

Duration of Nature Contact and Mood

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Supervised by Dr. Katherine Arbuthnott

University of Regina

by

Calum Neill

Regina, Saskatchewan

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Abstract

Exposure to natural environments is beneficial to both health and mood, but the mechanisms of causation have yet to be examined in depth (Sandifer Sutton-Grier, and Ward, 2015). The current study answers Sandifer et al's. (2015) call for further research into the dose-response effect of duration on nature exposure. The study replicates and expands on Brooks, Ottley, Arbuthnott, and Sevigny's (2017) study exploring the mood effects of exposure to natural environments. The current study examined whether the duration of nature exposure influences immediate mood effects. Participants were exposed to the same natural setting for either 5 or 15 minutes and rated their positive and negative moods both before and after the exposure. The results indicated a significant main effect for pre-test/post-test, indicating mood improvement for nature contact. The factor of duration did not influence mood ratings, indicating that very short exposures to nature provide statistically the same amount of improvement as exposures three times as long.

Keywords: nature contact, mood regulation, well-being

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Duration of Nature Contact and Mood

There has been a growing movement in psychology examining the restorative properties of nature on one's physiological and psychological health. This arguably stems from a study conducted by Ulrich (1984), who found that recovery times for postoperative patients are significantly less when patients are given a room with a view of a natural scene compared to when patients have a view of a brick wall. The field of environmental psychology has made enormous advances in understanding the relationship between nature and one's health. The literature suggests that nature has positive effects on both physical health (de Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Donovan et al., 2013) and mood (Cole & Hall, 2010; Nisbet, Zelenski, & Murphy 2011). However, little research has examined the specific conditions of these effects (Sandifer, Sutton-Grier, & Ward, 2015). The current study expands upon a study by Brooks, Ottley, Arbuthnott, and Sevigny (2017) by exploring how duration of exposure to nature influences people's immediate moods.

Background

Several studies of nature contact have produced findings that support the idea that nature contact has positive effects on mood (Brooks et al., 2017; McMahan & Estes, 2015; Nisbet et al., 2011). As an example of this research, two studies and a meta-analysis will be described in detail.

Nisbet et al. (2011) conducted a series of studies examining the role of nature relatedness on subjective well-being. In the first study, undergraduate students (with a mean age of 19.48) completed measures of nature-relatedness, well-being, and inclination towards the environment. The second study replicated the first with a sample of working people (with a mean age of 42.37) who completed the same survey anonymously online. Finally, the third study followed

students (with a mean age of 19.35) taking an environmental course and measured their nature relatedness and well-being throughout the course of the semester. This group was compared to a control condition (i.e., students not in an environmental course). The three studies found nature relatedness to be positively correlated with positive affect and this association was not age specific.

Brooks et al. (2017) conducted three experiments examining whether nature contact influences mood. The first study had undergraduate students walk for 10 minutes in either an indoor setting or outside in a natural environment and in either fall or winter months. The indoor condition consisted of a walk through hallways, with limited windows, and no view of plants or pictures of nature. The outdoor condition had participants walk through an urban park with a diverse grassland riparian habitat. The effects of these walks were measured for both general moods (i.e., positive and negative affect) and clinically-relevant moods (i.e., anxiety, stress, and depression). The second study examined the extent to which the benefits of nature exposure are obtainable from pictures of nature. Participants viewed 25 pictures of either nature or urban settings, taken in either fall or winter seasons, and answered the same self-report questionnaires as in the first study. The third study directly compared the benefits of actual and pictorial nature exposure. The results of each of these studies found considerable improvement in mood following 10 minutes of nature exposure as compared to the indoor or urban control conditions. Actual exposure to nature had greater effects on both general and clinical moods than did nature pictures; but mood benefits in the nature conditions were significant for both, general and clinical moods. Furthermore, reported mood effects were found to not be seasonally dependent (Brooks et al., 2017).

Evidence supporting nature exposure mood effects is further supported by McMahan and Estes (2015), who conducted a meta-analysis examining the effect of nature on mood. The analysis consisted of 32 relevant studies, all of which met inclusion criteria. Inclusion criteria consisted of four items: a) studies had to examine the effects of nature exposure directly through either physical or sensory contact or through laboratory simulations, b) studies had to use a randomized controlled design and a comparison group, c) studies had to have a self-report measure of current emotional state administered following the exposure and comparison condition, and d) all studies had to include an effect size of positive and negative affect between exposure and comparison conditions. The majority of studies examined the effect of nature using a randomized two-group design comparing exposure to nature or urban settings. The studies found higher levels of positive affect, as well as lower levels of negative affect, among participants exposed to a natural environment than those in a comparison condition. A random-effects meta-analysis found exposure to nature to have a moderate effect ($r = .31$) on positive affect and a small effect ($r = .12$) on negative affect.

Nisbet et al. (2011), Brooks et al. (2017), and McMahan and Estes (2015) provide significant support that contact with nature has beneficial effects on mood. The aforementioned studies provide evidence for the positive correlation between nature relatedness and positive affect, significant mood improvements for both general and clinical moods, and a negative correlation between nature exposure and negative affect (i.e., mood improvement). This provides a sound foundation to build upon in order to more fully understand the relationship between nature contact and mood.

