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*Utah State University*

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THE RELATIONSHIP OF OUTDOOR RECREATION AND GARDENING WITH  
DEPRESSION AMONG INDIVIDUALS WITH DISABILITIES

by

Justin F. Wilson

A thesis submitted in partial fulfillment  
of the requirements for the degree

of

MASTER OF LANDSCAPE ARCHITECTURE

Approved:

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UTAH STATE UNIVERSITY  
Logan, Utah

2012

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## ABSTRACT

The Relationship of Outdoor Recreation and Gardening with  
Depression among Individuals with Disabilities

by

Justin F. Wilson, Master of Landscape Architecture

Utah State University, 2012

Major Professor: Keith M Christensen

Department: Landscape Architecture and Environmental Planning

Activities involving natural environments have positive psychological impacts on participants. Both outdoor recreation and gardening have been shown to reduce feelings of depression. However, the effects of these activities on the depression levels of individuals with disabilities have not yet been studied. In order to better understand the relationship between these activities and depression among individuals with disabilities, two separate studies were conducted.

The first study seeks to better understand the relationship between outdoor recreation participation and depression among Montana residents with disabilities using publicly available Behavioral Risk Factor Surveillance System (BRFSS) data. It hypothesizes that depression would be negatively correlated with outdoor recreation participation and that individuals participating more frequently in outdoor recreation activities would have lower overall depression index scores. This study compares three outdoor recreation predictors (dichotomized participation, participation index score, and participation frequencies) to two depression dependents (dichotomized current major

depression and raw depression index score). Results reveal that there is a negative relationship between outdoor recreation participation and depression, outdoor recreation participants had lower overall depression scores than non-participants, and lower depression scores were related to more frequent outdoor recreation participation. Respondents participating in outdoor recreation at least four times a week had the lowest mean depression score.

The second study, also using BRFSS data, sought to identify the relationship between gardening and depression among Utah residents with disabilities. This study hypothesized that participation in gardening activities would be negatively correlated to depression. In order to test this hypothesis, this study compared the mean depression scores of five different gardening categories: non-gardeners, past gardeners, non-current gardeners, lifetime gardeners, and current gardeners. It likewise compared gardening status with depression scores to identify a linear relationship. Results reveal that there is a negative linear relationship between gardening and depression. Current gardeners and lifetime gardeners had significantly lower overall depression scores than non-gardeners.

(87 pages)

## PUBLIC ASTRACT

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Justin F. Wilson



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## CHAPTER 1

### INTRODUCTION

Nature-based activities, such as outdoor recreation and gardening, have been shown to positively impact the psychological health of participants (Maller et al. 2006; Townsend 2006). Increased interactions with nature can improve an individual's cognitive functioning (Berman, Jonides, and Kaplan 2008), attention capacity (Berto 2005), self-discipline (Taylor, Kuo, and Sullivan 2002) and personal satisfaction (Pothukuchi and Bickes 2001) while reducing stress, anger, blood pressure levels (Hartig et al. 2003).

Outdoor recreation, in particular, has been found to provide participants with physical, psychological, and social benefits (Norman et al. 2010). These positive benefits might explain the increase in outdoor recreation in the U.S. over the past 25 years (Cordell, Green, and Betz 2009) as well as the growing popularity of outdoor recreation therapy programs (Frances 2006).

Gardening has likewise increased in popularity as an intervention for improving psychological health (Sempik, Aldridge, and Becker 2003; Simson and Straus 1998). Horticulture Therapy (HT) programs that center around gardening activities have been shown to improve mood, emotions, quality of sleep, ability to concentrate, feelings of recovery, and peace of mind (Hayashi et al. 2008; Rappe and Kivela 2005; Yamane et al. 2004).

Both outdoor recreation (Frances 2006; Townsend 2006) and gardening (Gonzalez et al. 2011; Page 2008) have significant impacts on depression. In the United States, one out of every six individuals has a lifetime history of a major depressive

disorder (MDD) (Kessler et al. 2003). Symptoms of MDD frequently include feelings of sadness and emptiness, reduced interest or pleasure in daily activities, insomnia or hypersomnia, loss of energy, difficulty concentrating, and recurrent thoughts of death or suicide (American Psychiatric Association 2000). Furthermore, an estimated 50-60% of all suicide victims meet the requirements for current major depression (Kim et al. 2003). Although conventional treatments for depression have been found to be generally effective (Butler et al. 2007), continuing these treatments can be costly and only one third ever reach remission (Hollon, Thase, and Markowitz 2002) which warrants the exploration of alternative forms of treatment.

Individuals with disabilities are more at risk for depression than the general population (Kinne, Patrick, and Doyle 2004; Okoro et al. 2010). Estimates predict that this worldwide trend will continue to increase as unipolar depressive disorders become the second leading cause of disability-adjusted life years lost before 2030 (Mathers and Loncar 2006). The negative relationship that depression and disability have on each other often leads to a spiraling decline in overall health (Penninx et al. 1998). However, treating or preventing depression may likewise prevent or reverse disability (Von Korff et al. 1992).

Though a few studies among the general population have investigated the relationship between depression and nature-based activities such as outdoor recreation (Buettner and Fitzsimmons 2002; Frances 2006; Rawson 1994; Sheare 1975; Townsend 2006; Wassman and Iso-Ahola 1985) and gardening (Hayashi et al. 2008; Rappe and Kivela 2005; Ulrich 1999; Yamane et al. 2004), no studies have been conducted among individuals with disabilities. Because persons with disabilities represent a large

percentage (18.7%) of the United States' population (Brault 2008) and that decreased depressive symptoms can have a positive impact on disability, this study sought to identify the relationship of outdoor recreation and gardening with depression among persons with disabilities.

This thesis employed non-experimental analyses to explore the following research questions: "Is participation in outdoor recreation related to reported symptoms of depression among individuals with disabilities?" and "Is participation in gardening associated with reported symptoms of depression among individuals with disabilities?" The data used for this study was gathered from the 2006 Behavioral Risk Factor Surveillance System (BRFSS). Conducted annually by the Center for Disease Control and Prevention (CDC) in cooperation with state departments of health, the BRFSS uses a random-digit dialing telephone system to survey non-institutionalized adults age 18 years and older in order to monitor national and statewide health trends.

Chapter 2 of this thesis addresses the first research question regarding depression and outdoor recreation using 2006 BRFSS data from Montana. Chapter 3 employs 2006 BRFSS data from Utah in order to focus on one particular type of outdoor recreation, namely gardening, and its relationship with depression. Both Chapters 2 and 3 have been prepared as separate manuscripts for publication in scholarly journals. The purposes of these manuscripts are three-fold: 1) promote future experimental studies that can identify and quantify a causal direction within the relationship between depression and nature-based activities among persons with disabilities, 2) serve as a starting point for future studies addressing this particular issue, and 3) to inform professionals in the fields of psychology, landscape architecture, park and recreation planning, horticulture, and

disability studies of the relationship that nature-based interventions might have with depression among individuals with disabilities.

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## CHAPTER 2

THE RELATIONSHIP BETWEEN OUTDOOR RECREATION AND DEPRESSION  
AMONG INDIVIDUALS WITH DISABILITIES<sup>1</sup>**Abstract**

The purpose of this study is to identify the relationship between outdoor recreation participation and depressive symptoms among individuals with disabilities. The current paper compares three outdoor recreation predictors (dichotomized participation, participation index score, and participation frequencies) to two depression dependents (dichotomized current major depression and raw depression index score). Results reveal that there is a negative relationship between outdoor recreation participation and depression, outdoor recreation participants had lower overall depression scores than non-participants, and lower depression scores were related to more frequent outdoor recreation participation. Respondents participating in outdoor recreation at least 4 times a week had the lowest mean depression score.

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<sup>1</sup>Chapter 2 was coauthored by Justin Wilson and Keith Christensen for submission to the Journal of Leisure Research.

## Introduction

Participation in outdoor recreation has been shown to reduce depression among different demographics (Buettner & Fitzsimmons, 2002; Frances, 2006; Rawson, 1994; Sheare, 1975; Townsend, 2006; Wassman & Iso-Ahola, 1985). Individuals with disabilities are at increased risk for depression (Blazer, 2009; Bruce, 2000; Kinne, Patrick, & Doyle, 2004; Okoro et al., 2010; Schillerstrom, Royall, & Palmer, 2008; Weich et al., 2002) and outdoor recreation may help reduce that risk. Because no studies have yet explored this assumption, the purpose of this study is to identify the relationship between outdoor recreation participation and depression among individuals with disabilities.

### *Depression*

An estimated 16.6% of Americans have a lifetime history of a major depressive disorder (MDD) (Kessler et al., 2003) and 6.6% have experienced MDD within the past 12 months (Kessler, Chiu, Demler, Merikangas, & Walters, 2005). Symptoms associated with MDD that are present nearly every day include diminished interest or pleasure in daily activities, significant changes in appetite, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive guilt, diminished ability to think or concentrate, and recurrent thoughts of death or suicide (American Psychiatric Association, 1994). Depression is highly correlated with suicide and approximately 50-60% of suicide victims meet the requirements for current depressive disorders (Cavanagh, Carson, Sharpe, & Lawrie, 2003; Kim et al., 2003; Marttunen, Aro, Henriksson, & Lonnqvist, 1991). Depression also causes roughly \$83.1

billion per year in economic burden in the United States (Greenberg et al., 2003). Because of its high prevalence, comorbidity with other conditions, and its effect on worker performance, depression accounts for \$44 billion per year in lost productive time (Stewart, Chee, Ricci, Hahn, & Morganstein, 2003) making the treatment of mood disorders less expensive than the secondary costs associated with depression (Greenberg et al., 2003; Rihmer, 2001). Although treatments such as antidepressant medications and electroconvulsive therapy appear to be effective in treating depression, these treatments can have troublesome side effects, may be costly to continue or maintain, and do not have an enduring effect (Hollon, Thase, & Markowitz, 2002). Psychotherapies, such as cognitive behavioral therapy, behavior activation, and interpersonal therapy, have performed as well as antidepressants in treating moderate to severe depression (Dimidjian et al., 2006; Roth & Fonagy, 2005) and often have longer lasting effects (Hollon, et al., 2002; Spates, Pagato, & Kalata, 2006). However, persons with depression commonly receive no treatment and only 7 percent to 30 percent receive adequate treatment in the United States (Harman, Edlund, & Fortney, 2004; Kessler et al., 2003; U.S. Department of Health and Human Services, 1999; Weiberg, O'Leary, Meigs, Hennen, & Stafford, 2003; Young, Klap, Sherbourne, & Wells, 2001).

### *Depression and Disability*

Research has shown a strong relationship between depression and disability (Blazer, 2009; Bruce, 2000; Kinne, et al., 2004; Okoro et al., 2010; Schillerstrom, et al., 2008; Weich et al., 2002). Although studies disagree on whether depression is a risk factor for disability (Field & Jette, 2007; Kroenke et al., 2010; Penninx, Deeg, van Eijk, Beekman, & Guralnik, 2000) or if disability is a risk factor for depression (Holon, et al.,

2002; Ormel et al., 1993; Von Korff, Ormel, Katon, & Lin, 1992), longitudinal studies have indicated that a change in one condition results in a complementary change in the other condition (Barry, Allore, Bruce, & Gill, 2009; Koenig & George, 1998; Ormel, Rijdsdijk, Sullivan, van Sonderen, & Kempen, 2002). Just as Penninx et al. (1998) explain that the mutual reinforcing natures of depression and poor physical function can cause “a progressive downward spiral in physical and psychological health” ( p. 1725), a review of the disability and depression literature suggests that treating or preventing depression may likewise prevent or reverse disability (Lenze, Martire, Rollman, & Schulz, 2001).

### *Outdoor Recreation*

National participation levels in a wide range of outdoor recreation activities (i.e., camping, backpacking, walking, fishing, bird watching, golfing, hunting, swimming, boating, etc.) has increased over the past 25 years (Cordell, Green, & Betz, 2009). Recent studies have indicated that outdoor recreation can positively impact individual’s physical, psychological, and social health (Maller, Townsend, Pryor, Brown, & St. Leger, 2006; Norman, Annerstedt, Boman, & Mattsson, 2010; Rosenberger, Bergerson, & Kline, 2008; Townsend, 2006). Outdoor recreation activities often include physical activity which provides cardiovascular benefits, weight loss, quicker recovery from illness (Warburton, Nicol, & Bredin, 2006) and can effectively reduce a participant’s depression levels (Buettner & Fitzsimmons, 2002). Furthermore, outdoor recreation can increase an individual’s contact with natural environments which has been shown to improve attention capacity (Berto, 2005; Cimprich & Ronis, 2003) and cognitive functioning (Berman, Jonides, & Kaplan, 2008), increase self-discipline (Taylor, Kuo, & Sullivan, 2002), and enhance personal satisfaction (Pothukuchi & Bickes, 2001) while reducing

stress, anger, blood pressure levels (Hartig, Evans, Jamner, Davis, & Garling, 2003; Rodiek, 2002) and anxiety and depression symptoms (Mooney & Milstein, 1994). Outdoor recreation likewise provides a sense of connectedness and social interaction with other people also participating in recreational activities (Norman et al., 2010; Townsend, 2006).

Although there has been an increase in outdoor recreation programs aimed at improving psychological health (Frances, 2006), only a few studies have specifically measured the impacts of outdoor recreation on depression (Buettner & Fitzsimmons, 2002; Frances, 2006; Rawson, 1994; Sheare, 1975; Townsend, 2006; Wassman & Iso-Ahola, 1985). Furthermore, no such studies have been conducted specifically among individuals with disabilities. Therefore, the purpose of this study was to determine the relationship between outdoor recreation participation and depression among individuals with disabilities. This study is significant in that its findings can aid in improving the quality of life of individuals with disabilities, a demographic that represents a significant percentage (18.7%) of the United States' population (Brault, 2008). Furthermore, unipolar depressive disorders are projected to become the second leading cause of disability-adjusted life years lost in the world before 2030 (Mathers & Loncar, 2006). This study contributes to the available body of knowledge concerning depression treatment and will help identify the role that outdoor recreation might play in the treatment of individuals with disabilities who have depression.



## Methods

### *Framework*

This study employed a socio-ecological approach that suggests that the environment influences individuals' physical and mental health (Stokols, 1995). In this study, outdoor recreation is the environmental independent factor and the depression levels of individuals with disabilities are the dependent factor. Using non-experimental correlational analysis this study explored the following research question: "Is participation in outdoor recreation related to reported symptoms of depression among individuals with disabilities?"

### *Sample*

This study used data collected by the Behavioral Risk Factor Surveillance System (BRFSS), an annual survey conducted by the Centers for Disease Control and Prevention (CDC) to track health trends and risk factors on local and national levels. The study population included all non-institutionalized Montana residents aged 18 and older who participated in the 2006 BRFSS. As part of its 2006 nationwide core questions, BRFSS included a *Disability* module to survey respondents' physical, mental, and emotional health. Also in 2006, the state of Montana included a question module entitled *Anxiety and Depression*, which was designed to measure depression symptom frequencies among respondents. In addition, Montana included a question module entitled *Outdoor Recreation Questions* to collect information regarding respondents' participation in outdoor recreation (Centers for Disease Control and Prevention, 2006).

## *Measures*

### **Disability**

Disability status for this study was determined by a ‘yes’ response to one of the following BRFSS core questions: “Are you limited in any activities because of physical, mental, or emotional problems?” or “Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?” Following the recommendations found in *Healthy People 2010* (U.S. Department of Health and Human Services, 2000), this method of determination is used by the CDC, the Montana BRFSS, and other related studies employing BRFSS data (Rimmer, 2007; Strine, Kroenke, & Dhingra, 2009; Wolf, Armour, & Campbell, 2008).

### **Income and Employment Status**

A previous study using the 2006 Montana BRFSS found that current major depression is significantly related to a household income less than \$50,000 per year and unemployment or being unable to work (Oreskovich & Cummings, 2009). Therefore, these demographic variables were controlled for in this study. During the BRFSS survey, respondents were asked to indicate their annual household income from all sources. Participants were dichotomized into two groups—those with annual household incomes less than \$50,000 and those with \$50,000 or greater. Respondents were also asked to indicate their employment status. From their responses, participants were classified as employed (including employed for wages or self-employed), unemployed, or other (including students, homemakers, retired individuals, and those unable to work).

## **Age**

In this study, age plays a complex role. Studies have identified a negative relationship between age and depression symptoms (Blazer, 2009; Charles, Reynolds, & Gates, 2001; Schieman, van Gundy, & Taylor, 2002) including one report conducted specifically among Montana adults (Oreskovich & Cummings, 2009). Age also is related to outdoor recreation participation, but the relationship is unclear. National trends indicate that time spent participating in outdoor recreation decreases with age (Siikamäki, 2009). However, smaller studies show that the healthy baby-boomer generation is more likely to be engaged in outdoor activities than younger generations (Preister, Malone, & James Kent Associates, 2009). In a Montana based study, Christensen, Holt and Wilson (2011) found that fewer older adults participate in outdoor recreation than adults under 65 years of age. However, the same study showed that older adults average more outdoor recreation participation days than the younger cohort. Furthermore, Montana's Statewide Comprehensive Outdoor Recreation Plan (SCORP) has urged local outdoor recreation managers to increasingly focus on facilities and programs that will accommodate the increasing number of mature adults who are living longer and moving to Montana to retire (Montana Fish, Wildlife & Parks, 2008). Additionally, individual health decreases as populations grow older (Martin, Schoeni, Freedman, & Andreski, 2007; Zack, Moriarty, Stroup, Ford, & Mokdad, 2004). Considering these complications, this study controlled for age by aggregating the data into six different age groups (18-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, and 65 years of age or more).

## **Depression Symptoms**

An adaptation of the Patient Health Questionnaire eight-item depression scale

(PHQ-8) was used to assess depression among 2006 Montana BRFSS survey participants. The PHQ-8 resembles the widely used PHQ-9 which consists of nine criteria for depression derived from the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* (DSM-IV) (American Psychiatric Association, 1994). The PHQ-9 asks how often an individual has been bothered by nine different depression symptoms in the last two weeks allowing the respondents to answer “not at all,” “several days,” “more than half the days,” and “nearly every day” (Kroenke, Spitzer & Williams, 2001). The PHQ-8 differs from its predecessor in that it omits a question that assesses suicidal or self-injurious thoughts. This omission was due to interviewers’ inability to provide adequate intervention over the phone (Kroenke et al., 2008). When using the PHQ-8 in 2006, BRFSS surveyors asked respondents to quantify the number of days they experienced each depressive symptom (as opposed to asking how often) during the past 2 weeks. The change in phrasing was made to better reflect the format of other similar BRFSS questions. As recommended by Kroenke et al. (2008), the respondents’ answers were recategorized to match the original PHQ-8 response set and scoring method as follows: 0-1 day = “not at all” (0 points), 2-6 days = “several days” (1 point), 7-11 days = “more than half the days” (2 points), 12-14 days = “nearly every day” (3 points). The total points accumulated from the 8 symptom-related questions produced a raw index score for each respondent. In past studies, scores  $\geq 10$  have been found to accurately predict current major depression or other depression (Kroenke & Spitzer, 2002). Furthermore, the PHQ-8 in conjunction with BRFSS data has been identified as an effective method for predicting depression in the United States (Kroenke et al., 2008). For this study, the raw depression index score and the dichotomized cutpoint for current

major depression (depression scores  $\geq 10$ ) were used as the dependent variables in determining depression's relationship with outdoor recreation.

### **Outdoor Recreation**

Before asking respondents a series of outdoor recreation related questions, interviewers were required to explain that they were only interested in "OUTDOOR recreational activities...[and] not interested in INDOOR activities, such as bowling, line-dancing, weight-lifting, or other exercise activities" (Centers for Disease Control and Prevention, 2006). Montana respondents were then asked the following question: "What was the primary outdoor recreational activity you participated in during the past 12 months?" If a respondent answered "none", they were identified as not having participated in outdoor recreation. All other outdoor activities qualified as a "yes" response. Surveyors matched respondents' answers to a provided list of 33 various outdoor activities which included backpacking, bird watching, boating, camping, fishing, golfing, hunting, motorized recreation, team sports, walking, and other. Individuals who participated in outdoor recreation also reported the frequency of their participation per week, month, and year. Indicated frequencies were then developed into two separate scales. The first scale produced a raw participation index score for each respondent based on a 365-day year using the assumptions that there are 12 months or 52 weeks in a year, 4 weeks or 30 days in a month, and 7 days in a week. The second scale, using the same assumptions, categorized each respondent as participating in outdoor recreation daily (7+ times per week), at least 4 times a week (4-6 times per week), weekly (1-3 times per week), monthly (1-3 times per month), yearly (1-11 times per year), or never ("none" response to the first question). The dichotomized participation variable, the raw

participation index score, and the participation frequencies were used in this study as the independent outdoor recreation variables.

### *Analysis*

In order to compare persons with and without disabilities, descriptive frequencies were analyzed for each group looking at common demographic characteristics and percentages for current major depression and participation in outdoor recreation. Independent-samples *t* tests were also conducted to compare mean depression index scores and mean outdoor recreation participation index scores between the two groups. A series of analyses were used to identify the relationship between depression and outdoor recreation among individuals with disabilities. First this study conducted multiple regression analyses with outdoor recreation participation index scores to predict depression index scores while controlling for age, income, and employment. Additionally, a logistic regression analysis was conducted to predict current major depression from the dichotomized outdoor recreation participation variable while controlling for age, income, and employment. This study also used an independent-sample *t* test to compare mean depression index scores for individuals who did and did not participate in outdoor recreation. Finally, a one-way analysis of variance (ANOVA) was conducted to evaluate the relationship between participation frequencies and mean depression index scores. In order to control for age, a two-way ANOVA was also conducted. Statistical significance was set at  $\alpha = .05$  and analysis was conducted using SPSS Version 17.

## Results

### *Comparing Individuals with and without Disabilities*

#### **Descriptive Frequencies**

In 2006, 6,059 non-institutionalized Montana citizens over the age of 18 participated in the BRFSS survey. This group represents a calculated response rate of 55.2%. For this study, participants were excluded ( $n=967$ , 16%) if they had incomplete answers regarding disability status ( $n=40$ ), depression ( $n=773$ ), or participation in outdoor recreation ( $n=154$ ). Of the remaining respondents ( $n=5,092$ ), 25.7% reported a disability ( $n=1,310$ ). Individuals with disabilities included in this study had a mean age of 57.5 years, were predominately white (90.4%) and mostly female (60.5%). When compared to individuals without disabilities, individuals with disabilities were more likely to have current major depression (18.6% compared to 3.2%) and less likely to participate in outdoor recreation (81.8% compared to 93.0%). Further details comparing the descriptive frequencies of persons with and without disabilities are outlined in Table 2-1.

#### **Independent-Sample t Tests**

A comparison of depression index scores showed that individuals with disabilities ( $M = 5.26$ ,  $SD = 5.37$ ) on average had higher depression index scores than individuals without disabilities ( $M = 2.18$ ,  $SD=2.98$ ) ( $t(1,546.39) = 19.41$ ,  $p < 0.001$ ,  $CI = 2.77$  to  $3.40$ ). The eta square index indicates that 7.1% of the variance in depression index scores was attributed to disability status. A weak significance was found when comparing outdoor recreation participation index scores,  $t(2, 2,202.34) = 4.90$ ,  $p < 0.001$ ,  $CI = 10.87$  to  $25.39$ .

Table 2-1

*Participant Descriptives by Disability Status*

Variable	Individuals with Disabilities <sup>a</sup>		Individuals without Disabilities	
	<i>N</i>	<i>P</i> <sup>b</sup>	<i>N</i>	<i>P</i> <sup>b</sup>
Total	1,310	25.7	3,782	74.3
Sex				
Male	517	39.5	1566	41.4
Female	793	60.5	2216	58.6
Race/Ethnicity				
White	1177	90.4	3339	88.9
Black	3	0.2	7	0.2
Other	85	6.5	307	8.2
Multiracial	20	1.5	32	0.8
Hispanic	17	1.3	70	1.9
Education				
Not High School Graduate	108	8.3	204	5.4
High School Graduate	420	32.1	1126	29.8
College or Technical School	414	31.7	1089	29.0
Graduated from College	366	27.9	1355	35.8
Income				
<\$15,000	249	21.6	279	8.3
≥\$15,000 - \$25,000	266	23.0	582	17.4
≥\$25,000 - \$35,000	170	14.7	517	15.5
≥\$35,000 - \$50,000	205	17.8	680	20.3
<\$50,000	264	22.9	1288	38.5
Participated in Outdoor Recreation				
Yes	1072	81.8	3517	93.0
No	238	18.2	265	7.0
Current Major Depression				
Yes	244	18.6	120	3.2
No	1066	81.4	3362	96.8

*Note.* Participant information was gathered from the 2006 Montana BRFSS data for non-institutionalized adults 18 years and older. Participants unsure about their participation frequencies or refusing to answer were excluded from these analyses.

<sup>a</sup>Disability status is determined by a 'yes' response to one of the following questions: "Are you limited in any activities because of physical, mental, or emotional problems?" and "Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?" <sup>b</sup> All percentages represent the valid percent of the variable calculated after removing cases with inadequate responses.

Individuals with disabilities ( $M = 99.63$ ,  $SD = 113.55$ ) on average participated in outdoor recreation 18 less days during the year than individuals without disabilities ( $M = 117.76$ ,



$SD = 113.23$ ). The eta square index indicates that 0.5% of the variance in raw outdoor recreation scores was attributed to disability status (see Table 2-2).

Table 2-2

*Independent-Sample t Tests for Depression Index Scores and Recreation Participation Scores by Disability Status*

	<i>df</i>	<i>t</i>	<i>M</i>	<i>SD</i>	<i>p</i>
Depression Index Score <sup>a</sup>					
No disabilities	1546.39	19.41*	2.18	2.98	<.001
Disabilities <sup>b</sup>	-	-	5.26	5.37	-
Recreation Participation Score <sup>c</sup>					
No disabilities	2202.34	4.90*	117.76	113.23	<.001
Disabilities <sup>b</sup>	-	-	99.63	113.55	-

*Note.* Participant information was gathered from the 2006 Montana BRFSS data for non-institutionalized adults 18 years and older. Participants unsure about their participation frequencies or refusing to answer were excluded from these analyses.

<sup>a</sup>Depression Index Score is based on a scale ranging from 0-24 points. One whole index point represents up to 5 days of a particular depressive symptom, or a combination of symptoms, during a two week period. <sup>b</sup>Disability status is determined by a 'yes' response to one of the following questions: "Are you limited in any activities because of physical, mental, or emotional problems?" and "Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?" <sup>c</sup>Outdoor Recreation Participation Index Score is based on a scale ranging from 0-365. Respondents were assigned an index number based on their reported participation in their primary outdoor recreational activity (times per week, times per month, or times per year). Index numbers represent the numbers of days spent recreating during a year assuming that there 365 days in a year, 12 months or 52 weeks in a year, 4 weeks or 30 days in a month, and 7 days in a week.

\* $p < .05$ .

*Outdoor Recreation and Depression*

*among Individuals with Disabilities*

**Multiple Regressions**

An initial multiple regression was conducted to predict the overall depression index score from age, income, and employment status. The results from this analysis showed that these variables were significant, but accounted for a small percentage of the depression variability,  $R^2 = .11$ ,  $F(3, 1115) = 44.38$ ,  $p < 0.001$ . The test indicates that older employed individuals that make more than \$50,000 per year tend to have lower depression index scores.

A second multiple regression analysis was performed to evaluate whether outdoor recreation participation can predict depression scores over and above the age, income, and employment variables. The outdoor recreation participation index scores accounted for a significant but weak portion of the depression index variance after controlling for age, income, and employment,  $R^2$  change = .007,  $F(1, 1114) = 8.43$ ,  $p = 0.004$ . This finding suggests that individuals who are relatively similar in age, income, and employment status tend to have lower depression scores if they participate more in outdoor recreation. The resulting regression equation for predicting depression scores from outdoor recreation participation after controlling for age, income, and employment is

$$\text{Depression Index Score} = -.004 \text{ Outdoor Recreation Participation Index} + 10.80$$

Table 2-3 indicates the relative strength of age, income, employment status, and outdoor recreation participation when predicting depression index scores. These multiple regressions indicate that age accounts for 6.3%, income accounts for 2.8%, and employment accounts for 2.6%, of the variance in depression index scores. Outdoor recreation accounts for a much smaller percent (> 1%) of the variance in depression index scores.

### **Logistic Regression**

The logistic regression for predicting current major depression (index score  $\geq 10$ ) from dichotomized outdoor recreation participation indicated that individuals with disabilities participating in outdoor recreation decreased their odds for having current major depression by a factor of 1.723 ( $p = 0.001$ ,  $CI = 1.24$  to  $2.40$ ) (omnibus chi-square = 9.89,  $df = 1$ ,  $p < 0.001$ ). Even after controlling for age, income, and employment status,

yearly participants in outdoor recreation were still less likely to have current major depression than those who never participated ( $p < 0.001$ ,  $CI = 1.50$  to  $3.32$ ) (omnibus chi-square =  $15.30$ ,  $df = 1$ ,  $p < 0.001$ ).

### Independent-Sample t Test

When comparing the mean depression index scores of individuals who did and did not participate in outdoor recreation, the independent-sample  $t$  test was significant ( $t(321.28) = -4.06$ ,  $p < 0.001$ ,  $CI = -2.59$  to  $-0.87$ ). On average, individuals participating in outdoor recreation ( $M = 4.96$ ,  $SD = 5.19$ ) had lower depression index scores than those not participating in outdoor recreation ( $M = 6.66$ ,  $SD = 5.96$ ). The effect size based on the means was small,  $d = 0.30$ .

Table 2-3

#### *The Bivariate and Partial Correlations of the Predictors with Depression Index*

Predictors	Bivariate correlation with depression index	Partial correlation with depression index
Age <sup>a</sup>	-.188**	-.251**
Income <sup>b</sup>	-.198**	-.168**
Employment <sup>c</sup>	-1.41**	-.163**
Outdoor Recreation Participation <sup>d</sup>	-.095**	-.088**

<sup>a</sup> Age was aggregated into six different age groups (18-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, and 65 years of age or more). <sup>b</sup> Participants were dichotomized into two groups—those with annual household incomes less than \$50,000 and those with \$50,000 or greater. <sup>c</sup> Respondents were classified as employed (including employed for wages or self-employed), unemployed, or other (including students, homemakers, retired individuals, and those unable to work) according to their survey responses. <sup>d</sup> Outdoor recreation participation frequency was determined as individuals reported their participation per week, month, and year. Indicated frequencies were then developed into a raw participation index score for each respondent based on a 365 day year using the assumptions that there are 12 months or 52 weeks in a year, 4 weeks or 30 days in a month, and 7 days in a week.

\*  $p < .05$ , \*\*  $p < .01$

## ANOVA

A one-way analysis of variance was conducted to evaluate the relationship between participation frequencies (daily, 4 times a week, weekly, monthly, yearly, and never) and mean depression index scores. The ANOVA was significant  $F(5, 1261) = 5.17, p < 0.001$  and the strength of the relationship was small with outdoor recreation frequencies accounting for 2.0% of the variance of the depression index. This study then conducted a follow-up test to evaluate the pairwise differences among the frequency means. Because the variances between the six groups ranged from 18.56 to 35.57, the groups could not be assumed as homogenous and thus the Dunnett's *C* test for post was employed for hoc comparisons. Results showed significant differences between the group that never participated in outdoor recreation ( $M = 6.66, SD = 5.96$ ) and those who participated 4 times a week ( $M = 4.11, SD = 4.30$ ), weekly, ( $M = 4.94, SD = 5.37$ ), and monthly ( $M = 5.67, SD = 5.43$ ). However, no significance was found when compared to those who participate daily ( $M = 5.02, SD = 4.80$ ) or yearly ( $M = 5.67, SD = 5.43$ ). The means, standard deviations, and 95% confidence intervals resulting from the comparisons can be found in Table 2-4.

## Two-Way ANOVA

A 6 X 6 ANOVA was conducted to evaluate the effects of the 6 outdoor recreation participation frequencies and the 6 age groups on mean depression scores. In the previous regressions, age was found to account for the largest variance in depression and thus was the only demographic variable controlled for in the two-way ANOVA.

Table 2-4

*95% Confidence Intervals of Pairwise Differences in Mean Depression Index Scores for Participation Frequencies Compared to Never Participated*

Participation Frequency	<i>M</i>	<i>SD</i>	Never <sup>f</sup>
Daily <sup>a</sup>	5.02	4.80	-0.08 to 3.36
At least 4 times a week <sup>b</sup>	4.11	4.31	1.00 to 4.09*
Weekly <sup>c</sup>	4.94	5.37	0.41 to 3.03*
Monthly <sup>d</sup>	5.01	5.23	0.03 to 3.27*
Yearly <sup>e</sup>	5.67	5.43	-0.77 to 2.74
Never <sup>f</sup>	6.66	5.96	-

*Note.* Depression Index Score is based on a scale ranging from 0-24 points. One whole index point represents up to 5 days of a particular depressive symptom, or a combination of symptoms, during a two week period.

*Note.* Participant information gathered from the 2006 Montana BRFSS data for non-institutionalized adults 18 years and older. Participants unsure about their participation frequencies or refusing to answer were excluded from these analyses.

<sup>a</sup> 7+ times per week. <sup>b</sup> 4-6 times per week. <sup>c</sup> 1-3 times per week. <sup>d</sup> 1-3 times per month. <sup>e</sup> 1-11 times per year. <sup>f</sup> no participation in outdoor recreation during the year.

\*  $p < .05$  using Dunnett's *C* procedure.

The ANOVA indicated no significant interaction between outdoor participation and age,  $F(24, 1221) = 1.08, p = .36, \text{partial} = .02$ . However, significant main effects were found for both outdoor recreation participation ( $F(5, 1221) = 4.70, p < 0.001, \text{partial} = .02$ ) and age ( $F(5, 1221) = 7.78, p < 0.001, \text{partial} = .03$ ). The means and standard deviations for depression mean scores as a function of these two variables can be found in Table 2-5.

A follow-up ANOVA exploring the main effect of age on mean depression scores proved significant  $F(5, 1293) = 12.44, p < 0.001$  and the strength of the relationship was small with age accounting for 4.6% of the variance of the depression index. A follow-up Dunnett's *C* test revealed significant differences between the depression scores of adults older than 65 ( $M = 3.80, SD = 5.35$ ) and those ages 25-34 ( $M = 6.80, SD = 5.83$ ), ages 35-44 ( $M = 6.58, SD = 5.86$ ), ages 45-54 ( $M = 6.39, SD = 6.06$ ), and ages 55-64 ( $M = 5.25, SD = 5.46$ ). No other significant differences in mean depression scores were found between the other age groups.

Table 2-5

*Means and Standard Deviations for Mean Depression Index Scores*

Age	Participation Frequency	Mean	SD
18-24	Daily <sup>a</sup>	1.00	3.65
	≥ 4 times a week <sup>b</sup>	5.00	3.65
	Weekly <sup>c</sup>	3.78	1.72
	Monthly <sup>d</sup>	10.50	3.65
	Yearly <sup>e</sup>	2.00	5.16
	Never <sup>f</sup>	<sup>g</sup>	<sup>g</sup>
25-34	Daily	5.00	5.16
	≥ 4 times a week	7.00	1.72
	Weekly	6.61	0.93
	Monthly	5.17	1.50
	Yearly	5.83	2.11
	Never	11.20	2.31
35-44	Daily	6.80	1.43
	≥ 4 times a week	5.50	1.63
	Weekly	6.90	0.68
	Monthly	5.80	1.03
	Yearly	5.67	1.05
	Never	8.58	1.50
45-54	Daily	4.52	1.13
	≥ 4 times a week	4.89	0.99
	Weekly	5.57	0.45
	Monthly	6.05	0.84
	Yearly	6.97	0.90
	Never	9.91	0.80
55-64	Daily	4.52	0.93
	≥ 4 times a week	4.45	0.84
	Weekly	5.09	0.47
	Monthly	4.76	0.74
	Yearly	4.61	0.79
	Never	7.58	0.68
65+	Daily	4.75	0.78
	≥ 4 times a week	2.61	0.74
	Weekly	2.97	0.46
	Monthly	3.42	0.84
	Yearly	5.46	1.05
	Never	4.59	0.47

*Note.* Depression Index Score is based on a scale ranging from 0-24 points. One whole index point represents up to 5 days of a particular depressive symptom, or a combination of symptoms, during a 2-week period. Participant information gathered from the 2006 Montana BRFSS data for non-institutionalized adults 18 years and older. Participants unsure about their participation frequencies or refusing to answer were excluded from these analyses.

<sup>a</sup> 7+ times per week. <sup>b</sup> 4-6 times per week. <sup>c</sup> 1-3 times per week. <sup>d</sup> 1-3 times per month. <sup>e</sup> 1-11 times per year. <sup>f</sup> no participation in outdoor recreation during the year. <sup>g</sup> This level of combination factors was not observed, thus the corresponding population marginal mean is not estimable.

## Discussion

### *Relationship Between Outdoor Recreation and Depression*

The findings of this study support prior assertions that individuals with disabilities are more likely to have depression. They also support the study's hypothesis that there is a significant relationship between outdoor recreation participation and depression among individuals with disabilities, albeit rather weak. Although the regressions, *t* tests, and ANOVA all indicate a significant negative relationship, the nature of the data does not allow for assumptions of causality or direction. Findings that appear to indicate that participation in outdoor recreation reduces depression can likewise be understood to indicate that individuals with depression are less likely to participate in outdoor recreation. Therefore, either variable might be dependent on the other, or it is possible that they are interdependent to some degree, and further study is recommended.

In the multiple regressions, the negative relationship between outdoor recreation participation and depression appears to be very flat ( $B = -0.004$ ,  $CI = -0.006$  to  $-0.001$ ). The rather inconsequential appearance of this negative relationship is largely due to the different scales used for the two variables (i.e. 0-365 for outdoor recreation, 0-24 for depression). The disproportion in scales also explains why a substantial increase in outdoor recreation frequency (e.g. from never to four times a week) is associated with a disproportionately small reduction in mean depression score (e.g. from 6.66 to 4.11) as found in the ANOVA. However, it is important to note that a 2.5-point reduction in the depression index score is equivalent to approximately 12 less reported days of a particular depression symptom (or a combination of various symptoms over a few days) during a 2-week period.

The ANOVA indicates that the lowest mean depression score was found among those participating in outdoor recreation four to six times per week ( $M = 4.11$ ,  $SD = 4.30$ ) and that all recreation participation frequency groups have lower mean depression scores than those never participating. However, significance was not found for those participating daily ( $M = 5.02$ ,  $SD = 4.80$ ) or yearly ( $M = 5.67$ ,  $SD = 5.43$ ). Though the lack of significance might be expected among the yearly participants, further research is needed to understand its absence among those who daily participate in outdoor recreation.

As expected from the literature review, age, income, and employment status was also related to depression. When controlling for these variables in the multiple regressions and logistic regression, the relationship between outdoor recreation participation and depression remained significant. Also, when controlling for the age in the two-way ANOVA, results showed no significant interaction between age and outdoor recreation participation. However, there was a significant relationship between mean depression scores and the age categories. In particular, adults over 65 years of age had significantly lower mean depression scores than individuals between the ages of 25 and 64. Further exploration into this relationship, in combination with outdoor recreation, would contribute to the findings of this study.

### *Recommendations*

The findings of this study identify a negative correlation between outdoor recreation participation and depression symptoms. Future experimental studies aimed at identifying causality will add significant understanding to some of the findings. For instance, if future evidence shows that increased outdoor recreation participation can



reduce depression scores, the findings would recommend that individuals with disabilities engage in outdoor recreation at least four times per week. Not only does this frequency have the lowest mean depression score, but it also agrees with the 2008 Physical Activity Guidelines for Americans (U.S. Department of Health and Human Services, 2008). Therefore, it is recommended that future studies be conducted to identify causality and to focus on interesting subgroups identified in this study (e.g. older adults, persons participating daily in outdoor recreation, and certain types of outdoor recreation). Studies of these types will support the disability initiative found in *Healthy People 2010* which focuses on the reduction of feelings of sadness, unhappiness, or depression that interfere with the life activities of persons with disabilities (U.S. Department of Health and Human Services, 2000).

### *Limitations*

The data collected for this study by the BRFSS survey allows only for correlational analyses and thus no causal relationship between depressive symptoms and outdoor recreation can be determined. The BRFSS also makes it difficult to achieve accurate estimates because phone surveys may exclude individuals of low socioeconomic status, people with severe mental or physical disabilities, and institutionalized individuals. As such, this study may have excluded persons likely experiencing higher levels of depression and disability. Furthermore, the adaptation of the PHQ-8 used in the 2006 BRFSS survey required that respondents' answers be recategorized to match the original structure of the PHQ-8. It is possible that this recategorization could misrepresent the respondents' intended answers and subsequently skew the results. However, the BRFSS adaptation of the PHQ-8 has been validated as an accurate measure

of depression prevalence in the United States (Kroenke et al., 2008). Finally, the phrasing of the BRFSS disability questions prevents the identification of particular disability types or limitations. Therefore, it is possible that individuals were included in this study as having a disability because they felt limited in their activities due to “mental or emotional problems” (Centers for Disease Control and Prevention, 2006). If those who use equipment were to select to be the only disability group, this study would also be selecting those who are less likely to participate in outdoor recreation due to accessibility issues. Furthermore, the selection of those only using equipment provides an inaccurate representation of individuals with disabilities in Montana. Using a broader designation of disability consistent with *Healthy People 2010* (U.S. Department of Health and Human Services, 2000) and other reports (Rimmer, 2007; Strine et al., 2009; Wolf et al., 2008), this study more accurately represents all disability types in Montana.

### *Conclusion*

This study shows that there is a negative relationship between outdoor recreation and depression among individuals with disabilities, albeit rather weak. From this demographic, outdoor recreation participants decreased their odds of having current major depression by a factor of 1.723 when compared to individuals who did not participate in outdoor recreation during the past year. Also, individuals who participated monthly, weekly, and 4 to 6 times per week had significantly lower overall depression scores than those who never participated in outdoor recreation. The strongest negative correlation was found among individuals who participated in outdoor recreation 4 to 6 times per week. Future experimental studies are needed in order to fully understand the strength and causal direction of the relationship between outdoor recreation and

depression and to explore outdoor recreation's potential as a nonpharmacologic therapy for individuals with disabilities.

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## CHAPTER 3

THE RELATIONSHIP BETWEEN GARDENING AND DEPRESSION  
AMONG INDIVIDUALS WITH DISABILITIES<sup>2</sup>**ABSTRACT**

The purpose of this study is to identify the relationship between gardening and depressive symptoms among individuals with disabilities. The current paper compares the mean depression scores of five different gardening categories: non-gardeners, past gardeners, non-current gardeners, lifetime gardeners, and current gardeners. A linear relation is identified using gardening frequency and reported depression scores. Results reveal that there is a negative relationship between gardening and depression. Current gardeners with disabilities had lower overall depression scores than non-gardeners with disabilities.

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<sup>2</sup>Chapter 3 was coauthored by Justin Wilson and Keith Christensen for submission to the Occupational Therapy Journal of Research.

## INTRODUCTION

Interactions with nature, including gardening, have been shown to reduce depression. Though individuals with disabilities are at increased risk for depression, no studies have investigated the relationship between gardening and depression among this significant demographic. Therefore, the purpose of this study is to identify the relationship between gardening and depression among individuals with disabilities.

Nature-based interventions have been specifically studied to identify their impacts on participants' health (Hansen-Ketchum, Marck, & Reutter, 2009; Hartig, Mang, & Evans, 1991; Maller, Townsend, Pryor, Brown, & St. Leger, 2006). Findings show that increased contact with nature can increase an individual's attention capacity (Berto, 2005; Cimprich & Ronis, 2003), improve cognitive functioning (Berman, Jonides, & Kaplan, 2008), and enhance personal satisfaction (Pothukuchi & Bickes, 2001) while reducing stress, anger, and blood pressure levels (Hartig, Evans, Jamner, Davis, & Garling, 2003; Rodiek, 2002). Horticulture Therapy (HT) is a growing nature-based intervention that involves different gardening activities to improve psychological health (Davis, 1998; Sempik, Aldridge, & Becker, 2003; Simson & Straus, 1998). Recent studies have shown that HT activities have caused significant lasting declines in depression severity among participants (Gonzalez, Hartig, Patil, Martinsen, & Kirkevold, 2011). Rappe and Kivela (2005) reported that elderly people who regularly visited a local garden experienced improvements in mood, quality of sleep, ability to concentrate, feelings of recovery, and had greater peace of mind. However, engaging in gardening has greater positive impacts on participants' reported mood than simply observing nature (Hayashi et al., 2008). Even short 10-minute gardening sessions can significantly lower participants' level of fatigue

and positively affect their emotions (Yamane, Kawashima, Fujishige, & Yoshida, 2004). Gardening can also have long-term impacts on participants' life patterns resulting in motivation to begin new endeavors such as losing weight, taking music lessons, or volunteering (Cimprich, 1993).

Gardening can also reduce depressive symptoms (Gonzalez, Hartig, Patil, Martinsen, & Kirkevold, 2010; Page, 2008). In America, almost 17% of the population has a lifetime history of a major depressive disorder (MDD) (Kessler et al., 2003) and nearly 7% have experienced MDD within the past year (Kessler, Chiu, Demler, Merikangas, & Walters, 2005). Symptoms associated with MDD, as identified by the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR)*, include feelings of sadness and emptiness, reduced interest or pleasure in daily activities, insomnia or hypersomnia, loss of energy, difficulty concentrating, and recurrent thoughts of death or suicide (American Psychiatric Association, 2000). The gravity of depression is evidenced in that 50-60% of all suicide victims meet the requirements for current major depression (Cavanagh, Carson, Sharpe, & Lawrie, 2003; Kim et al., 2003) and that depression creates an \$83.1 billion economic yearly burden in the United States (Greenberg et al., 2003). Not only does depression hinder the quality of life of the individual, but it also impacts the family (Bouma, Ormel, Verhulst, & Oldehinkel, 2008; Henderson, Sayger, & Horne, 2003), the workplace (Stewart, Chee, Ricci, Hahn, & Morganstein, 2003), and the local economy (Greenberg et al., 2003). Conventional treatments for depression, such as antidepressant medications and cognitive-behavioral or interpersonal psychotherapies, have proven efficacious (Butler, Hatcher, Price, & Von Korff, 2007). However, only half of all patients respond to any given intervention, only

about one third reach remission, and continued treatment can be very costly (Hollon, Thase, & Markowitz, 2002). Complementary therapies for depression, such as therapeutic horticulture, can help supplement traditional treatments (Ernst, Rand, & Stevinson, 1998; Jorm, Christensen, Griffiths, & Rodgers, 2002), yet further research is needed to validate new treatments for depression (Hirschfeld et al., 1997).

The reinforcing natures of depression and disability often lead to a progressive downward spiral in physical and psychological health (Penninx et al., 1998). Depression is strongly related to physical and psychological impairment (Blazer, 2009; Bruce, 2000; Kinne, Patrick, & Doyle, 2004; Okoro et al., 2010; Schillerstrom, Royall, & Palmer, 2008; Weich et al., 2002) making it a leading cause of disability (Field & Jette, 2007; Kroenke et al., 2010; Murray & Lopez, 1997; Penninx, Deeg, van Eijk, Beekman, & Guralnik, 2000). Furthermore, estimates show that unipolar depressive disorders will become the leading cause of disability-adjusted life years (DALYs) lost in the United States by 2030 (Mathers & Loncar, 2006). Physical health problems can also lead to depressive symptoms (Holon et al., 2002; Ormel et al., 1993; Von Korff, Ormel, Katon, & Lin, 1992). This relationship places individuals with disabilities at more risk for depression (Prince, Harwood, Blizard, Thomas, & Mann, 1997; Turner & Noh, 1988; Weich et al., 2002). However, positive mood improvements have been shown to produce large positive reductions in disability (Lenze, Martire, Rollman, & Schulz, 2001; Von Korff et al., 1992).

Though there are a few studies focused primarily on the impacts of gardening on depression (Hayashi et al., 2008; Rappe & Kivela, 2005; Ulrich, 1999; Yamane et al., 2004), no known studies measure these impacts among individuals with disabilities.



Further research is needed to determine how gardening and depression are related among this demographic. This study is significant in that persons with disabilities represent a large percentage (18.7%) of the United States' population (Brault, 2008) and that they are more frequently affected by depressive symptoms (Bruce, 2000). Due to the unsupportive relationship existing between depression and disability, individuals with disabilities are likely to benefit greatly from any level of depression reduction. Identifying the relationship that depression has with gardening is one step towards identifying an additional treatment for depression among individuals with disabilities. Therefore, the purpose of this study was to better understand the relationship between gardening and depression among individuals with disabilities.

## **METHODS**

### **Framework**

This study used a socio-ecological approach positing that the environment influences individuals' physical and mental health (Stokols, 1995). In this study, gardening was the environmental factor and depression among individuals with disabilities was the dependent human factor. Using multivariate correlational analysis, this study explored the following research question: "Is participation in gardening associated with reported symptoms of depression among individuals with disabilities?"

### **Sample**

All respondents to the 2006 Utah Behavioral Risk Factor Surveillance System (BRFSS) were included in this study. The BRFSS is an annual survey conducted by the

Centers for Disease Control and Prevention to track health trends and risk factors on local and national levels by using core questions (administered nationwide), optional supplemental questions (as desired by each state), and state-added questions (developed by the state). The 2006 BRFSS survey contained a core *Disability* question module to survey respondents' physical, mental, and emotional health. Along with 41 other states and territories, the state of Utah included the supplemental *Anxiety and Depression* module to gather depression prevalence data among respondents. In addition, Utah included a state-added question module titled *Garden Questions* to survey respondents' participation in and perceived benefits of gardening (Centers for Disease Control and Prevention, 2006).

## **Measures**

*Disability.* Individuals were determined to have a disability if they responded 'yes' to one of the following BRFSS core questions: "Are you limited in any activities because of physical, mental, or emotional problems?" or "Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?" This method of determination follows the recommendations found in Healthy People 2010 (U.S. Department of Health and Human Services, 2000), and is used by the CDC, the Utah BRFSS, and other related studies employing BRFSS data (Rimmer, 2007; Strine, Kroenke, & Dhingra, 2009; Utah Department of Health, 2003).

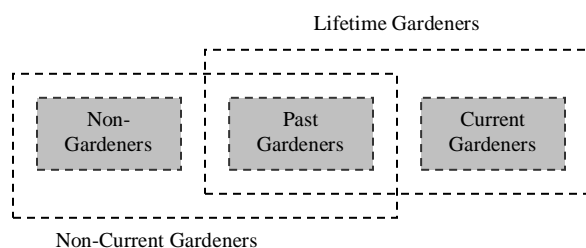
*Demographics.* A recent study using 2005-2007 Utah BRFSS data revealed several correlations between depression and demographic variables such as age, education, employment, and income (Utah Department of Health, 2009). Therefore, this study will

be controlling for these variables when needed. According to their survey responses, participants' were grouped into the following education categories: did not graduate from high school, graduated from high school, attended some college or technical school, and graduated from college or technical school. Participants were also aggregated into five annual income groups: <\$15,000; \$15,000 to <\$25,000; \$25,000 to <\$35,000; \$35,000 to <\$50,000; ≥\$50,000. Respondents also indicated if they were employed, unemployed, or other (including homemakers, students, retirees, and those unable to work).

*Depression Symptoms.* In 2006, BRFSS used an adapted version of the Patient Health Questionnaire eight-item depression scale (PHQ-8) to assess depression in 41 states and territories including Utah. The PHQ-8 is patterned after the PHQ-9, a widely used depression assessment survey consisting of nine criteria derived from the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV)* (American Psychiatric Association, 2000). The PHQ-9 asks individuals to indicate how often they have been bothered by nine different depression symptoms in the last two weeks (not at all, several days, more than half the days, and nearly every day). The nine depression symptoms include (1) little interest or pleasure in doing things, (2) feeling down, depressed, or hopeless, (3) trouble sleep or sleeping too much, (4) feeling tired or having little energy, (5) poor appetite or overeating, (6) feeling bad about yourself or that you are a failure, (7) trouble concentrating, (8) moving or speaking slowly or being fidgety or restless, and (9) thoughts that you would be better off dead or of hurting yourself (Kroenke, Spitzer, & Williams, 2001). The PHQ-8 differs from the PHQ-9 in that it omits the question about suicidal or self-injurious thoughts due to the interviewers' inability to provide adequate intervention over the phone (Kroenke et al., 2008). In the 2006 BRFSS survey, the PHQ-

8 questions were restructured to match the format of other similar BRFSS questions. Instead of asking how often an individual had been bothered by a particular depressive symptom, the restructured questions asked respondents to identify the number of days they experienced a particular symptom over the past 2 weeks. This adapted version of the PHQ-8 became the *Anxiety and Depression* module. As suggested by Kroenke et al. (2008), participants' responses were then recategorized and quantified to match the original response set of the PHQ-8. The recategorization of responses breaks down as follows: 0-1 day = "not at all" (0 points), 2-6 days = "several days" (1 point), 7-11 days = "more than half the days" (2 points), 12-14 days = "nearly every day" (3 points). The accumulated points from the eight depressive symptoms produced a raw depression index score for each respondent with possible scores ranging from 0-24. Past studies using this BRFSS version of the PHQ-8 have found that depression index scores greater than or equal to 10 have accurately represented depression prevalence in the United States (Kroenke et al., 2008). In this study, the raw depression index score and the dichotomized cutpoint for major depression were both used as the dependent variables in determining depression's relationship with gardening.

*Gardening.* Utah respondents were asked two questions to assess their participation in gardening: "Have you ever gardened?" and "Have you gardened in the past 12 months?", with the second question being omitted if the respondent answered 'no' to the first. From these two questions five gardening groups were defined: non-gardeners, past gardeners, non-current gardeners, lifetime gardeners, and current gardeners as illustrated in Figure 3-1.



*Figure 3-1.* Classification of gardening groups by participation frequency.

### **Analysis**

Descriptive frequencies were used to compare the demographics, current major depression frequencies, and gardening status frequencies of individuals with and without disabilities. This study also used independent-sample *t* tests to compare the mean depression scores of individuals with and without disabilities.

Looking solely at individuals with disabilities, This study ran several independent-samples *t* tests to explore the mean depression scores between the five different gardening groups (current gardeners vs. non-current gardeners, current gardeners vs. non-gardeners, current gardeners vs. past gardeners, lifetime gardeners vs. non-gardeners, and past gardeners vs. non-gardeners). In each independent-samples *t* tests, depression scores located more than three standard deviations from the gardening group mean depression score were not included. To further understand the linear relationship between gardening and depression this study used a linear regression and a multiple regression analysis while controlling for age, income, education, and employment. Statistical significance was set at  $\alpha = .05$  and analysis was conducted using SPSS Version 17.

## RESULTS

### **Comparing Individuals with and without Disabilities**

*Descriptive Frequencies.* The 2006 Utah BRFSS gathered responses from 5,210 non-institutionalized Utah residents ages 18 and older over the course of the year (62.4% response rate). For this study, only respondents who provided adequate information regarding their disability status, participation in gardening, and depression symptoms were included (n=1,146). The disparity between total respondents and included respondents is largely due to the limited time in which the gardening questions were administered (October through January). This short four-month window excluded about 76% (n=3,972) of the original 5,210 respondents who were never asked about their gardening habits. Of the 1,146 included respondents, 269 reported a disability (23.4%). Individuals with disabilities had a mean age of 55 years, were predominately white (94.3%) and mostly female (62.1%). When compared to individuals without disabilities, individuals with disabilities were more likely to have current major depression (20.8% compared to 5.2%) and less likely to have gardened in the past 12 months (63.2% compared to 67.0%) (see Table 3-1).

Initial exploration of the depression scores of each gardening status group revealed that mean scores ranged from 7.97 (non-gardeners) to 5.49 (current gardeners). Depression index scores located more than three standard deviations from their group mean score were identified as outliers.

Table 3-1

*Participant Descriptives by Disability Status*

Variable	Individuals with Disabilities <sup>a</sup>		Individuals without Disabilities	
	<i>N</i>	<i>P</i> <sup>b</sup>	<i>N</i>	<i>P</i> <sup>b</sup>
Total	269	23.5	877	76.5
Sex				
Male	102	37.9	387	44.1
Female	167	62.1	490	55.9
Race/Ethnicity				
White	250	94.3	789	90.3
Black	0	0	4	0.5
Other	3	1.1	24	2.7
Multiracial	0	0	2	0.2
Hispanic	12	4.5	55	6.3
Education				
Not High School Graduate	14	5.2	49	5.6
High School Graduate	75	28.0	229	26.1
Attended College or Technical	99	36.9	303	34.5
Graduated from College	80	29.9	296	33.8
Employment				
Employed for Wages	95	35.3	480	54.7
Self-Employed	24	8.9	118	13.5
Out of Work < 1 Year	12	4.5	6	.7
Out of Work > 1 Year	9	3.3	11	1.3
Homemaker	25	9.3	134	15.3
Student	2	0.7	25	2.9
Retired	67	24.9	102	11.6
Unable to Work	35	13.0	1	.1
Income				
<\$15,000	29	12.0	25	3.1
≥\$15,000 - \$25,000	47	19.5	88	11.0
≥\$25,000 - \$35,000	42	17.4	105	13.1
≥\$35,000 - \$50,000	37	15.4	161	20.1
≥\$50,000	86	35.7	423	52.7
Ever Gardened				
Yes	238	88.5	779	88.8
No	31	11.5	98	11.2
Gardened in Past 12 Months				
Yes	170	63.2	588	67.0
No	99	36.8	289	33.0

Table 3-1 (continued)

Variable	Individuals with Disabilities <sup>a</sup>		Individuals without Disabilities	
	<i>N</i>	<i>P</i> <sup>b</sup>	<i>N</i>	<i>P</i> <sup>b</sup>
Current Major Depression				
Yes	56	20.8	46	5.2
No	213	79.2	831	94.8

*Note.* Participant information was gathered from the 2006 Utah BRFSS data for non-institutionalized adults 18 years and older. Participants unsure or refusing to answer about their gardening status, disability status, or depressive symptoms were excluded from these analyses.

<sup>a</sup>Disability status is determined by a 'yes' response to one of the following questions: "Are you limited in any activities because of physical, mental, or emotional problems?" and "Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?" <sup>b</sup>All percentages represent the valid percent of the variable calculated after removing cases with inadequate responses.

Outliers were present in the current gardener ( $n = 2$ ) lifetime gardener ( $n = 5$ ), and non-current gardener ( $n = 4$ ) groups. Table 3-2 shows the mean depression score and standard deviation of each garden status group, including the adjusted means of the previously mentioned groups after removing outliers.

Table 3-2

*Mean Depression Index Scores<sup>a</sup> by Gardening Status<sup>b</sup>*

Gardening Status	<i>N</i>	<i>M</i>	<i>SD</i>
Current Gardeners <sup>a</sup>	172	5.49	5.43
Adjusted <sup>c</sup>	170	5.27	5.09
Lifetime Gardeners	243	5.73	5.86
Adjusted <sup>c</sup>	238	5.34	5.27
Past Gardeners	68	6.34	6.85
Non-Current Gardeners	99	6.85	5.51
Adjusted <sup>c</sup>	95	6.13	5.80
Non-Gardeners	31	7.97	6.29

*Note.* Participant information was gathered from the 2006 Utah BRFSS data for non-institutionalized adults 18 years and older. Participants unsure or refusing to answer about their gardening habits or depressive symptoms were excluded from these analyses.

<sup>a</sup>Depression Index Score is based on a scale ranging from 0-24 points. One whole index point represents up to 5 days of a particular depressive symptom, or a combination of symptoms, during a two week period. <sup>b</sup>Utah participants' gardening status was determined after respondents were asked the following two questions: "Have you ever gardened?" and "Have you gardened in the past 12 months?" The second question was omitted if the respondent answered 'no' to the first. From these two questions respondents were categorized into five gardening groups: current gardeners, lifetime gardeners, past gardeners, non-current gardeners, and non-gardeners. <sup>c</sup>Depression scores located more than three standard deviations from the gardening group mean depression score were considered outliers and removed from the group resulting in the adjusted number, mean, and standard deviation.



*Independent-Sample t Test.* When comparing mean depression index scores, individuals with disabilities ( $M = 5.99, SD = 5.94$ ) on average had higher scores than individuals without disabilities ( $M = 3.04, SD=3.53$ ) ( $t(1,327.83) = 7.73, p < 0.001, CI = 2.20$  to  $3.70$ ). The eta square index indicates that 4.9% of the variance in mean depression index scores can be attributed to disability status.

### **Gardening and Depression among Individuals with Disabilities**

*Independent-Sample t Test.* When comparing the mean depression scores of current gardeners to the mean depression scores of non-current gardeners, the independent-sample  $t$  test indicated that current gardeners ( $M = 5.27, SD = 5.09$ ) did not have significantly lower mean depression scores than non-current gardeners ( $M = 6.13, SD = 5.80$ ) ( $t(175.06) = -1.20, p = 0.233, CI = -2.26$  to  $0.553$ ). Since non-current gardeners include non-gardeners and past gardeners, This study compared the mean depression scores of each of these two smaller groups to the mean depression scores of current gardeners. The tests showed that the mean depression scores of current gardeners were significantly lower than those who have never gardened ( $M = 7.97, SD = 6.29$ ) ( $t(37.59) = -2.25, p = 0.03, CI = -5.11$  to  $-0.27$ ). However, current gardeners did not have significantly lower mean depression scores than past gardeners ( $M = 6.34, SD = 6.85$ ) ( $t(98.31) = -1.16, p = 0.25, CI = -2.89$  to  $-0.76$ ). When comparing the mean depression scores of lifetime gardeners to those who have never gardened, lifetime gardeners ( $M = 5.34, SD = 5.27$ ) had lower mean depression scores than those who have never gardened ( $M = 7.97, SD = 6.29$ ) ( $t(35.84) = -2.23, p = 0.03, CI = -5.02$  to  $-0.23$ ). A final

independent-sample *t* test that compared the mean depression scores of non-gardeners ( $M = 7.97$ ,  $SD = 6.29$ ) to the mean depression scores of past gardeners ( $M = 6.34$ ,  $SD = 6.85$ ) was not significant ( $t(62.99) = -1.16$ ,  $p = 0.25$ ,  $CI = -4.43$  to  $1.17$ ). See Table 3-3 for a comprehensive comparison of mean depression scores by gardening status.

Table 3-3

*Independent-Sample t Tests for Depression Index Scores<sup>a</sup> by Gardening Status<sup>b</sup>*

Gardening Status	<i>df</i>	<i>t</i>	<i>M</i>	<i>SD</i>	<i>CI</i>
Current Gardeners <sup>a</sup>	-	-	5.27	5.09	-
Non-Current Gardeners	175.06	-1.20	6.13	5.80	2.26 to -0.55
Past Gardeners	98.31	-1.16	6.34	6.85	2.89 to -0.76
Non-Gardeners	37.59	-2.25*	7.97	6.29	5.11 to -0.27
Lifetime Gardeners	-	-	5.34	5.27	-
Non-Gardeners	35.84	-2.23*	7.97	6.29	5.02 to -.023
Past Gardeners	-	-	6.34	6.85	-
Non-Gardeners	62.99	-1.16	7.97	6.29	-4.43 to 1.17

*Note.* Participant information was gathered from the 2006 Utah BRFSS data for non-institutionalized adults 18 years and older. Participants unsure or refusing to answer about their gardening habits or depressive symptoms were excluded from these analyses.

<sup>a</sup> Depression Index Score is based on a scale ranging from 0-24 points. One whole index point represents up to 5 days of a particular depressive symptom, or a combination of symptoms, during a two week period. <sup>b</sup> Utah participants' gardening status was determined after respondents were asked the following two questions: "Have you ever gardened?" and "Have you gardened in the past 12 months?" The second question was omitted if the respondent answered 'no' to the first. From these two questions respondents were categorized into five gardening groups: non-gardeners, past gardeners, non-current gardeners, lifetime gardeners, and current gardeners.

\* $p < .05$ .

*Linear and Multiple Regressions.* The initial linear regression identified a significant negative linear relationship between gardening frequency and depression index scores ( $p = 0.01$ ,  $CI = -0.28$  to  $-2.26$ ). The analysis indicates that depression index scores decrease as gardening participation frequency increases resulting in the following regression equation for predicting depression index scores:

$$\text{Depression Index Score} = -1.270 \text{ Gardening Participation Frequency} + 3.97$$

The correlation between gardening participation frequency and depression index score was -0.15. Therefore, gardening participation accounted for approximately 2.3% of the variance in the depression mean scores.

Two multiple regression analyses were conducted to control for age, income, education, and employment status. The results from the first analysis showed that these demographic variables accounted for a significant amount of the depression variability,  $R^2 = 0.22$ ,  $F(4, 234) = 16.20$ ,  $p < 0.001$ , indicating that depression scores decreased as age increased and as income, employment status, and education levels improved.

A second multiple regression analysis was performed to evaluate whether gardening participation frequency can predict depression scores over and above the age, income, education, and employment variables. The regression was not significant ( $R^2$  change = .003,  $F(1, 233) = 1.01$ ,  $p = 0.32$ ), indicating that gardening status does not predict depression over and above age, income, education, and employment status.

Table 3-4 details the relative strength of age, income, education, employment status, and gardening participation when predicting depression index scores.

## **DISCUSSION**

### **Gardening and Depression**

This study's findings agree with prior research indicating that persons with disabilities are more likely to have depression than persons without disabilities. When compared to those without disabilities, this study found that a greater percentage of individuals with disabilities met the criteria for current major depression and had a higher overall mean depression score.

Table 3-4

*The Bivariate and Partial Correlations of the Predictors with Depression Index*

Predictors	Bivariate Correlation with depression index	Partial Correlation with depression index
Age <sup>a</sup>	-0.11**	-0.17**
Income <sup>b</sup>	-0.35**	-0.20**
Education <sup>c</sup>	-0.35**	-0.19**
Employment Status <sup>d</sup>	-0.30**	-0.19**
Gardening Participation Frequency <sup>e</sup>	-0.15	-0.07

<sup>a</sup> Age was based on a scale beginning at 18 years. <sup>b</sup> Participants were aggregated into five groups based on annual income: <\$15,000; \$15,000 to <\$25,000; \$25,000 to <\$35,000; \$35,000 to <\$50,000; ≥\$50,000. <sup>c</sup> Participants' were grouped into the following education categories: did not graduate from high school, graduated from high school, attended some college or technical school, and graduated from college or technical school. <sup>d</sup> Respondents were classified as employed, unemployed, or other (including students, homemakers, retired individuals, and those unable to work) according to their survey responses. <sup>e</sup> Gardening participation frequency was determined as individuals answered the following questions: "Have you ever gardened?" and "Have you gardened in the past 12 months?" Participants were then classified as non-gardeners, past gardeners, or current gardeners.

\* $p < .05$ . \*\* $p < .001$ .

The independent-sample  $t$  tests and regressions indicated that there exists a relationship between mean depression scores and gardening among individuals with disabilities. However, the nature of the data does not allow this study to assume causality. From the literature review on therapeutic horticulture, one might assume that the findings indicate that depression levels are affected by gardening habits. However, the study's results can also be interpreted to mean that individuals with depression are less likely to participate in gardening.

Although the psychological benefits of therapeutic horticulture have already been explored, this study is unique in that it is the first to identify a relationship between gardening and depression specifically among individuals with disabilities. Therefore, a few of the findings are worthy of discussion. First, the initial linear regression identified a negative linear relationship between depression and gardening participation frequency.

However, the multiple regressions indicated that age, income, education, and employment status accounted for the variance found in the depression index scores making gardening's relationship with depression no longer significant. This loss of significance might be attributed to the number of variables that this study was controlling for and their correlations with recreational and leisure activities (Law et al., 2006; Pan et al., 2009) such as gardening. Second, the independent-samples *t* test findings indicate that the lowest mean depression score was found among those who have gardened within the past 12 months. This cohort of current gardeners had significantly lower depression mean scores than those who have never gardened. Third, lifetime gardeners (past and current gardeners) also had a significantly lower mean depression score than non-gardeners. However, when past gardeners were tested alone against non-gardeners, their mean score was lower but the difference was not found to be significant. Furthermore, no significance in means was identified when current gardeners were compared to past gardeners. This means that the depression scores of past gardeners is neither significantly less than non-gardeners, nor significantly more than current gardeners.

The mean depression scores of current gardeners ( $M = 5.27$ ,  $SD = 5.09$ ) was 2.7 points lower than non-gardeners ( $M = 7.97$ ,  $SD = 6.29$ ). If these points were reverted into the original BRFSS scoring of the *Anxiety and Depression* module, 2.7 less points would equate to about 8-13 days of not experiencing a particular depression symptom during a two week period.

Horticulture Therapy has already been shown to have positive impacts on several quality-of-life indicators among individuals with disabilities (Martorell & Lugo, 2008; Sempik et al., 2003). This study confirms that there exists a negative relationship

between gardening participation and depression levels among this demographic. Future research aimed at establishing causality within this relationship is highly recommended, especially when considering the cost and inconsistency of conventional depression treatment methods (Hollon et al., 2002). If HT can be identified to effectively reduce depression symptoms among individuals with disabilities, gardening could become an accessible, inexpensive, and sustainable primary or supplementary treatment for depression among persons with disabilities.

### **Limitations**

As mentioned before, data collected by the BRFSS survey only allows for correlational analyses, which limit the study's ability to identify causality. Also, by adapting the PHQ-8 for use in the 2006 BRFSS survey, the meaning of the respondents' answers might be misrepresented as they are recategorized to match the original structure of the PHQ-8. This effect could have subsequently blurred the results. However, the BRFSS adaptation of the PHQ-8 has been validated as an accurate measure of depression prevalence in the United States (Kroenke et al., 2008). