

**The Nature of Stress:**  
**Outcomes of Nature Walks in Skidmore's North**  
**Woods in Relation to Student Mental Health**  
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May 4, 2015

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**Abstract:**

*There is a high incidence of stress and anxiety in young adults throughout the world, and a number of factors contribute to particularly high stress levels among college-aged students. A number of tangible initiatives have been taken across college campuses to promote mental health; however, few utilize the natural environment in these efforts. There is, however, growing research supporting the positive effects of interaction with the natural environment on stress, happiness, and other indicators of good mental health and cognitive functioning. This study investigates the effects of three weekly nature walks on a group of students at Skidmore College. This mixed methods research includes a quantitative analysis of happiness and other mental health indicators through post-walk surveys, and a qualitative analysis through coded weekly blog posts by the participants. Our study found that stress levels in participants decreased immediately following each nature walk, however did not show significant long term changes in baseline stress levels, nor positive and negative affect, over the course of the three week period. Our findings can be used to inform future studies on the relationship between nature walks and mental health, and to inspire the modern movement towards nature based healing, leadership, and college pre-orientation programming.*

**Key Words:**

*Stress, happiness, college students, nature, group walks, mixed methods research*

**Introduction:**

A large number of college students and young adults suffer from high levels of stress, leading to illnesses such as anxiety disorders and depression (AHCA, 2010). While Skidmore College offers eight free counselling sessions to its students, this number may not be sufficient for students who need continual care. One quarter of the students surveyed in the most recent National College Health Assessment (2010) reported that stress has hurt their academic performance, with impacts including lower grades and dropped courses. Stress can have negative effects on almost every aspect of a college student's life, including but not limited to, eating disorders, depression, alcohol and drug abuse, and suicide.

Due to increasing recognition of the high levels of stress and depression among young adults, college students are given a variety of mechanisms to deal with these stressors-- ranging from counseling services, to stress balls, to sleep recommendations and even prescription

medication. However, there has only recently been a shift of attention to the positive impacts of spending time outdoors on stress levels. A recent breakthrough study by Marselle, Irvine, and Warber (2014) found that group walks are in fact associated with significantly lower rates of depression, perceived stress, and negative affect, as well as lead to an enhanced positive affect and mental well-being. Time spent in nature has the potential to restore directed-attention mechanisms (Berman, 2008), help veterans find relief from PTSD (Caddick, 2014), increase personal vitality (Ryan, 2010), and could be a gateway to happiness and environmental sustainability (Zelenski, 2014). A study by Mitchell (2013) found that each additional use of the natural environment per week is associated with about a 6% lower risk of poor mental health. Nature walks have the potential to positively impact stressed students and stressed people in general. However, there is a lack of scholarly research surrounding this topic. With the strong presence of stress, anxiety, and depression on college campuses, the need for further research is important. Our capstone research undertakes a study of the outcomes of nature walks on college students, and, thus, fills this gap in the existing research.

Our study looks specifically at the effects of weekly nature walks on a treatment group of college students. Respondents completed well established quantitative emotional surveys before and after these walks to explore any changes in stress and/or happiness indicators. Long-term effects of group nature walks on personal well-being and stress levels were also measured by online weekly journal entries, as well as written surveys that tracked consistent changes over time. The research questions guiding this effort include:

### **Research Questions:**

1. What effect do nature walks have on mental health indicators, specifically stress levels and positive and negative affect?
2. What are the short-term vs. long-term outcomes of nature walks on participants?
3. Will student demographics affect change in stress levels?

### **Hypotheses:**

- Weekly nature walks will lead to decreased perceived stress levels in participants at the end of the study period
- Positive affect of participants will increase over the three week study period
- Negative affect of participants will decrease over the three week study period
- There will be a significant decrease in presence of stress indicators exhibited by each participant directly after each walk, as well as across the entire study period
- Participants with higher perceived stress scores at the beginning of the study will have greater changes in stress levels than participants with lower perceived stress scores

### **Literature Review**

#### ***1. Stress in College Students:***

In 2010 the American College Health Association published the National College Health Assessment (NCHA). The NCHA is a survey meant to help college health service providers, educators, counselors, and more in the understanding of their students. It is a resource that promotes positive mental health through data collection in the form of surveys. The survey touches upon nine major topics: general perceptions of health, disease and injury perception,

academic impacts, violence, abusive relationships and personal safety, alcohol, tobacco and other drug use, sexual behavior, nutrition and exercise, mental health, and sleep. Their findings were startling and present the issue of mental health as one that is dramatically underaddressed in our nation. The most telling findings showed that in 2010 around 43% of students felt things were hopeless, 84% felt overwhelmed by everything they had to do, 78% felt exhausted for no reason, 54% felt very lonely, 58% felt very sad, 8% felt so depressed it was difficult to function, 46% felt overwhelming anxiety, 38% felt overwhelming anger, 6% considered suicide, 1% highly considered suicide, and 5% intentionally cut, bruised, or injured themselves (American College Health Association, 2010). The NCHA suggests that mental health on College campuses is a serious issue that needs attention.

Further studies show that the mental health of college students can be directly impacted by factors such as time-management capabilities and the resulting increase of stress and impact on quality of academic work. Macan, Shahani, Dipboye, & Phillips (1990) found that time-management capabilities have effects on levels of stress as well as academic success; moreover, students who had perceived control of their time reported much higher levels of success for everything from school work to overall satisfaction.

In addition to time-management, Heckert, Niebling, & Ross (1999, p 1), conducted a quantitative study on the various sources of stress among college students, “The scale consisted of 40 potential stressful situations. The scale addressed interpersonal, academic, and environmental sources of stress.” The results of the study show that the second highest stressor for college students was environmental, in other words, based on location and setting. Moreover, their results highlight some of “the necessary components of a stress management program

specific to the needs of college students” (Heckert et al, 1999, p 5). Authors stated that with the understanding that a college student’s environment may be one of the highest stressors present in their lives, the obvious next step is to explore the possibilities of a stress management program that deals with this specifically. The study concludes that colleges could incorporate stress management training in orientation activities for freshmen as a solution.

It is increasingly apparent that stressors affect different groups differently. College students can be broken up by race, class, gender, sexual orientation, etc. The primary stressors for each of these groups are likely to be different. For example, Misra & McKean (2000) found that “Females had more effective time management behaviors than males, but also experience higher academic stress and anxiety. Males benefited more than females from leisure activities. Freshmen and sophomore students had higher reactions to stress than juniors and seniors” (Misra & McKean, 2000, p 1). Therefore, stress management programs may have to be targeted at different groups specifically. The stress reduction methods outlined in this study should be applied, as “Methods to reduce stress by students often include effective time management, social support, positive reappraisal, and the engagement in leisure pursuits” (Misra & McKean, 2000, p 1).

The importance of mitigating stress lies partly in its negative tendency to lead to psychological and physical problems at a later point in time. What can be viewed as day-to-day stressors, things such as “identity development, relationships, sexuality, roommate problems, academic pressures, extracurricular demands, parental expectations, and racial and cultural differences that effect self-worth” actually lead to common yet serious issues such as “depression, sleep disorders, substance abuse, anxiety disorders, eating disorders, impulsive

behaviors, and suicide” (Kadison & DiGeronimo, 2004, p 1). The importance of stress mitigation programs is highlighted by the authors and include exercise, diet, etc. By helping college students who are suffering from excess stress, the likelihood of the manifestation of such conditions mentioned above may be significantly reduced.

## **2. *Effects of nature on mental health and happiness:***

A growing area of interest in Environmental Science and Psychology research is the effects of nature on mental health and happiness. This research has gained popularity in the mid-to-late 2000s, with a diverse array of studies looking to find relationships between time spent in the natural environment and a variety of signifiers of good mental health.