Unexamined Questions

Sandifer et al. (2015) reviewed research examining the links between ecosystem services, biodiversity, nature, and psychological and physical health. The authors concluded that the reviewed literature provides clear support for health effects from nature exposure, but called for further research to examine the dose-response characteristics of these effects. Specifically, Sandifer et al. (2015) concluded that there was a significant lack of understanding of both the mechanisms of causation, and the conditions supporting these benefits. With respect to the latter they argued for research examining dose-response characteristics, which they define as duration, frequency, and intensity of nature contact. Duration is the amount of time exposed to nature, frequency refers to how often one is exposed to nature, and intensity is the type of nature contact (e.g., actual time in nature or viewing pictures; Sandifer et al., 2015). They suggested that by researching these specific characteristics, the understanding of nature exposure effects would be heightened resulting in better being able to utilize nature for mood regulation. The purpose of this study is to examine one of these factors, duration.

Theoretical Explanations

Understanding the relationship between nature and one's health is generally explained using one of three theories: the Biophilia Hypothesis (Wilson, 1993), Stress Reduction Theory (SRT; Ulrich et al., 1991), and Attention Restoration Theory (ART; Kaplan & Kaplan, 1989). The Biophilia Hypothesis asserts that humans have an innate emotional connection with other living organisms (Wilson, 1993). It posits that through evolution, humans have developed a positive biological response to natural environments that has aided in the survival of the species (Wilson, 1993). SRT also takes an evolutionary perspective and suggests that when human beings are stressed, exposure to a natural environment has a restorative effect (Ulrich et al.,

1991). SRT hypothesizes that the positive response elicited by natural environments is unlearned and aids in survival (Cracknell, White, Pahl, Nichols, & Depledge, 2016). While the Biophilia Hypothesis predicts that one's health is determined by their relationship with nature, SRT posits that exposure to a natural setting will reduce recovery time following a stressful situation (Cracknell et al., 2016; Howell, Dopko, Passmore, & Buro, 2011). Finally, ART suggests that nature has a restorative effect on one's attention (Kaplan & Kaplan, 1989; Kaplan, 1995). It has been found that intense, prolonged directed attention is associated with mental fatigue and can have negative effects on one's health and cognitive performance (Berman, Jonides, & Kaplan, 2008; Herzog, Maguire, & Nebel, 2003). ART suggests that fascination, or the ability for the environment to hold one's attention, can be described as either *hard* or *soft* (Kaplan, 1995). The restorative effect of nature is associated with that of *soft* fascinations (e.g., watching the motion of leaves in the wind), which effortlessly hold one's attention without the arousal and mental fatigue associated with *hard* fascinations (Kaplan, 1995). The current study does not contrast these theoretical explanations, so they are presented to provide context to the literature.

Duration

The current literature in environmental psychology is making significant advances in understanding the relationship of nature's restorative properties (e.g., Kuo, 2015). However, as Sandifer et al. (2015) have pointed out, more needs to be done to examine practical factors related to the dose-response characteristics. Throughout the literature, the duration of exposure to natural environments varies considerably; but, duration itself has not directly been examined. Despite ample evidence of the existence of nature's salutary impact on mood (Brooks et al., 2017; McMahan & Estes, 2015; Nisbet et al., 2011), evidence of the features of different durations of exposure is scarce.

Reviewing the literature, it becomes clear that the relationship between duration of exposure to nature and the restorative properties is not well understood. While research evidence indicates that nature exposure is beneficial, the durations at which it is tested vary dramatically from one study to another.

Cole and Hall (2010) examined self-reported nature restoration in day and overnight hikers. Visitors to wilderness areas were surveyed as they left the trails. Most respondents reported significant stress and tension reduction, as well as mental rejuvenation, and that daytrips facilitated stress reduction and mental rejuvenation to the same extent as overnight trips. Thus, this correlational study indicated that duration did not influence nature benefit effects.

Using an experimental study, Cracknell et al. (2016) examined the physiological and psychological reactions of participants seated in front of an aquarium exhibit for either 5 or 10 minutes. They predicted that longer exposure time would produce an increase in the mood effects associated with nature exposure. The results partially supported this prediction. Participants reported that 10 minutes of exposure to the exhibit was more enjoyable, interesting, and made them feel better than exposures of 5 minutes. However, further analysis revealed that the majority of the effects took place in the first 5 minutes and little gains came after that.

Barton and Pretty (2010) conducted a meta-analysis examining the best doses of acute exposure to green exercise (i.e., physical activity in a natural environment) for mood effects. Overall, 10 studies were included in the analysis, all of which used identical measurements of mood and self-esteem following acute exposure to green exercise. The results found that the biggest benefits to mood and self-esteem came at 5 minutes of exposure, and did not significantly increase with longer durations.

