 18. *Journal of human stress*. 11(1), 36-41.
- Thompson, C. W. (2011). Linking landscape and health: The recurring theme. *Landscape and Urban Planning*. 99(3), 187-195.
- Thompson, C. W. (2012). Landscape perception and environmental psychology. *The Routledge Companion to Landscape Studies*. 25.
- Thompson, C. W., Roe, J., Aspinall, P., Mitchell, R., Clow, A. and 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.
- Thompson, S., Kent, J. and Jalaludin, B. (2011). Supporting Human Health: Focusing Effective Built Environment Interventions. *Proceedings of the 2011: Conference Paper, State of Australian Cities Conference*,
- Thornhill, R. (1998). Darwinian aesthetics.
- Thorsen, R. S. (2015). Conceptualizations of pluralistic medical fields: exploring the therapeutic landscapes of Nepal. *Health & place*. 31, 83-89.
- Tsunetsugu, Y., Lee, J., Park, B.-J., Tyrväinen, L., Kagawa, T. and 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.-J., Ishii, H., Hirano, H., Kagawa, T. and 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. *Journal of physiological anthropology*. 26(2), 135-142.
- Tsunetsugu, Y., Park, B.-J. and Miyazaki, Y. (2010). Trends in research related to “Shinrin-yoku”(taking in the forest atmosphere or forest bathing) in Japan. *Environmental health and preventive medicine*. 15(1), 27-37.
- Turner, S., Fiedeldey, A. C. and Sharma, Y. (1998). A Cross-Cultural Ranking of the Pleasantness of Visual and Non-Visual Features of Outdoor Environments Francis T. McAndrew Knox College.
- Tveit, M. S. (2009). Indicators of visual scale as predictors of landscape preference; a comparison between groups. *Journal of Environmental Management*. 90(9), 2882-2888.
- Tyrväinen, L., Ojala, A., Korpela, K., Lanki, T., Tsunetsugu, Y. and Kagawa, T. (2014). The influence of urban green environments on stress relief measures: A field experiment. *Journal of Environmental Psychology*. 38, 1-9.
- Uduma-Olugu, N. (2013). Perception of Suitability of Landscape Features of the Lagos Lagoon for Tourism by its Users and Users of Lagos Coastal Tourism Venues. *International Journal of Sciences*. 2(2013-07), 37-46.
- Ulrich, R. (1984). View through a window may influence recovery. *Science*. 224(4647), 224-225.
- Ulrich, R. S. (1979). Visual landscapes and psychological well-being. *Landscape research*. 4(1), 17-23.
- Ulrich, R. S. (1981). Natural versus urban scenes some psychophysiological effects. *Environment and behavior*. 13(5), 523-556.
- Ulrich, R. S. (1983). Aesthetic and affective response to natural environment. *Behavior and the natural environment*. (pp. 85-125)Springer.
- Ulrich, R. S. (1986). Human responses to vegetation and landscapes. *Landscape and urban planning*. 13, 29-44.
- Ulrich, R. S. (1999). Effects of gardens on health outcomes: Theory and research. *Healing gardens: Therapeutic benefits and design recommendations*. 27-86.
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A. and Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of environmental psychology*. 11(3), 201-230.

- Valins, S. and Baum, A. (1973). Residential group size, social interaction, and crowding. *Environment and Behavior*.
- Valtchanov, D., Barton, K. R. and Ellard, C. (2010). Restorative effects of virtual nature settings. *Cyberpsychology, Behavior, and Social Networking*. 13(5), 503-512.
- Valtchanov, D. and Ellard, C. G. (2015). Cognitive and affective responses to natural scenes: Effects of low level visual properties on preference, cognitive load and eye-movements. *Journal of Environmental Psychology*. 43, 184-195.
- Van den Berg, A. E. (2003). Personal need for structure and environmental preference. *Human Decision Making and Environmental Perception: Understanding and Assisting Human Decision Making in Real-life Settings*. Rijksuniversiteit Groningen, Groningen. 129-148.
- Van Den Berg, A. E. and Custers, M. H. (2010). Gardening promotes neuroendocrine and affective restoration from stress. *Journal of Health Psychology*.
- van den Berg, A. E., Hartig, T. and Staats, H. (2007). Preference for nature in urbanized societies: Stress, restoration, and the pursuit of sustainability. *Journal of social issues*. 63(1), 79-96.
- van den Berg, A. E., Jorgensen, A. and Wilson, E. R. (2014). Evaluating restoration in urban green spaces: Does setting type make a difference? *Landscape and Urban Planning*. 127, 173-181.
- Van den Berg, A. E. and Koole, S. L. (2006). New wilderness in the Netherlands: An investigation of visual preferences for nature development landscapes. *Landscape and Urban Planning*. 78(4), 362-372.
- van den Berg, A. E., Koole, S. L. and van der Wulp, N. Y. (2003). Environmental preference and restoration:(How) are they related? *Journal of environmental psychology*. 23(2), 135-146.
- Van den Berg, A. E., Maas, J., Verheij, R. A. and Groenewegen, P. P. (2010). Green space as a buffer between stressful life events and health. *Social science & medicine*. 70(8), 1203-1210.
- van der Ha, B. (2011). What makes nature restorative?
- Velarde, M. D., Fry, G. and Tveit, M. (2007). Health effects of viewing landscapes—Landscape types in environmental psychology. *Urban Forestry & Urban Greening*. 6(4), 199-212.