Dr. William Bird, a Strategic Health Advisor to Natural England and a General Practitioner in Reading, UK, compiled a report reviewing evidence linking biodiverse areas and green spaces with mental health-- seeing that this correlation was accepted and integrated into past cultures, yet is changing, and thus in need of scientific backing (2007). In this report, Bird outlines mental health, and the three major theories linking mental health to the environment: Biophilia, the instinctive bond between human beings and other living systems, Attention Restoration Theory, the belief that people can concentrate better after spending time in nature, and Psycho-Physiological Stress Recovery Theory, the theory that explains how physical setting can play a role when dealing with stress. His report shows that contact with the natural environment does offer mental health benefits for the individual and has a positive effect on the communities as well, giving the natural environment a quantifiable value for health (Bird, 2007). He backs this up through his analysis of studies on the correlation of time spent in the natural



environment and the presence of discipline issues and ADHD in children and teenagers; poverty, crime, and aggression; the elderly population; and hospitals (Bird, 2007). Bird found there was a significant decrease in children's ADHD symptoms that played for a week in green spaces, as opposed to those who played indoors. Bird also found that time spent in the outdoors can reduce violent behavior in fact mothers who lived in homes in view of grass or trees showed less violent and aggressive tendencies; elderly individuals showed improved concentration after interacting with nature, and those suffering from dementia showed increased coherence and reduced aggression and agitation; and that hospital patients responded faster to treatments if interacting with, or even just seeing from their window, natural green space.

Wells & Evans (2003) look further at the potential of nature to act as a buffer for children from life's stress and adversity, particularly for 377 grade school children living in rural upstate New York. They collected data through parent-reported measures of their child's psychological distress, and the child's personal rating of self-worth (surveys that included a quantitative measure of levels of nearby nature, frequency of stressful events, and feeling of self-worth) to quantitatively examine the ability of vegetation near the child's residence to moderate/buffer the effects on the child's psychological well-being amidst stressful life events, finding that children with higher levels of nearby nature were less impacted by life stressors (Wells & Evans 2003). "Nearby nature" in this study refers to the amount of nature, as opposed to concrete, visible from the individual's kitchen and living room; the amount of plants in their living room; and the material of the individual's yard (grass, dirt, or concrete) (Well & Evans 2003).

Researchers have found evidence that visual impressions of nature as compared with urban environments aid in recovery after psychological stress, and have started to study the

possibilities of auditory stimulation having similar effects. Albarsson (2010) designed an experiment where the participant would be exposed to nature sounds and then noisy environment sounds after completing a stressful mathematical task. The recovery to normal Skin Conductance Levels was faster during the natural sounds than the noisy sounds, suggesting that nature sounds do facilitate the recovery from one's sympathetic activation after a stressful event.

Nature has also been linked with high vitality, the state of feeling strong and active. Ryan (2010) found that a combination of outdoor environments, physical activity and social connections would be linked with high vitality. By analyzing five studies, they looked at a variety of ways to link nature with vitality. The first study looked at 171 undergraduate students' reactions to pretend situations in terms of social, physical, and outdoor (as opposed to indoor) situations. Studies two and three (n=80 and 97 undergraduate students, respectively) dealt with actual nature versus indoor situations where nature again was found to be more vitalizing than indoor situations. Studies four (n=138 students) and five (n= 51 students) were diary based, with study five using more intensive daily sampling in relation to the subject of vitality, more sensitive measures of social and physical activity, and a more sensitive measure of the presence of nature. The students believed that outdoors would promote vitalization more than indoors and also experienced and wrote in journals about the vitalizing effects.

### ***3. Effects of Nature on Cognitive Functioning and Overall Vitality:***

There are cognitive benefits associated with nature experiences, as the interaction of nature with the brain starts positive psychological and physiological reactions (Mitchell, 2013). Berman (2008) used attention restoration theory to look at what settings can improve attention.

This theory explains that environments with “inherently fascinating stimuli” like sunsets turn on involuntary attention modestly that allows directed attention to replenish. Urban environments grab attention dramatically and require direct attention to avoid danger (like cars), making urban settings less restorative. The researchers were confident that directed-attention mechanism were restored by interactions with nature.

Hartig, Mang & Evans (1991) carried out two distinct studies to analyze the differences between natural environments, urban environments, and passive relaxation conditions in affective states, cognitive performance, and physiological measures. Both studies found that restorative effects were greater after experiences taking place in natural settings as opposed to the other two settings (Hartig, Mang & Evans, 1991).

Kaplan (1995) focused on the ability of our minds to replenish top down cognitive functioning, and how nature, as opposed to urban environments, might replenish this functioning in different ways. Kaplan found that nature will restore directed attention abilities (an indicator of cognitive functioning) greater than will urban environments, thus suggesting a resulting decrease in the individual’s experience with stress.

Research by Weinstein (2009) has shown that people may enjoy benefits from their efforts to interact with nature, such as greater well-being, physical health, relaxation, and reduce stress. There is also the question of immersion, and if people immersed in nature feel like they are completely present instead of distracted, and able to reap more benefits. Weinstein’s (2009) experiment examined the hypothesis that immersion in nature would increase valuing of intrinsic aspirations and decrease valuing of extrinsic aspirations, compared to immersion in non-natural environments. The researchers found results that suggested that nature, which is unrelated to

human intervention, brings individuals closer to others, whereas human-made environments orient goals toward more selfish or self-interested ends (Weinstein, 2009).

#### **4. *Physical Activity, Nature, and Mental Health:***

A recurring question in research regarding activity in nature and its effect on stress levels and overall mental health is whether it is the exposure to nature that is promoting mental health, or simply the experience of exercise. Psychologically, running improves our self-image and self-worth (Ledwidge, 1980). Physiologically, running improves stamina, decreasing your bodies' response to negative physical stimulation (Ledwidge, 1980). The combination of nature and exercise has the potential to be even more beneficial than exercise indoors. Roe (2011) carried out two experiments comparing the restorative effects of walking in urban and rural settings on two groups of adults: one with good and the other with poor mental health. Mental health of the participants was studied through an examination of mood and personal project techniques to show reflection on everyday life tasks. The data showed that rural walks were more advantageous for both groups than urban walks, however this positive change was more drastic in the poor mental health group. Outside exercise proves to promote mental health.

The type of natural environment could also have an impact on results. Less aesthetically pleasing and less convenient environments are correlated with a lower likelihood of taking walks of any motivation. Lack of company to walk with was also correlated with less likelihood of taking walks, especially for women. The effects of these factors on walking habits were the same for individuals with both poor and good mental health (Ball, 2001).

In a water based study, Caddick (2014) looked at the idea of the "blue gym" and at the benefits of being active in natural water environments. The researchers did interviews and

participant observations with combat veterans from the UK as the veterans participated in a surf camp. They found that surfing helped the veterans find relief from PTSD. “Respite was a fully embodied feeling of release from suffering that was cultivated through surfing and shaped by the stories veterans told of their experiences” (Caddick, 2014, p 1). It was concluded that nature-based physical activity can be good for the mental health of veterans.

Mitchell (2013) also looks at the effects of everyday experiences of physical activity in nature, using an analysis of previous health surveys to gather information as opposed to an artificially designed experiment. The data collected suggests an association between the regular use of natural environments, as opposed to non-natural environments, and a lower risk of poor mental health, and that each additional use of a natural environment per week is associated with about a 6% lower risk of poor mental health (Mitchell, 2013). While this report did not take account for the form, quantity, or duration of physical activity in each environment, other studies have done just that.

However perhaps most pertinent to our study are two recent studies published by Marselle, Irvine & Warber (2013, 2014) looking specifically at the quantitative effects of group nature walks on mental health in adults. The first of these studies was a cross-sectional study looking at whether or not different walking settings had different outcomes on mental health. The ten provided environment type categories were natural and semi-natural places, green corridor, farmland, parks and gardens, urban public space, coastal, amenity green space, allotments, community gardens, urban farms, outdoor sports facilities and other. The study found that group walks in farmland were significantly associated with decreased levels of perceived stress and negativity, as well as greater mental well-being, in comparison to group walks in

urban settings. They also found the group walks in green corridors to be significantly associated with less perceived stress and negative affect. Participants were surveyed on mental well-being (Warwick Edinburgh Mental Well-being Scale; 2006), depression (Major Depressive Inventory; 2001), perceived stress (Perceived Stress Scale; Cohen et al., 1983) and emotional well-being (Positive and Negative Affect Scale; Watson et al., 1988). We used the Perceived Stress Scale (PSS) and the Positive and Negative Affect Scale (PANAS) in our study.

Their follow up to this study was a longitudinal study over a 13-week period looking at the effects of group nature walks on well-being. Their findings suggest that group walks in nature are, in fact, associated with lower rates of depression, perceived stress, and negative affect, and even an enhanced positive affect and mental well-being. These nature walks also showed to lessen the effects on the individual of stressful life events. This appears to be the first study looking at the multiple components of well-being from participation in group nature walks at the national scale.

## **5. *Wilderness Therapy:***

The field of wilderness therapy is a relatively recent one. As such, it is an ill-defined field, “Despite a growing number of programs operating in the United States under the guise of ‘wilderness therapy,’ a consistent and accepted definition is lacking” (Russell, 2001, p 70). Through critiquing the current definitions of wilderness therapy their study hopes to create a comprehensive definition that can be used to identify and progress the field. Russell presents a more suitable definition of wilderness therapy. At its base a wilderness therapy program, “Should be therapeutically based, with assumptions made clear and concise, in order to better determine target outcomes and evaluate the effectiveness of the intervention” (Russell, 2001, p

76). Wilderness therapy, as Russell defines it, is an intensive program that includes trip or group leaders and trained therapists. It includes outdoor adventure and personal reflection. This definition of wilderness therapy programs is extremely specific. Not all scholars will mandate that wilderness therapy programs must occur in groups or that there must actually be trained therapists present (Berman et al, 1996).

There are a variety of current wilderness orientation programs that exist in the United States that are affiliated with universities and colleges. Wilderness orientation programs can be distinct from wilderness therapy. However, in some cases the two can be one and the same. Berman et al (1996) examine the programs by looking at the philosophies behind the programs, the program goals, the issues with the programs, and their overall success. Moreover, “Outdoor orientation programs represent a prominent area of experiential education with over 25,000 participants annually. More than 191 outdoor orientation programs currently operate in the United States and Canada” (Berman et al, 2014, p 1). Outdoor orientation programs are argued to help college students with the rough transition into college life. Students who may benefit are those that experience a dramatic increase in stress due to all the changes that college life brings, social, academic, environmental, etc.

As mentioned earlier, the second highest stressor to college students are environmental. Wilderness orientation programs could be a way to ease into these environmental stressors. Going from a house or apartment style living to dorms, going from an urban to a rural setting or vice versa, are some examples of environmental stressors that may be mitigated by wilderness orientation programs. (Berman et al, 2014).

If we view wilderness therapy programs as a legitimate practice of therapy, ethical issues arise. There are key differences between “therapy” and “therapeutic experiences”. Some of these concerns may include consent, confidentiality, and aftercare. The difference between Russell’s (2001) definition of wilderness therapy programs and Berman et al’s (2014) description of wilderness orientation programs could be found in the difference between therapy and therapeutic experiences. Therapy has to be done with trained and certified professionals with specific outcomes, while therapeutic experiences may not have specific outcomes and do not need professional therapists to be facilitated.

### ***Conclusion:***

Human interaction with nature as a means to decrease stress and enhance happiness is therefore an area of study warranting further examination. The high rates of stress and other indicators of poor mental health in college students makes them a demographic that can especially benefit from nature-based interventions. The convincing evidence, as presented in this literature review, of the positive effects of nature interaction on well-being, positive affect, vitality, overall stress levels, stress response capabilities, and other cognitive functioning has provided a groundwork for research in this field, and interventions--such as wilderness therapy and outdoor orientation programs--that draw on these findings. In a similar view, our study will work to better understand the effects of nature on mental health indicators by applying nature-based interventions specifically to a group of stressed college students.

### **Methods:**

#### ***Population and Setting:***



Our research focuses on the student population of Skidmore College. Skidmore College is located in the town of Saratoga Springs in upstate New York. Saratoga Springs is a city with a population of about 28,000 (City of Saratoga Springs, 2014). The population triples in the summer months because of the popular race track. Health, History, Horses is the motto of the city because of the mineral waters, Revolutionary War battlefield, and the nation's oldest thoroughbred racetrack (City of Saratoga Springs, 2014).

Skidmore College is known for "its creative approach to just about everything" (Skidmore College, 2014). Skidmore student enrollment is approximately 2,400 with 41% men and 59% women. Students come from 60 countries and 45 states. Skidmore's student population is made up of 22% domestic students of color, 7% international students, 5% students with dual passports, and 13% first-generation students. Tuition for the 2014-2015 academic year was \$52,476 plus room fees (Skidmore College, 2014).

Our research site is located in Skidmore's North Woods. The North Woods span close to 160 acres, and are maintained as a natural space for the Skidmore community and surrounding community alike. The North Woods are an area where people can connect with nature through meditation, walking, hiking, and running. There are four maintained trails throughout the woods, ranging from 0.8 miles to 2.1 miles in length. The Woods are comprised of Northern Hardwood and Oak-Hickory Forest, holding over 660 species of plants, 33 species of ferns, and a variety of animals including etfs, hawks, turtles, woodpeckers, snakes, toads and frogs (Skidmore College, 2014). The North Woods thus serve as Skidmore's outdoor laboratory, with over 30 courses utilizing the woods for classwork and student-faculty research.

We recruited participants for our study through a variety of methods. We submitted an announcement to the entire school, had department chairs send out an e-mail to the students on their interest lists, and put up colorful flyers around Skidmore's campus. These announcements and flyers did not directly state the motive of our study, rather offered the opportunity to get paid \$20 to participate in three weekly walks in the North Woods and fill out short surveys and journal entries. Around 80 students responded with interest, and the first 30 to respond to our follow up e-mail providing details of the commitment were selected. The original 30 participants decreased to 24 participants over the course of the study due to various reasons such as injury and a family emergency.

The 24 participants in our study came from all class years at Skidmore College, and represented a variety of disciplines. From our preliminary survey, we found that 25% of the participants were First-Years, 33% Sophomores, 25% Juniors, and 17% Seniors. Females made up 63% of group, whereas males were 37%. The 24 participants came from 17 different majors. The most popular was the Environmental Studies major with 5 students, followed by Neuroscience and Government, each with 3. We asked the participants on average how much time they spent in the woods per week, 58% responded that they spend zero hours in the woods, 29% said one to two hours and 13% said three to five hours.

### ***Instrumentation and Data Collection:***

We offered two guided walks each week for a period of three weeks during the month of March. The walks were conducted in snowy weather. The participants were required to attend one each week. The walks were one-hour long in duration, following a combination of the Red, Blue, and Orange trails in Skidmore's North Woods. The length of the trails along the perimeter

is about 2.1 miles. The participants were allowed to talk with one another during the walks; however, instructed to remain quiet, respectful, and stay on the trail, in order to keep it a quiet and mindful walk for those who wished it to be. Each walk was led by just one of our research group members in order to keep our other two researchers as neutral as possible for the later facilitation of the focus groups. The average size of our nature walks was 13 people. The average length of our nature walks was 57 minutes.

#### *Qualitative Data Collection:*

Three main methods of data collection were used in our study in order to ensure data triangulation (Silverman, 2006). These mixed methods combined both quantitative and qualitative measures. For the qualitative data components, our participants filled out short weekly prompted journals in the form of an anonymous online Qualtrics journal entry. We emailed the participants midweek with a link to the Qualtrics survey form. The journal prompt after both the first and second walk stated:

Please write about how your walk in the North Woods impacted the rest of your week. How did you feel while you were on your walk? Did you notice any changes before and / or after the walk? Please also include any other thoughts you want to share about your experience.

The journal prompt after the third walk stated:

How did you feel about the nature walks? Favorite part, Least favorite part? What did you get out of this experience? Do you have any altered perceptions that you would attribute to your time in the woods or the reflections? Do you think that you are likely to continue to take walks in nature?

On the Wednesday following the final walk, 6 participants met with the two researchers who did not conduct the nature walks in a library room for a 1.5 hour long focus group. The

focus group was digitally recorded. The focus group findings were used to further qualitatively validate the data collected in our online journal entries and quantitative surveys.

#### *Quantitative Data Collection:*

For our quantitative data collection, we administered two separate surveys at the beginning of the first walk of the three-week period, and again at the end of the third walk of the three week period. These two surveys included: the Perceived Stress Scale (PSS: Cohen, 1983, Appendix 1) and the Positive and Negative Affect Scales (PANAS: Watson, Clark, and Tellegen, 1988, Appendix 2), which measures positive and negative affect of the participants, and in effect “authentic happiness.” The PSS had questions such as “In the last month, how often have you felt that you were unable to control the important things in your life?” and “In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?” with a scale from 0 to 4. The PANAS Questionnaire has a list of 20 words and asks the participants to rate them based on how they were feeling in the moment on a scale from 1 being very slightly or not at all to 5 being extremely. The list of words included alter, upset, determined, and interested.

We also created our own short survey (Appendix 3) measuring stress indicators--drawing on sample questions from the *State-Trait Anxiety Inventory* (STAI, Spielberger, 1983)--that we administered at the beginning and end of each our weekly nature walks. We felt that making our own survey using inspiration from previously established ones would allow us to measure the specific stress indicators we were looking to study and analyze in relation to the nature walks. We named this survey the JLO Stress Scale. All of our surveys were administered to the

participants in Falstaff's--a community-gathering space on Skidmore's campus--before and/or after their respective walks. Participants did not provide their names on each survey; however, the forms were coded numerically so that changes over time in each respondent could be anonymously tracked.

Figure 1. Surveys Distribution

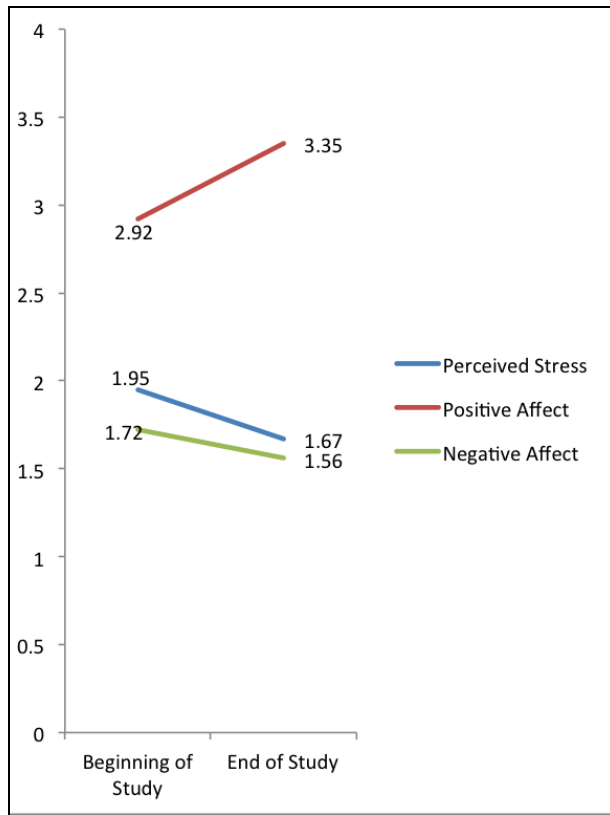
	PSS	PANAS	JLO
Week 1 Beginning	X	X	X
Week 1 End			X
Week 2 Beginning			X
Week 2 End			X
Week 3 Beginning			X
Week 3 End	X	X	X

## Results and Discussion

### *Quantitative Data:*

To test our first hypothesis, which stated that weekly nature walks would lead to decreased perceived stress levels in participants at the end of the study period, we ran a repeated measures ANOVA to look at the change in perceived stress levels over the three-week period. For changes in the Perceived Stress Scale (Survey 1), there was a significant effect,  $F(1, 23) = 12.882, p = 0.002, \eta^2 = 0.359$ , with perceived stress levels before the walks ( $M = 1.95, SD = 0.625$ ) significantly higher than directly after the walks ( $M = 1.67, SD = 0.608$ ) (Figure 2).

Figure 2. Perceived Stress and Positive and Negative Affect levels at the beginning and end of the three-week study period



To test the effects of group nature walks on participants' PANAS levels, we ran a repeated measures ANOVA to look at the change in both positive and negative affect in the participants during the entire duration of our study. For changes in positive affect (Survey 2), there was a significant increase  $F(1, 23) = 10.137, p = 0.004, \eta^2 = 0.306$ , with positive affect levels before the first walk ( $M = 2.9167, SD = 0.608$ ) lower than after the third walk ( $M = 3.3458, SD = 0.621$ ). There was no significant decrease in negative affect levels during the period of nature walks, but rather a trend,  $F(1, 23) = 3.065, p = 0.093, \eta^2 = 0.118$ , with negative affect levels before the first walk ( $M = 1.7208, SD = 0.837$ ) higher than after the third walk ( $M = 1.5583, SD = 0.683$ ) (Figure 2).

The findings gathered in the first two repeated measures ANOVAs supported our first two hypotheses that weekly nature walks would lead to decreased perceived stress levels in participants at the end of the study period, and that positive affect of participants would increase over the three-week study period. They also supported the third hypothesis that negative affect of participants would decrease over the three-week study period, although this finding did not reach significance. This finding does not yet establish the exact aspect of the walks that led to improved mental health (in terms of stress levels) of participants, nor does it reveal the pattern of increased mental health levels during the walk and throughout the course of the study period, however, it does support that simply walking in nature for an hour a week will improve mental health, even across a time period as short as three weeks.

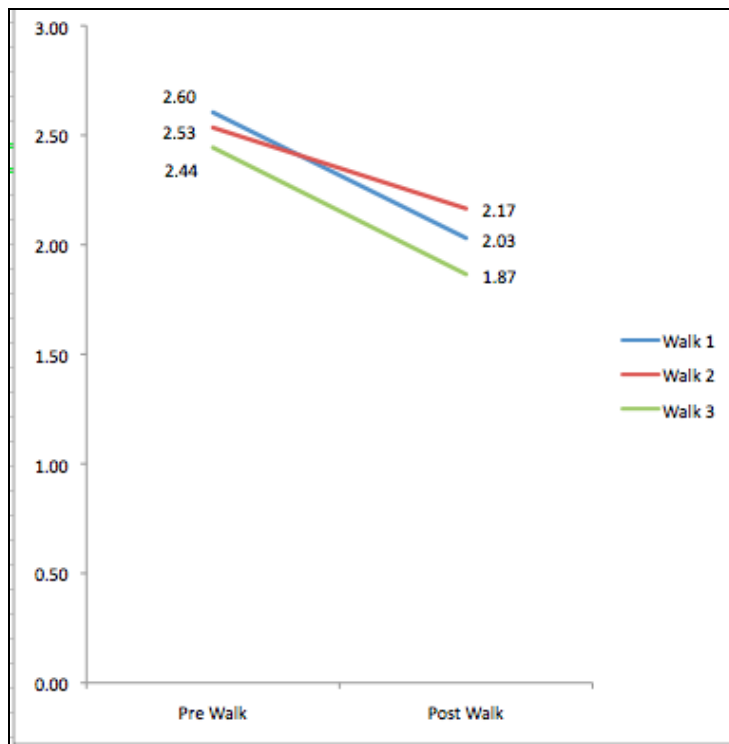
To examine the more immediate impact of nature walks on stress level indicators, as measured in the JLO Scale (Survey 3), we ran a repeated measures ANOVA, this time looking at stress level totals at six different time points: before and after each group nature walk. The overall ANOVA, looking at changes in stress levels of the participants from time 1 (before the first walk) to time 6 (after the third walk), showed that there are significant differences somewhere in our group over the course of the study: Overall  $F(5,110)=17.43, p < .001$  (Figure 3).