Overall, these three studies show that nature benefits are observed with very short exposure times and suggest that longer durations do not increase the effect. However, at least two studies indicate that greater contact duration increases mood benefits (Carrus et al., 2015; White, Pahl, Ashbullby, Herbery, and Depledge, 2013). Carrus et al. (2015) examined subjective well-being of urban residents visiting selected green spaces based on level of biodiversity and setting location. The study used a 2 (biodiversity) x 2 (location) factorial design in which participants experienced either an urban or peri-urban setting with either high or low levels of biodiversity. All participants completed a questionnaire that consisted of questions on setting experience, activity performed, socio-demographic data, as well as questions pertaining to perceived restorativeness. Analysis found that the length of visit to a green space was significantly correlated with the self-reported benefits of the exposure. It was found that self-reported benefits and well-being were significantly correlated with length of visit to green spaces ($r = .15, p = .000$). The length of visits were expressed in minutes and hours and then recoded into a scale ranging from 1-4.

White et al. (2013) also found evidence suggesting that increased exposure length increases mood effects. The study utilized a national survey to examine one's feelings of restoration after visiting parks and open spaces in towns and cities, the countryside, seaside resorts and towns, and open coastline. Analysis of the data found that individuals had higher recalled restoration for longer visits compared to shorter ones. It should be noted, that the study utilized self-reported durations, rather than manipulating the duration of nature or measuring the time of exposure. This is an important factor to consider, as people may believe that longer durations of nature exposure influences the magnitude of the effects they should experience, and in turn report in a manner consistent with their beliefs.

Purpose

The present study examined whether the duration of nature exposure influences immediate mood effects. Participants were exposed to the same natural setting for either 5 or 15 minutes and rated their positive and negative moods both before and after this exposure. These two durations were chosen based on the durations used in previous studies. As reviewed above, several studies indicate significant mood effects with 5 minute exposures (e.g., Barton & Pretty, 2010; Cracknell et al., 2016). There is, however, some suggestion that longer exposure may increase benefits (e.g., Carrus et al., 2015; White et al., 2013), so a duration three times longer was selected. This evidence will potentially inform individuals and psychotherapists about the best 'doses' of nature contact to use for mood improvement benefits.

Method

Participants

Seventy participants (58 women) were recruited using the University of Regina Participant Pool operated by the Department of Psychology. Participants' ages ranged from 18 to 34 years ($M = 21.67$, $sd = 3.57$). In exchange for participation, participants received one bonus credit in an introductory psychology class. The sample size was determined using a power analysis (i.e., G*Power 3.1) assuming a moderate effect size, using $\alpha = .05$, and $\text{power} = .95$. Participants were randomly assigned to either a 5 or 15 minute condition.

Setting

All participants were asked to sit at the same location, which affords a view of natural vegetation in an urban setting. The selected location is on the University of Regina campus between the Riddell Center and the Education Building. This location was chosen due to its relatively high level of bio-diversity, which has been shown to play an important role in eliciting

the positive effects of nature exposure (Dallimer et al., 2012; Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007). The chosen area is surrounded by unique plant life as well as an array of different songbirds.

Measures

Positive and Negative Affect Schedule (PANAS; Watson, Clarke, & Tellegan, 1988).

The PANAS was chosen due to its demonstrated internal consistency, validity, and efficient means of administration (Watson et al., 1988), as well as its use in previous nature benefit studies (Brooks et al., 2017). The PANAS consisted of 20 mood items (10 positive and 10 negative). Participants rated the extent they were currently experiencing each of the moods on a 5-point Likert scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). For the present sample, the Cronbach's alpha for PA was .85 pre-test and .92 post-test, and for NA was .85 pre-test and .87 post-test.

Elevating Experience Scale (EES; Huta & Ryan, 2010). As was done in Brooks et al., (2017), nine items from the EES were appended to the PANAS list to measure eudemonia, one's meaning of life, life satisfaction, and elevating experience (Huta & Ryan, 2010), which has been identified as an important part of well-being. Participants rated the extent they were currently experiencing each of the moods on the same 5-point likert scale of the PANAS. For the present sample, the EES Cronbach's alpha was .85 for pre-test and .91 for post-test.

Short-form version of the Depression and Anxiety Stress Scales (DASS-21; Henry & Crawford, 2005). The DASS-21 is a 21-item scale adapted from the original Depression, Anxiety, and Stress Scale (DASS; Lovibond & Lovibond, 1995). The DASS-21 was chosen due to its adequate construct validity and reliability (Henry & Crawford, 2005), as well as its previous use in nature effect research (Brooks et al., 2017). The scale consists of three sub-

scores: stress, anxiety, and depression, each with seven items. Each item is rated on a 4-point scale ranging from 0 (*does not apply to me at all*) to 3 (*applies to me very much*). It should be noted that, unlike for the previously mentioned measures, higher scores for this scale indicate greater levels of distress. For the present sample, Cronbach's alpha at pre-test was .77, .76, and .80 and at post-test was .60, .79, and .76 for Anxiety, Stress, and Depression respectively.

Design and Procedure

The study used a 2 (pre-test vs. post-test) x 2 (duration: 5 vs. 15 min.) mixed factorial design. Duration was tested between participants, and pre/post test was a within-participants factor. It is important to note that the current study has elected to exclude a control condition, as there is substantial evidence for nature exposure mood effects compared to a control of an urban or built environment (e.g., McMahan & Estes, 2015).

Participants met with the researcher in the lab at their individually assigned time. Prior to starting the study, all participants were given a consent form outlining the study as well as their rights as a participant. Upon signing the consent form, participants were administered the first questionnaire. The questionnaire consisted of the DASS-21, the PANAS, and the EES. The current study utilized a pre/post-test design as it enables more sensitive measurement of mood effects. Following the completion of the first questionnaire, participants were guided to the selected nature exposure location, reminded that they would be sitting in silence, and asked to sit on a bench and focus their attention on the surrounding nature. Following the randomly assigned exposure duration, participants were administered the second questionnaire, which was identical to the first. Once respondents finished the second questionnaire, they were debriefed to the nature of the study

Results

To assess general mood, we conducted 2 (duration) x 2 (pre-test vs. post-test) ANOVAs of positive affect (PA), negative affect (NA), and EES scores. The mean scores for these analyses are shown in Table 1. These analyses indicated only main effects of pre-test/post-test for the NA scores, $F(1, 68) = 53.86, p < .001$, and EES scores, $F(1,68) = 54.35, p < .001$. For both, mood improved (scores increased for EES; decreased for NA) from pre-test to post-test, indicating that nature contact improved mood, regardless of duration. The analysis of PA scores indicated no significant effects for positive affect. No significant effects of duration were observed for any of the analyses.

The null hypothesis that duration of nature exposure did not influence mood ratings is theoretically meaningful in this study, so we conducted a Bayesian t -test (Rouder, Speckman, Sun, Morey, & Iverson, 2009) to assess the odds favouring support towards the null hypothesis. The Bayesian factor (B_{01}) allows researchers to express preference towards the null hypothesis or the alternative. Using the online calculator provided by Rouder et al. (2009), and the recommended JSZ prior, $B_{01} = 3.18$ ($t = 0.757$) for Negative Affect, and 3.26 ($t = 0.719$) for EES. These values indicate that the null hypothesis (i.e., no effect of duration of nature exposure) were approximately three times that of the alternative hypothesis (i.e., that duration influence mood effects).

Table 1
PANAS mean scores.

Scale	Pre-test		Post-test	
	Mean	s.d.	Mean	s.d.
PA	2.69	.705	2.80	.915
NA	1.52	.535	1.22	.394
EES	2.53	.751	3.09	.902

Note: PA= Positive Affect; NA= Negative Affect; EES= Elevating Experience Scale

Means for the pre-test and post-test DASS-21 subscale scores are shown in Table 2. As a check on the reliability of measurement between the PANAS and the DASS-21, we analyzed the correlation between the post-test scores for ‘sad’ and Depression. The two were significantly positively correlated, $r(70) = 0.572, p < 0.01$.

To assess clinically-relevant negative emotions, we conducted 2 (duration) x 2 (pre-test vs. post-test) ANOVAs of the DASS-21 anxiety, stress, and depression subscale ratings. As for general moods, there were no significant main effects or interactions involving duration. There were, however, significant main effects of pre-test/post-test for all three scores, ($F(1, 68) = 63.12, p < 0.001$ for anxiety; $F(1, 68) = 178.08, p < 0.001$ for stress; $F(1, 68) = 26.26, p < .001$ for depression). In all cases, scores were lower for the post-test than for the pre-test, indicating an improvement in negative emotions.

Table 2
DASS-21 mean scores.

Scale	Pre-Test		Post-test	
	Mean	s.d.	Mean	s.d.
Anxiety	.806	.582	.373	.378
Stress	.961	.494	.392	.399
Depression	.382	.396	.173	.273

Using the online calculator provided by Rouder et al. (2009), and the recommended JSZ prior, $B_{01} = 3.98$ ($t = 0.224$) for Anxiety, 3.90 ($t = 0.311$) for Depression, and 3.98 ($t = 0.255$) for Stress, indicating that the null hypothesis (i.e., no effect of duration of exposure) were approximately four times that of the alternative hypothesis (i.e., that duration influence negative emotions).

Discussion

The current study was conducted to determine whether the duration of nature exposure influences immediate moods in a dose-response fashion to respond to Sandifer et al.’s (2015) call

for further research on this question. We observed no significant difference in mood effects between 5 and 15 minutes of nature exposure. Mood improvements, for both general (i.e., PANAS/EES) and clinical moods (i.e., DASS-21), were found across both conditions indicating that short exposures to nature provide statistically the same amount of mood improvement as do exposures three times as long. On the basis of this evidence, we conclude that the emotional benefits of nature exposure are not sensitive to duration, but rather occur immediately and do not increase across time, at least for intervals under an hour in length.

This finding has significant implications for both research and practical mood regulation strategies. The most obvious implication of this finding is the ability to use nature to self-regulate one's mood. Being aware of the significant effects nature exposure has on one's mood and the short period of time required to benefit from the exposure, people can utilize nature contact for mood improvement, more easily facilitating well-being. The results also have significant implications for urban design. Knowing how important nature is in mood regulation, city planners can now better utilize green spaces within urban settings; maximizing the number of green spaces and the size of green spaces to be as effective as possible to support the well-being of citizens. As Li, Deal, Zhou, Slavenas, and Sullivan (2018) found, the average contact with nature for adolescents is usually within their own neighbourhoods. Only occasionally visiting greenspaces outside of their neighbourhood. Adolescence is a time of great psychological and physiological change, and with that comes changes in mood. Knowing this and the findings from Li et al. (2018) urban design can better facilitate nature exposure for all by maximizing its availability from neighbourhood to neighbourhood. Architects can also take this into account when designing buildings. Homeowners can utilize these findings in the interior design of their

home. By maximizing views of nature, as well as the number of plants within the home, they are able to benefit from the effects of nature.

The current findings can also facilitate future research. The short amount of time required (i.e., 5 minutes) to see significant mood improvement from nature exposure, makes further research easier to perform. Thus, for instance, the other aspects of Sandifer et al.'s (2015) dose-response elements can be examined using short exposure times while manipulating types of nature contact (e.g., outdoor, window views, and pictorial nature conditions) or the frequency of nature contact.

Although the short exposure durations provide potential benefits to research and practical applications, they also limit conclusions about the influence of duration on mood benefits. Short exposure durations were selected as a first test of the existence of dose-response effects within a single study. However, having shown that duration at these levels does not influence emotional change, further study is needed to investigate whether exposure at different time levels, such as minutes versus hours, does influence the magnitude of benefit. Longer exposure times, for instance, may influence the duration of mood benefits even if they do not result in larger mood changes.

Sandifer et al. (2015) suggest that dose-response relationships also include the components of frequency and intensity, which in this context refers to the directness of nature contact such as through pictures versus actual outdoor experience. The results of several studies indicate that the intensity component influences emotional benefits, with actual contact showing greater benefits than pictorial contact (e.g., Brooks et al., 2017; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; McMahan & Estes, 2015). As with duration, however, the frequency component has received little research, and is another important avenue of future research.

In conclusion, the current study has demonstrated that short exposures to nature (i.e., 5 minutes) achieve the same degree of mood improvement as do longer exposures (i.e., 15 minutes). We observed significant mood improvement from pre-test to post-test for NA, EES, Depression, Anxiety, and Stress. These findings provide valuable insight into the effect of nature exposure on mood, specifically within a university sample. Given previous findings, age does not limit the benefits of nature contact (e.g., Nisbet et al., 2011), but university students consistently display higher levels of depression, anxiety, stress, and suicidal ideation than the general public (Beiter et al., 2015; Rotenstein et al., 2016), so it is of utmost importance to develop attainable and effective means of mood regulation. Nature contact is clearly one such means. Researchers are beginning to investigate the mechanisms of nature exposure (e.g., Kuo, 2015; Markevych et al., 2017), but even without such explanatory models, the evidence provided by the results of the current study enables individuals and clinical practitioners to develop strategies to utilize nature for mood regulation at an optimal level.

References

- Barton, J., Pretty, J. (2010). What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Interdisciplinary Centre for Environment and Society*, 44, 3947-3955. doi: 10.1021/es903183r
- Beiter, R., Nash, R., McGrady, M., Rhoades, D., Linscomb, M., Clarahan, M., & Sammut, S. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *Journal of Affective Disorders*. 90-96. doi: 10.1016/j.jad.2014.10.054
- Berman, M. G., Jonides, J., & Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological Science*, 19, 1207-1212. doi: 10.1111/j.14679280.2008.02225.x
- Brooks, A. M., Ottley, K. M., Arbuthnott, K. D., Sevigny, P. (2017). Nature-related mood effects: Season and type of nature contact. *Journal of Environmental Psychology*, 54, 91-102. doi: 10.1016/j.jenvp.2017.10.004
- Carrus, G., Scopelliti, M., Laforteza, R., Colangelo, G., Ferrini, F., Salbitano, F., Agrimi, M., Portoghesi, L., Semenzato, P., Sanesi, G. (2015). Go greener, feel better? The positive effects of biodiversity on the well-being of individuals visiting urban and peri-urban green areas. *Landscape and Urban Planning*. 134, 221-228. doi: 10.1016/j.landurbplan.2014.10.022
- Cole, D. N., & Hall, T. E. (2010). Experiencing the restorative components of wilderness environments: does congestion interfere and does length of exposure matter? *Environment and Behaviour*. 42(6), 806-823. doi: 8443/10.1177/0013916509347248
- Cracknell, D., White, M. P., Pahl, S., Nichols, W. J., & Depledge, M. H. (2016). Marine biota and psychological well-being: A preliminary examination of dose-response effects in an

- aquarium setting. *Environment & Behavior*, 48(10), 1242-1269. doi:
2048/10.1177/0013916515597512
- Dallimer, M., Irvine, K. N., Skinner, A. M. J., Davies, Z. G., Rouquette, J. R., Maltby, L. L., . . .
Gaston, K. J. (2012). Biodiversity and the feel-good factor: Understanding associations
between self-reported human well-being and species richness. *Bioscience*, 62(1), 47-55.
doi: 2048/10.1525/bio.2011.61.10.10
- Donovan, G. H., Butry, D. T., Michael, Y. L., Prestemon, J. P., Liebhold, A. M., Gatzliolis, D.,
& Mau, M. Y. (2013). The relationship between trees and human health: evidence for
the spread of emerald ash borer. *American Journal of Preventative Medicine*, 44(2), 139-
145. doi:10.1016/j.amepre.2012.09.066
- Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., Gaston, K. J. (2007).
Psychological benefits of greenspace increase with biodiversity. *Biology Letters*, 3, 390-
394. doi: 10.1098/rsbl.2007.0149
- Henry, J. D., & Crawford, J. R. (2005). The short-form version of the depression
anxiety stress scales (DASS-21): Construct validity and normative data in a large non-
clinical sample. *British Journal of Clinical Psychology*, 44, 227-239. doi:
10.1348/014466505x29657
- Herzog, R., Maguire, C. P., Nebel, M. B. (2003). Assessing the restorative components of
environments. *Journal of Environmental Psychology*, 23, 159-170. doi: 10.1016/S0272-
4944(02)00113-5
- Howell, A. J., Dopko, R. L., Passmore, H., Buro, K. (2011). Nature connectedness: Associations
with well-being and mindfulness. *Personality and Individual Differences*, 51, 166-171.
doi: 10.1016/j.paid.2011.03.037

- Huta, V. & Ryan, R.M. (2010). Pursuing pleasure or virtue: The differential and overlapping well-being benefits of hedonic and eudaimonic motives. *Journal of Happiness Studies*, 11, 735-762.
doi: 10.1007/s10902-009-9171-4
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15, 169-182.
doi: 10.1016/0272-4944(95)90001-2
- Kaplan, S., & Kaplan, R. (1989). *The experience of nature: A psychological perspective*. New York: *Cambridge University Press*. Retrieved from <http://willsull.net/resources/270-Readings/ExpNature1to5.pdf>
- Kuo, M. (2015). How might contact with nature promote human health? Promising mechanisms and a possible central pathway. *Frontiers in Psychology*, 6, 1093. doi: 10.3389/psyg.2015.01093
- Li, D., Deal, B., Zhou, X., Slavenas, M., & Sullivan, W. C. (2018). Moving beyond the neighborhood: daily exposure to nature and adolescents. *Landscape and Urban Planning*, 173, 33-43. doi:10.1016/j.landurbplan.2018.01.009
- Lovibond, P.F., & Lovibond, S.H. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, 33, 335-343.
doi: 10.1016/0005-7967(94)00075-U
- Markevych, I., Schoierer, J., Hartig, T., Chudnovsky, A., Hystad, P., Dzhambov, A.M., de Vries, S., Triguero-Mas, M., Brauer, M., Nieuwenhuijsen, M.J., Lupp, G., Richardson, E.A., Astell-Burt, T., Dimitrova, D., Feng, X., Sadeh, M., Standl, M., Heinrich, J., Fuertes, E.

- (2017). Exploring pathways linking greenspace to health: Theoretical and methodological guidance. *Environmental Research*, 158, 301–317. doi: 10.1016/j.envres.2017.06.028
- Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why is nature beneficial? The role of connectedness to nature. *Environment and Behavior*, 41, 607-643. doi: 10.1177/0013916508319745
- McMahan, E. A., & Estes, D. (2015). The effect of contact with natural environments on positive and negative affect: A meta-analysis. *Journal of Positive Psychology*, 10, 507-519. doi: 10.1080/17439760.2014.994224
- Nisbet, E.K., Zelenski, J.M. & Murphy, S.A. (2011). Happiness is in our nature: exploring nature relatedness as a contributor to subjective well-being. *J Happiness Stud*, 12, 303-322. doi: 8443/10.1007/s10902-010-9197-7
- Rotenstein, L. S., Ramos M. A., Torre M., Segal, B. J., Peluso, M. J., Guile, C., Sen, S., & Mata, D. A. (2016). Prevalence of depression, depressive symptoms, and suicidal ideation among medical students: a systematic review and meta-analysis. *JAMA*. (21) 2214–2236. doi: 10.1001/jama.2016.17324
- Rouder, J. N., Speckman, P. L., Sun, D., Morey, R.D., & Iverson, G. (2009). Bayesian *t* tests for accepting and rejecting the null hypothesis. *Psychonomic Bulletin & Review*, 16, 225-237. doi: 10.3758/PBR.16.2.225
- Sandifer, P. A., Sutton-Grier, A. E., Ward, B. P. (2015). Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: opportunities to enhance health and biodiversity conservation. *Ecosystem Services*, 12, 1-15. doi: 10.1016/j.ecoser.2014.12.007
- Ulrich, R. S. (1984). View through a window may influence recovery from surgery.

- Science*, 224, 125-133. Retrieved from
<http://www.jstor.org/stable/pdf/1692984.pdf>
- Ulrich, R. S., Simons, R. S., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11, 201-230. doi: 10.1016/S0272-4944(05)80184-7
- de Vries, S., Verheij, R. A., Groenewegen, P. P., & Spreeuwenberg, P. (2003). Natural environments - healthy environments? An exploratory analysis of the relationship between greenspace and health. *Environment and Planning A*, 35, 1717-1731. doi: 10.1068/a35111
- Watson, D., Clark, L.A., & Tellegen, A. (1988). Development and validation of the brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063-1070. doi: 10.1037//0022-3514.54.6.1063
- Wilson, E. O. (1993). Biophilia and the conservation ethic. In S. Kellert & E. O. Wilson (Eds.), *The biophilia hypothesis* (pp. 31-41). Retrieved from
<https://books.google.ca/books?hl=en&lr=&id=GAO8BwAAQBAJ&oi=fnd&pg=PP6&dq=the+biophilia+hypothesis&ots=plo8IDBVuY&sig=c26qu3nrYXjVqHYXqB0nJf2RoEA#v=onepage&q&f=false>
- White, M., Pahl, S., Ashbullby, K., Herbert, S., Depledge, M. (2013). Feelings of restoration from recent nature visits. *Journal of Environmental Psychology*, 35, 40-51. doi: 10.1016/j.jenvp.2013.04.002

Appendix A



***Research Ethics Board
Certificate of Approval***

PRINCIPAL INVESTIGATOR
Neill Calum

DEPARTMENT
Psychology

REB#
2017-138

SUPERVISOR:
Dr. Katherine Arbuthnott

TITLE
Nature and Mood

APPROVED ON:
September 17, 2017

RENEWAL DATE:
September 17, 2018

APPROVAL OF:
Application for Behavioural Research Ethics Review, Experimental Management System Description, Debriefing Form, Emotional Experience Form, and Participant Consent Form.

Full Board Meeting

Delegated Review

The University of Regina Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol, consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS

In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: <http://www.uregina.ca/research/for-faculty-staff/ethics-compliance/human/forms1/ethics-forms.html>.

Laurie Clune, PhD
Chair, Research Ethics Board

Please send all correspondence to:

Research Office
University of Regina
Research and Innovation Centre 109
Regina, SK S4S 0A2
Telephone: (306) 585-4775 Fax: (306) 585-4893
research.ethics@uregina.ca

Appendix B

Participant Consent Form

Project Title: Nature & Mood

Researcher(s): Calum Neill, University of Regina, 306-551-9090, neill20c@uregina.ca
Katherine Arbuthnott, Campion College, 306-359-1239, katherine.arbuthnott@uregina.ca

Purpose(s) and Objective(s) of the Research:

- The purpose of this research is to examine the effect of exposure to nature on a range of moods.
- The results of the studies will be used for student theses, articles in professional journals, and professional conference presentations.

Procedures:

- Participants will first rate their initial mood using adjective lists then move to a particular setting, where they will be asked to focus on their environment for a few minutes. Following this, they will return to the lab and complete the mood rating lists once again.
- Your responses will be identified using only a participant number.
- The study will take less than 1 hour to complete.
- Please feel free to ask any questions regarding the procedures and goals of the study or your role.

Potential Risks:

- There are no known or anticipated risks to you associated with participating in this research

Potential Benefits:

- This research will enable us to better understand how exposure to nature affects one's mood.
- For you, participation in this study will provide a brief period of respite from the usual demands of your day.

Compensation:

- As thanks for your participation, you will receive 1 bonus credit in a psychology class.

Confidentiality:

- Your responses will be coded using only a participant number.
- As a result of this coding, once you leave the lab, your responses will not be identifiable as yours.
- Completed consent forms and mood ratings will be stored separately in locked filing cabinets in Dr. Arbuthnott's lab and office, respectively. The data will also be entered into a computer database, again coded only using participant numbers.

Storage of Data:

- Hard copies of the consent forms and mood ratings will be kept in the locked filing cabinets for 5 years (CPA regulations), and will then be shredded.

Right to Withdraw:

- Your participation is voluntary and you can answer only those questions that you are comfortable with. You may withdraw from the research project for any reason, at any time without explanation or penalty of any sort. You will receive a bonus credit as long as you complete the consent procedure and receive a debriefing form.

- Whether you choose to participate or not will have no effect on your class standing or how you will be treated. Your professor will never know which studies you participated in and will not be informed whether you have participated in any studies until the end of the term.
- Should you wish to withdraw, just let the researcher know, and all data that you have completed prior to that time will be shredded. Once you leave the lab, we will not be able to identify your data, as it will be coded using only a participant number, and so your data cannot be withdrawn after you leave.

Follow up: To obtain results from the study, please contact the researcher at Katherine.arbuthnott@uregina.ca after the end of the Winter 2018 term.

Questions or Concerns:

- Contact the researcher using the information at the top of page 1 or on the Debriefing form
- This project has been approved on ethical grounds by the UofR Research Ethics Board on Sept. 17, 2017. Any questions regarding your rights as a participant may be addressed to the committee at (306-585-4775 or research.ethics@uregina.ca). Out of town participants may call collect.

Consent:

Your signature below indicates that you have read and understand the description provided; I have had an opportunity to ask questions and my/our questions have been answered. I consent to participate in the research project. A copy of this Consent Form has been given to me for my records.

<i>Name of Participant</i>	<i>Signature</i>	<i>Date</i>
<i>Researcher's Signature</i>	<i>Date</i>	

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix C

Emotional Experience

For each of the statements below, please circle the number which best indicates how much the statement applies to you RIGHT NOW. There are no right or wrong answers. Do not spend too much time on any one statement.

	<i>Does not apply to me at all</i>	<i>Applies to some degree</i>	<i>Applies to a considerable degree</i>	<i>Applies to me very much</i>
1. I feel that I am using a lot of nervous energy.	0-----	1-----	2-----	3-----
2. I am aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).	0-----	1-----	2-----	3-----
3. I feel downhearted and blue.	0-----	1-----	2-----	3-----
4. I experience trembling (e.g., in the hands).	0-----	1-----	2-----	3-----
5. I find it difficult to work up the initiative to do things.	0-----	1-----	2-----	3-----
6. I find it hard to wind down.	0-----	1-----	2-----	3-----
7. I feel that I had nothing to look forward to.	0-----	1-----	2-----	3-----
8. I find it difficult to relax.	0-----	1-----	2-----	3-----
9. I feel close to panic.	0-----	1-----	2-----	3-----
10. I feel that life is meaningless.	0-----	1-----	2-----	3-----
11. I am unable to become enthusiastic about anything.	0-----	1-----	2-----	3-----
12. I tend to over-react to situations.	0-----	1-----	2-----	3-----
13. I experience breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).	0-----	1-----	2-----	3-----
14. I can't seem to experience any positive feeling at all.	0-----	1-----	2-----	3-----
15. I feel scared without any good reason.	0-----	1-----	2-----	3-----
16. I find myself getting agitated.	0-----	1-----	2-----	3-----

17. I am worried about situations in which I
might panic and make a fool of myself. 0-----1-----2-----3
18. I feel that I am rather touchy. 0-----1-----2-----3
19. I feel I'm not worth much as a person. 0-----1-----2-----3
20. I am aware of dryness of my mouth. 0-----1-----2-----3
21. I am intolerant of anything that keeps me from
getting on with what I am doing. 0-----1-----2-----3

Mood Scale

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way RIGHT NOW. Use the following scale to record your answers.

1-----2-----3-----4-----5
very slightly a little moderately or not at all quite a bit extremely

- | | |
|------------------|----------------|
| ___ interested | ___ irritable |
| ___ distressed | ___ alert |
| ___ excited | ___ ashamed |
| ___ upset | ___ inspired |
| ___ strong | ___ nervous |
| ___ guilty | ___ determined |
| ___ scared | ___ attentive |
| ___ hostile | ___ jittery |
| ___ enthusiastic | ___ active |
| ___ proud | ___ afraid |
| ___ fascinated | ___ in awe |
| ___ curious | ___ sad |
| ___ relaxed | ___ joyful |
| ___ grateful | ___ enriched |
| ___ elevated | ___ energized |

Appendix D

DEBRIEFING FORM

Title: Nature & Mood

Researchers: Calum Neill & Katherine Arbuthnott
(Katherine.arbuthnott@uregina.ca)

The purpose of this research was to determine whether the duration of exposure to nature affects mood. Previous research (e.g., Cole & Hall, 2010), including studies in our lab, has found that people report more positive feelings in outdoor than indoor locations, but little previous research has examined whether the amount of contact time influences this effect. Half of you were asked to sit quietly and focus on a natural setting for 5 minutes, and half of you focused for 15 minutes. All of you rated your moods both before and after the nature exposure. By comparing your mood ratings of pre- and post-exposure we will be able to determine whether or not moods were affected differently by the different amounts of time.

This study will be running throughout the next term, so we request that you do not discuss the details of this study with your classmates. Prior knowledge of the details and purposes of the study could influence future participants' responses in ways that do not reflect their actual experiences (i.e., demand characteristics).

Thank you for your participation in this study. If you have any questions or comments, please contact katherine.arbuthnott@uregina.ca. If you are interested in the results of this study, please contact me at the end of term, and I will give you a summary of the study and its results.

If the experiences of this study (e.g., reflection, answering the mood questionnaires) have drawn your attention to distressed feelings that you would like help with, please contact the U of R Counselling Services at www.uregina.ca/student/counselling/. At that site you can schedule an appointment on line. Counselling Services offer personal and group counselling for students experiencing problems, and emergency counselling if you need immediate aid. Alternatively you could contact Dr. Arbuthnott (Katherine.arbuthnott@uregina.ca; 306-359-1220) to discuss your options for assistance.

Cole, D.E., & Hall, T. (2010). Experiencing the restorative components of wilderness environments: Does congestion interfere and does length of exposure matter? *Environment and Behaviour*, 42, 806-823. doi: 10.1177/0013916509347248