- Viriden, R. J. and Walker, G. J. (1999). Ethnic/racial and gender variations among meanings given to, and preferences for, the natural environment. *Leisure Sciences*. 21(3), 219-239.
- Völker, S. and Kistemann, T. (2011). The impact of blue space on human health and well-being—Salutogenetic health effects of inland surface waters: A review. *International journal of hygiene and environmental health*. 214(6), 449-460.
- Waghmare, M. and Chatur, P. (2012). Temperature and Humidity Analysis using Data Logger of Data Acquisition System: An Approach. *International Journal of Emerging Technology and Advanced Engineering*. 2(1), 102-106.
- Wagner, J. A. and Horvath, S. M. (1985). Cardiovascular reactions to cold exposures differ with age and gender. *Journal of Applied Physiology*. 58(1), 187-192.
- Wang, Xiao-bo and LI, J.-f. (2012). Analysis of the healing landscape and its relevant conceptions. *Journal of Beijing University of Agriculture*. 2, 021.
- Wang, J., Korczykowski, M., Rao, H., Fan, Y., Pluta, J., Gur, R. C., McEwen, B. S. and Detre, J. A. (2007). Gender difference in neural response to psychological stress. *Social cognitive and affective neuroscience*. 2(3), 227-239.
- Ward Thompson, C. and Aspinall, P. A. (2011). Natural environments and their impact on activity, health, and quality of life. *Applied Psychology: Health and Well-Being*. 3(3), 230-260.
- Waterhouse, J., Reilly, T. and Edwards, B. (2004). The stress of travel. *Journal of Sports Sciences*. 22(10), 946-966.
- Wattchow, B. (2013). Landscape and a Sense of Place: a Creative Tension'. *The Routledge Companion to Landscape Studies*, Routledge, Abingdon, Oxon. 87-96.
- Weathington, B. L., Cunningham, C. J. and Pittenger, D. J. (2010). *Research methods for the behavioral and social sciences*. John Wiley & Sons.
- Wells, A. and Matthews, G. (2014). *Attention and Emotion (Classic Edition): A Clinical Perspective*. Psychology Press.
- Welsh, A. J. and Griffin, M. J. (2008). Normal values for finger systolic blood pressures in males and females. *International archives of occupational and environmental health*. 81(5), 625-632.
- Wener, R. E. and Evans, G. W. (2011). Comparing stress of car and train commuters. *Transportation Research Part F: Traffic Psychology and Behaviour*. 14(2), 111-116.

- Werner, J. (2008). Process-and controller-adaptations determine the physiological effects of cold acclimation. *European journal of applied physiology*. 104(2), 137-143.
- White, E. V. and Gatersleben, B. (2011). Greenery on residential buildings: Does it affect preferences and perceptions of beauty? *Journal of environmental psychology*. 31(1), 89-98.
- White, M., Smith, A., Humphryes, K., Pahl, S., Snelling, D. and Depledge, M. (2010). Blue space: The importance of water for preference, affect, and restorativeness ratings of natural and built scenes. *Journal of Environmental Psychology*. 30(4), 482-493.
- White, M. P., Alcock, I., Wheeler, B. W. and Depledge, M. H. (2013a). Would you be happier living in a greener urban area? A fixed-effects analysis of panel data. *Psychological science*. 0956797612464659.
- White, M. P., Pahl, S., Ashbullby, K., Herbert, S. and Depledge, M. H. (2013b). Feelings of restoration from recent nature visits. *Journal of Environmental Psychology*. 35, 40-51.
- Wilder, J. (1957). The law of initial value in neurology and psychiatry; Facts and problems 1. *The Journal of nervous and mental disease*. 125(1), 73-86.
- Wilder, J. (2014). *Stimulus and response: The law of initial value*. Elsevier.
- Wilkie, S. and Stavridou, A. (2013). Influence of environmental preference and environment type congruence on judgments of restoration potential. *Urban Forestry & Urban Greening*. 12(2), 163-170.
- Williams, A. (2009). Therapeutic landscapes as health promoting places. *A companion to health and Medical geography*. 207-223.
- Wilson, E. O. (1984). *Biophilia*. Harvard University Press.
- Wright, R. (2010). *The moral animal: Why we are, the way we are: The new science of evolutionary psychology*. Vintage.
- Yamaguchi, M., Deguchi, M. and Miyazaki, Y. (2006). The effects of exercise in forest and urban environments on sympathetic nervous activity of normal young adults. *Journal of International Medical Research*. 34(2), 152-159.
- Yang, L., Li, L., Lewington, S., Guo, Y., Sherliker, P., Bian, Z., Collins, R., Peto, R., Liu, Y. and Yang, R. (2015). Outdoor temperature, blood pressure, and cardiovascular disease mortality among 23 000 individuals with diagnosed

- cardiovascular diseases from China. *European heart journal*. 36(19), 1178-1185.
- Yang, T., Rockett, I. R., Lv, Q. and Cottrell, R. R. (2012). Stress status and related characteristics among urban residents: a six-province capital cities study in China. *PloS one*. 7(1), e30521.
- Ying, J. (2009). Two examples of western medical gardens. *Chinese Landscape Architecture*. 8, 007.
- Yu, K. (1995). Cultural variations in landscape preference: comparisons among Chinese sub-groups and Western design experts. *Landscape and Urban Planning*. 32(2), 107-126.
- Zohrabi, M. (2013). Mixed method research: Instruments, validity, reliability and reporting findings. *Theory and Practice in Language Studies*. 3(2), 254-262.
- Zuckerman, M. (1977). Development of a situation-specific trait-state test for the prediction and measurement of affective responses. *Journal of Consulting and clinical psychology*. 45(4), 513.