Figure 3a. JLO Scale means over the six time points

	Mean	Std. Deviation
Pre Walk One (Beginning of Study)	2.6043	.68588
Post Walk One	2.0304	.66636
Pre Walk Two	2.5348	.65547

Post Walk Two	2.1652	.69256
Pre Walk Three	2.4435	.58607
Post Walk Three (End of study)	1.8652	.56134

Figure 3b. Graph of JLO Scale means pre- and post- each walk



In order to determine where in our time series differences occurred, and in effect test the hypothesis that participants' stress levels will decrease directly after each walk, and across the entire study period, we ran pairwise comparisons that looked at stress level changes before and after *each* of the three walks, as well as at the very beginning and very end of our research study. The comparison of JLO Scale Totals at the beginning (before walk one) and end (after walk three) of our study, demonstrated a significant decrease in stress  $t(22) = 6.91, p < .001$ . There was also a significant decrease in the participants' JLO Scale Totals from before to after each of the



three walks: Pre-Post Walk One:  $t(22) = 6.45, p < .001$ ; Pre-Post Walk Two:  $t(22) = 3.25, p = .004$ ; and Pre-Post Walk Three:  $t(22) = 7.60, p < .001$ . These findings suggest that nature walks decrease stress levels immediately after they are conducted. This finding supports our fourth hypothesis, which states that there will be a significant decrease in presence of stress indicators exhibited by each participant directly following each walk, and demonstrates the ability of short walks in nature to provide instantaneous benefits to mental health for college students.

In testing the latter portion of our fourth hypothesis--that there will be a significant decrease in the presence of stress indicators exhibited by each participant across the entire study period--we looked at the changes in baseline stress levels, as demonstrated by JLO Scale totals, over the course of the study. More specifically, we looked at JLO totals at the beginning of walk one and the beginning of walk three, and found no significant change, but rather a trend:  $t(22) = 1.85, p = .073$  (Figure 3). JLO totals at the beginning of walk three, as opposed to the end walk three, were used in this test in order to eliminate the immediate effect of the walk.

This finding provides insight into the nature of the effect of the walks on participant stress levels. The fact that stress levels dropped significantly directly before and after each walk, yet that there were no significant changes in pre-walk stress levels over the three week study period, but rather only subtle changes, suggests the short term nature of the effects of nature walks on stress. Had the stress-reducing effect of nature walks lasted a longer period of time, our findings would have shown a decrease in beginning stress levels (measured by the JLO scale) each consecutive week. This decrease in beginning stress levels of the study period, however, was only slight, progressing from 2.60 (Pre Walk One) to 2.53 (Pre Walk Two) to 2.44 (Pre Walk Three) (Figure 3). This finding in no way invalidates the data previously discussed, which

supports that weekly group nature walks decrease stress levels, but rather further informs the nature of this decrease in stress levels. It suggests that the stress-reducing impact of nature walks may only be short term.

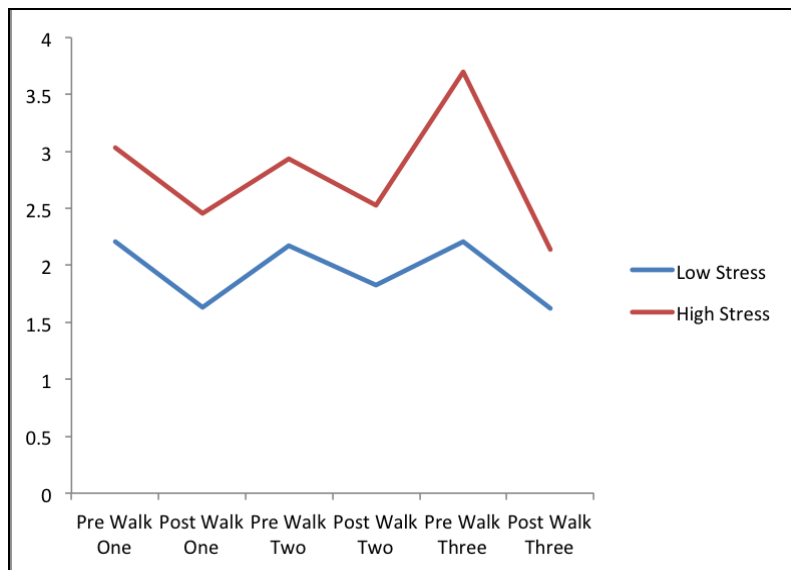
With general trends in our entire group's mental health levels across the three-week study period now measured, we were interested to determine whether participants with higher starting perceived stress level would in fact show a greater decrease in stress as a result of the nature walks than participants with lower starting perceived stress levels, our final hypothesis. To test this hypothesis, we did a median split that grouped the participants into high and low stress groups. The median was 1.95, with high stress participants above the median, and low stress participants below. We then ran a 2 (perceived stress: low, high) x 6 (time points: Pre walk one (beginning of study), post walk one, pre walk two, post walk two, pre walk three, and post walk three (end of study)) ANOVA on participants' scores on the JLO scale. We found a main effect for the condition,  $F(5, 22) = 13.34, p = .001, \eta^2 = .39$ . This finding shows that participants low in perceived stress remained lower ( $M = 1.95$ ) than the group of high perceived stress participants ( $M = 2.65$ ) at each of the time points. The second variable we looked at was time, which examines the participants' stress levels over the six time points. This analysis shows a significant relationship,  $F(5, 22) = 17.56, p < .001, \eta^2 = .46$ , which remains consistent with our earlier finding that JLO totals decreased significantly across our participants over the course of the study. We then looked at the interaction between the group of high perceived stress and low perceived stress participants to determine whether or not the high perceived stress group saw greater changes in stress levels over the period of the three weeks. No significant interaction was found:  $F(5, 22) = 1.07, p > .10$  (Figure 4). This finding rejects our final hypothesis that high stress

participants will see greater decreases in stress from the nature walks than low stress participants. Instead, it suggests that stress levels change consistently, in the same direction across the two groups. Although high stress participants experienced decreased stress levels as a result of the nature walks, the high stress group remained higher in stress than low stress individuals.

Figure 4a. Split group comparison of the effect of nature walks on high versus low stress participants

<b>Time Point</b>	<b>Perceived Stress Level Group</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>N</b>
Pre Walk One (Beginning of Study)	low stress	2.2167	.52020	12
	high stress	3.0273	.60015	11
Post Walk One	low stress	1.6333	.35248	12
	high stress	2.4636	.66674	11
Pre Walk Two	low stress	2.1667	.47927	12
	high stress	2.9364	.59376	11
Post Walk Two	low stress	1.8333	.59442	12
	high stress	2.5273	.62465	11
Pre Walk Three	low stress	2.2083	.60371	12
	high stress	2.7000	.46476	11
Post Walk Three (End of study)	low stress	1.6167	.44687	12
	high stress	2.1364	.56440	11

Figure 4b. Graph of the split group comparison of the effect of nature walks on high versus low stress participants



We were interested to see if there were, instead, differences in stress levels over the course of the study period among our different demographic groups. We first tested the effect of gender on perceived stress levels, and found a significant main effect for gender:  $F(1,22) = 9.8$ ,  $p = .005$ ,  $\eta^2 = .32$ , showing that males ( $M = 1.887$ ,  $SE = .158$ ) are on average less stressed than females ( $M = 2.523$ ,  $SE = .127$ ). However, there was no significant difference between the two gender groups in the extent of change in the stress levels over the three-week study period. Similarly, we found no significant difference in the effects of the nature walks on the stress levels of participants who previously spent more hours in the North Woods per week (two or more hours) and those spending less hours in the Woods per week (zero to one hours) ( $F(1,22) = .22$ ,  $p = .64$ ). There was also no significant difference in extent of stress level change in underclassmen and upperclassmen, however a trend was found  $F(1, 22) = 3.79$ ,  $p = .07$ . Upperclassmen students reported on average lower perceived stress levels ( $M = 2.011$ ,  $SE =$

.177) than underclassmen ( $M=2.443$  ,  $SD = .142$ ) over the course of the study. These findings show that regardless of gender, class year, perceived stress levels, and average time spent in the woods, all participants showed the same trends of short term reduction of stress levels immediately following each walk. Generally, men (and upperclassmen) are less stressed, as is consistent with literature that women report higher levels of stress than men; however, the extent of change in their stress levels over the course of the study did not differ.

#### *Qualitative Data:*

In addition to the quantitative measures outlined above, we also used two qualitative measures to gage the changing levels of stress, positive affect, and negative affect in the participants. These measures were weekly journal entries and a singular focus group at the end of the study. The journal prompts were administered online and were sent to the participants the Wednesday following each walk. The first journal prompt was, “Please write about how your walk in the North Woods impacted the rest of your week. How did you feel while you were on your walk? Did you notice any changes before and/or after the walk? Please also include any other thoughts you want to share about your experience.” From the data gathered from the first journal entries on February 25th, a significant number of participants reported that during the walk in the North Woods and for the immediate time after the walk they felt less stressed and had a more positive outlook on their personal and academic lives than prior to the walk. For example one participant wrote,

“I noticed that before I went on the walk I was feeling rather stressed about things that had happened to me the night before. However, while I was on the walk I felt a sense of calmness come over me....After the walk I felt that my head had been cleared of

these thoughts that were bugging me and they never really came back. Its as if they left my head when I went on the walk and remained in Northwoods” (Journal, 2/25/15).

Very few participants reported that the walks reduced their stress levels for the entirety of the following week. This is exemplary of our quantitative findings pertaining to long term changes in stress levels. As noted previously, the results from the JLO scale totals determined that there was a trend, not a significant change, in stress measures from the beginning of walk one to the beginning of walk three. However, the measured stress levels before compared to after individual walks showed a significant decrease. In the first journal entries, only two participants reported a change in stress levels that lasted longer than the immediate 24 hours after the walk.

The participants that reported no decrease in stress did so for one of two reasons. The first was the weather. Two participants noted that the cold made it impossible for them to feel relaxed on the walks, “I was a little bit distracted by how cold I was, which prevented me from enjoying it as much as I might have” (Journal, 2/25/15). However, a number of participants reported that they were happy with the fact that the walks took place in the winter, because they are usually unwilling to walk during this time of year without motivation.

The second reason for negative journal responses came from students who reported having an overwhelming amount of work. These students felt as though their work-load was so great that they were wasting time walking in the woods when they could have devoted the time to studying, “As the walk progressed my level of enjoyment decreased. I thought more and more about how much I needed to study for my exam on Tuesday, and got nervous that I wasn't studying, but could be doing that with my time instead” (Journal, 2/25/15). The negative responses from the first round of walks were heavily outweighed by the positive ones. The vast

majority of respondents reported feelings such as “calmness”, “relaxation”, “happiness”, “rejuvenation”, “refreshed”, and “motivation” (Journal, 2/25/15).

The second journal was administered online on March 5th. The prompt was the same as the first week; however, we additionally asked the participants if they noticed any changes since the previous weeks walk. The participants responses were very similar to the entries from the first weeks prompts. However, there were two trends that were of note. The first pertained to the weather. Participants who had previously felt as though the snow or cold negatively impacted their moods during the walk reported that the warmer weather and packed snow made the second walk much more enjoyable, “I enjoyed this past week's walk much more than the first, because the weather was much nicer and I was much less stressed.... On this past week's walk, however, the sun was out, I was content, at ease, and stress-free, and therefore I could fully appreciate the beauty of the nature around me” (Journal, 3/5/15). Several participants alluded to the positive effect of being able to appreciate the “beauty” of nature.

Another interesting trend that emerged from the second round of journal responses was the positive effect that came along with knowing one had the walk coming up. For example, one student felt more at ease knowing that they had a time approaching when they could detach themselves from the normal happenstances of their lives, “Since the last walk, I have been looking forward to each Saturday, which represents a time during which I can give myself an excuse to take a break from my studies and from the typical anxieties of life as a college student” (Journal, 3/5/15). The knowledge that a potentially stress-reducing event is approaching gave certain students a feeling a relief.

The final round of journals were administered online on March 12th. The prompt differed from the previous two in that it had participants reflect on their entire time in the study, “Overall, how did you feel about the nature walks? Favorite part, Least favorite part? What did you get out of this experience? Do you have any altered perceptions that you would attribute to your time in the woods or the reflections? Do you think that you are likely to continue to take walks in nature?” Overall, the participants reported that they were happy to have been a part of this study. The majority of the responses to the question of what was your favorite part of the walk was the decrease in stress and increase in mood that occurred during and immediately after the walks, “I believe that spending a certain amount of time each week in nature, reflecting and meditating has been essential to my well-being” (Journal, 3/12/15). The majority of the responses to the question of what was your least favorite part of the walks was the weather conditions. However, there were several recommendations presented by participants that could tie into suggestions for further research.

There was a general trend of frustration pointed towards the fact that the walks were silent, “It was frustrating that we couldn't speak to each other as being conversational would have made the experience more enjoyable” (Journal, 3/12/15). Moreover, there were individuals who thought that a solitary walk would have benefitted them more than group walks. There was one individual who, after walking alone in the woods reported, “ Doing the walk in solitude and in my own pace was actually much nicer than the walking together, I could stop and look at things, back track and otherwise just revel in the beauty around me without being concerned with keeping pace with everybody” (Journal, 2/12/15). This ties in to a general feeling that certain



participants had throughout the journal entries of the walks as more of a chore than a positive experience.

A positive trend that came out of the third week of journal entries was that nearly all the participants expressed the sentiment that they wished to continue with walks in the North woods. And while no one reported that this study altered their perceptions of the north woods or nature, a majority of respondents reported that they were happy to have discovered or rediscovered the north woods as a viable place to take a hike and get away from “the Skidmore bubble” (Journal, 3/12/15).

In addition to weekly journal entries, another form of qualitative data that we gathered was through a focus group we held at the end of the study. Our focus group was comprised of six participants and lasted 45 minutes. Overall, the participants present reflected upon many of the same things they did in the journal entries.

One of the notable thing that was discussed in the focus group was the nature of the walks themselves. For example, five of the six participants noted that they were happy that the walks were silent. One participant noted that he wished he was able to listen to music and/or talk to the other participants. However, the other five participants said that the silence made the walks feel more akin to solitary hikes, which they enjoyed.

100% of the participants stated that they thought the fact that the walks took place in the north woods as opposed to an urban environment or the gym was beneficial, “The presence of nature has a unique kind of rhythm of the consistency of trees and landscape that you don’t get when you’re with lots of people in a city street” (Focus group). This sentiment was reflected by the rest of the focus group.

83% of the focus group reported that the study inspired them to walk in the woods more in the future. The one participant who stated that he was not likely to continue walking in the woods said that even he knows it would be good for him, he probably still won't do it.

100% of participants reported that the time spent in the woods was an opportunity to destress and focus on things other than their academic responsibilities, "Going to the woods is a time for me to reflect and destress and it really allows me to reconnect with myself and my goals and breakaway from what I've been striving for" (Focus group). The idea of breaking away from Skidmore was repeatedly mentioned during the focus group. The walks were referred to as a "blank slate" for the remainder of the week and a "rejuvenating experience" (Focus group).

Our qualitative data presented overarching themes throughout our study. One such theme was the length of the positive effects gained through the walks. In the journal entries, the majority of participants reported that they felt the positive effects from the nature walks such as a reduction in stress levels, increase in positivity, and clearheadedness for a maximum of 24 hours after the walks. There were several reasons behind this. One reason was the infrequency of walks. Participants reported that one walk a week for three weeks was perhaps not enough time to consistently decrease stress levels.

Another reason for the lack of positive longevity was the presence of stressful academic work. Many of the respondents felt that after the walks they were immediately hurled back into the "Skidmore bubble," a place of stress. This is an interesting finding as, by the end of the study in the journals, many of the participants were associating calmness with the woods and stressfulness with skidmore's campus.

Another trend in the journals was the frustration with the weather. It was snowing on and off during the first two walks and it was especially cold during the first walk. The snow on the ground made it difficult for certain people to hike uphill. The difficulties that come with the cold and snow led to several participants not enjoying the hikes. On the other hand, several participants noted that they gained a newfound love for winter due to the hikes. They reported that they had never walked in the north woods before due to the weather; however, after participating in this study they reported that they were more likely to do so in the future.

## **Limitations and Suggestions for Further Research**

### *Limitations*

One limitation of our study was the lack of diversity within our recruited population as well as the lack of diversity within our test group. Due to the manner in which we recruited participants, by flier and announcements, those who elected to participate in our study were mostly those with a previous disposition for the environment. Many of the participants therefore entered the study with a positive outlook of how the walks in the North Woods would make them feel, and on the whole had relatively low stress levels. Furthermore, the majority of participants were Environmental Studies or Geoscience majors. This was an interesting phenomenon; however, it did limit our ability to pull from a more diverse range of participants in terms of academics and personal interests.

Another issue that derived from our population setting was the lack of ability to make our walks mandatory. We were able to offer monetary incentives; however, at times, this was not enough to ensure full participation. With 30 participants signed up at the beginning of the study,

only 24 participants completed all of the walks and supplementary journal entries. This is a 20% attrition rate. The limited number of participants also prevented us from holding a control group. We would have liked to have a group that either did weekly walks in urban areas in alongside our nature walk groups, or a group that walked on a treadmill in the sports center, to see potential differences in outcomes. The groups would be testing for the difference between urban and rural environments, and the difference between exercise and exercise in a natural environment. These alternative intervention groups would be a valuable addition to the study because they would decrease the amount of variability in our results.

There were also several limitations that derived from the fact that we are doing this pilot study as a part of our senior capstone in Environmental Studies at Skidmore College. One such limitation was a time constraint. We were only able to hold walks in the North Woods for three weeks, and we were only able to hold these walks once a week. This was due to both the time parameters of our research gathering and the availability of our participants. Our research parameters also necessitated our research gathering to be done in winter. Therefore, the walking conditions were, at times, cold and icy. An alternative would be to do the study in the summer or fall when conditions are more suitable.

We were unable to keep our participants ignorant, or “blind,” to the nature and purpose of our surveys. Our surveys specifically targeted stress and positive and negative affect; therefore, it was obvious to our participants what we were testing for. This could have led to some level of response bias in the form of demand characteristics from our participants. Participants might respond unnaturally with the thought that we are hoping they will be less stressed after the walks than before. We were also unable to ask certain questions because we were working with

potentially vulnerable populations. In order to ask certain questions, such as inquiries related to depression or suicide, we would have needed to gain IRB approval.

Due to the small size of our recruitment population, our sample size was also limited. This decreased the statistical power for testing our hypotheses. A solution to this would be to run a regression analysis using perceived stress as a continuous predictor variable. We also encountered a few limitations when running our data analyses, particularly the split-group analyses. In the testing of our final hypothesis, that those with lower starting perceived stress levels would see more drastic decreases in stress from the nature walks, we split the group in half to divide them into high and low stress participants. The median for this median split, however, was very low (around 2), so the difference between “high” vs. “low” stress participants was slim, and participants were, on the whole, relatively unstressed. The breakdown of participants in terms of gender, class year, etc. was also uneven, which made it difficult to find significant trends in comparing the different demographics. Simply the fact of splitting the groups to find comparisons was difficult due to a small sample size to begin with, which only got smaller as participants was broken down into categories for comparison. Finally, in splitting our participants into two groups based on their perceived stress levels, and then measuring, and comparing, the two groups’ changes in stress levels (according to JLO totals), we were essentially correlating stress with stress, which is not ideal. With greater resources and more extensive surveying, we would have been able to use grouping variables that were unique to the independent variables.

*Suggestions for further research*

Much research remains to be done to examine the relationship between nature walks and mental health. Using a similar design to our pilot study, future studies may include a control group, as well as alternative intervention groups (that walks on treadmills or in an urban setting, for instance) to eliminate third variables, such as endorphins, that arise simply from engaging in exercise. Our nature walks required participants to be with the group, and silent, however future studies may want to look at the relative effectiveness of individual nature walks, nature walks where the participants can listen to music, informational nature walks, and nature walks in new or varying settings. It would also be valuable to look at the relative effects of nature walks in warmer settings as opposed to in cold upstate New York winters. It may also be valuable to look at relative changes in stress of participants who go on nature walks, and those who simply spend the hour in a greenhouse or surrounded by greenery indoors.

In terms of the methods used to collect data, as discussed previously, it was hard to avoid response bias and demand characteristics (the phenomenon of participants responding in the way they think they think the researcher wants) in our surveys, journals, and focus groups. For this reason, we recommend the use of alternative methods of assessing stress levels of participants, such as physiological tests that measure stress and other mental health indicators. The inclusion of physiological tests would also act as a good distraction to participants from the intention of the study, and be effective in convincing participants of a “cover story.” Journal entries can also be coded more extensively, which may provide telling findings, as they include broad questions and allow for greater candidness in participant responses.

Finally, we recommend that future studies on the relationship between nature walks and mental health be conducted over a longer period of time, ideally with more frequent walks, in

order to see more significant effects. The timing of the journal entries and focus groups can be adjusted accordingly. Our pilot study also lacked the follow up with participants a few months after the final walk to measure the presence of lasting effects of nature walks on individuals' habits and mental health levels, which we see as valuable to future knowledge in this area. It is important that the timing of interviews, surveys, and journals, be considered, as external events such as vacation, final exams, or graduation may serve as third variables that affect outcomes.

## **Conclusion**

College students report and exhibit high rates of stress, making them an informative demographic to focus on in measuring nature induced stress reduction. Published literature has found that interaction with nature decreases stress and negative affect, and increases happiness and positive affect. Our pilot study, which examined the effect of nature walks on mental health indicators, further supported these findings. After each walk in the North Woods, as well as across the entire three-week study period, the 24 participants showed a significant increase in mental health, as reflected by stress level and positive and negative affect measures. The journal entries and focus group supported the quantitative findings, and further informed that during and directly after each walk, participants felt less stressed and had a more positive outlook on their personal and academic lives than prior to the walk. The significance of the findings of our pilot study suggest the positive effects of nature walks on a variety of mental health indicators, and therefore the worthiness of further research in this area. Our study validates the North Woods not only as a place for recreation and academic research, but also as a resource for positive mental health.

## **Bibliography:**

Alvarsson, J.J., Wiens, S., & 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.

American College Health Association. 2010. National College Health Assessment. Retrieved from [http://www.acha.org/docs/ACHA-NCHA-II\\_ReferenceGroup\\_ExecutiveSummary\\_Fall2010.pdf](http://www.acha.org/docs/ACHA-NCHA-II_ReferenceGroup_ExecutiveSummary_Fall2010.pdf)

Ball, K., Bauman, A., Leslie, E., & Owen, N. (2001). Perceived Environmental Aesthetics and Convenience and Company Are Associated With Walking For Exercise Among Australian Adults. Preventative Medicine. 3(5), 434-40. DOI: 10.1006/pmed.2001.0912

Becker, S. P. (2010). Wilderness Therapy: Ethical Considerations for Mental Health Professionals. Child & Youth Care Forum. 39(1), 47-61.

Berman, M., Jonides, J., & Kaplan, S. (2008). The Cognitive Benefits of Interacting with Nature. Psychological Science. 19(12). DOI: 10.1111/j.1467-9280.2008.02225.x

Bird, W. (2007). Natural Thinking: Investigating the Links Between the Natural Environment, Biodiversity and Mental Health. London: Royal Society for the Protection of Birds.

Caddick, N., Smith, B., & Phoenix, C. (2014). The Effects of Surfing and the Natural Environment on the Well-Being of Combat Veterans. Qualitative Health Research. 3(1), 286-299. DOI: 10.1177/1049732314549477

City of Saratoga Springs. (2014). History of Saratoga Springs. *SaratogaSprings.org*. Retrieved from [http://www.saratoga-springs.org/index.php?option=com\\_content&view=article&id=95&Itemid=93](http://www.saratoga-springs.org/index.php?option=com_content&view=article&id=95&Itemid=93)

Cohen, S., Kamarck., & Mermelstein, R. (1983). A Global Measure of Perceived Stress. Journal of Health and Social Behavior. 24(4), 385-396. DOI: 10.2307/2136404

Davis-Berman, J., & Berman, D. (1996). Using the Wilderness to Facilitate Adjustment to College: An Updated Description of Wilderness Orientation Programs. Journal of Experiential Education. 19(1), 22-28. DOI: 10.1177/105382599601900104



Hartig, T., Marlis, M., & Evans, G.W. (1991) Restorative Effects of Natural Environment Experiences. *Environment and Behavior*. 23(1), 3-26. DOI: 10.1177/0013916591231001

Heckert, T., Ross, S., & Niebling, B. (1999). Sources of Stress Among College Students. *College Student Journal*. 33(2), 312.

Kadison, R., & Foy, T. (2004) *College of the Overwhelmed: The Campus Mental Health Crisis and What to Do about It*. San Francisco: Jossey-Bass.

Kaplan, S. (1995). The Restorative Benefits of Nature: Towards an Integrative Framework. *Department of Psychology, Journal of Environmental Psychology*. (15)3, 169-182. DOI:10.1016/0272-4944(95)90001-2

Ledwidge, B. (1980). Run For Your Mind: Aerobic Exercise as a Means of Alleviating Anxiety and Depression. *Canadian Journal of Behavioural Science*. 12(2), 126-140. DOI: 10.1037/h0081048

Macan, T.H., Shahani, C., Dipboye, R.L., & Phillips, A.P. (1990). College Students' Time Management: Correlations with Academic Performance and Stress. *Journal of Educational Psychology*. 82(4), 760-768.

Marselle, M., Irvine, K., & Warber, S. (2013). Walking for Well-Being: Are Group Walks in Certain Types of Natural Environments Better for Well-Being than Group Walks in Urban Environments? *International Journal Environmental Research and Public Health*. 10, 5603-5628. DOI: 10.3390/ijerph10115603

Marselle, M., Irvine, K., & Warber, S. (2014). Examining Group Walks in Nature and Multiple Aspects of Well-Being: A Large Scale Study. *Ecopsychology*. 6(30), 134-147. DOI: 10.1089/eco.2014.0027

Misra, R., & McKean, M. (2000). College Students' Academic Stress and Its Relation to Their Anxiety, Time Management, and Leisure Satisfaction. *American Journal of Health Studies*. 16(1), 41-51.

Mitchell R. (2013). Is Physical Activity in Natural Environments Better for Mental Health Than Physical Activity In Other Environments? *Social Science and Medicine*. 91, 130-134. DOI: 10.1016/j.socscimed.2012.04.012

Roe, J., & Aspinal, P. (2011). The Restorative Benefits of Walking In Urban and Rural Settings In Adults with Good and Poor Mental Health. *Health and Place*. 17, 103-113. DOI: 10.1016/j.healthplace.2010.09.003.

Russell, K.C. (2000) Exploring How the Wilderness Therapy Process Relates to Outcomes. *Journal of Experiential Education* December. 23(3), 170-176 DOI: 10.1177/10538259000230030

Russell, K.C. (2001). What is Wilderness Therapy? *Journal of Experiential Education*. 24(2), 70-79. DOI: 10.1177/105382590102400203

Ryan, R., Weinstein, N., Bernstein, J., Brown, K., Mistretta, L., & Gagne, M. (2010). Vitalizing Effects of Being Outdoors In Nature. *Journal of Environmental Psychology*. 30, 159–168. DOI:10.1016/j.jenvp.2009.10.009

Silverman, D. (2006). *Interpreting Qualitative Data: Methods for Analysing Talk, Text and Interaction* (Third edition). London: Sage

Skidmore College. (2014). Admission Facts. *Skidmore Admissions*. Retrieved from <http://skidmore.edu/admissions/facts/>

Skidmore College. (2014). Skidmore's North Woods. *Skidmore Sustainability Office*. Retrieved from [http%3A%2F%2Fskidmore.edu%2Fsustainability%2Fnorthwoods%2Findex.php](http://skidmore.edu/sustainability/northwoods/index.php)

Skidmore College. (2014). Why Skidmore? 9 Reasons. *Skidmore Admissions*. Retrieved from <http://skidmore.edu/admissions/news/nine-reasons.php>

Watson, D. & Clark, L.A. (1988). Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales. *Journal of Personality and Social Psychology*. 54(6), 1063-1070.

Weinstein, N., Przybylski, A., & Ryan, R. (2009). Can Nature Make Us More Caring? Effects of Immersion in Nature on Intrinsic Aspirations and Generosity. *Personality and Social Psychology Bulletin*. 35, 1315. DOI: 10.1177/0146167209341649

Wells, N.M., & Evans, G.W. (2003) Nearby Nature; A Buffer of Life Stress Among Rural Children. *Environment and Behaviour*. 35(3), 311-330. DOI: 10.1177/0013916503035003001

Zelenski, M., & Nisbet, E. (2014). Happiness and Feeling Connected: The Distinct Role of Nature Relatedness. *Environment and Behavior*. 46(3), 3-23 DOI: 10.1177/0013916512451901

## Appendices

### Appendix 1

#### Perceived Stress Scale- 10 Item

Instructions: The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way.

**1. In the last month, how often have you been upset because of something that happened unexpectedly?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**2. In the last month, how often have you felt that you were unable to control the important things in your life?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**3. In the last month, how often have you felt nervous and "stressed"?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**4. In the last month, how often have you felt confident about your ability to handle your personal problems?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**5. In the last month, how often have you felt that things were going your way?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**6. In the last month, how often have you found that you could not cope with all the things that you had to do?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**7. In the last month, how often have you been able to control irritations in your life?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**8. In the last month, how often have you felt that you were on top of things?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**9. In the last month, how often have you been angered because of things that were outside of your control?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

**10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?**

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

## Appendix 2

### Positive and Negative Affect Scale:

This scale consists of a number of words and phrases 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 very slightly or not at all	2 a little	3 moderately	4 quite a bit	5 extremely
___ attentive		___ upset		___ proud	___ determined
___ strong		___ active		___ jittery	___ interested
___ irritable		___ guilty		___ ashamed	
___ inspired		___ nervous		___ scared	
___ afraid		___ excited		___ enthusiastic	
___ alert		___ hostile		___ distressed	

### *Appendix 3*

Before and After each walk: JLO Stress Scale

Please answer the following questions based on how you are feeling at this moment.

1 - Very slightly or not at all   2 - A little   3 - Moderately   4 - Quite a bit   5 - Extremely

\_\_\_ I am calm

\_\_\_ I feel secure

\_\_\_ I am tense

\_\_\_ I am worried

\_\_\_ I am content

\_\_\_ I worry too much about something that doesn't really matter

\_\_\_ I am stressed

\_\_\_ I feel like I am unable to manage my work-load

\_\_\_ I am worried about my time-management capabilities

\_\_\_ I am happy where I am right now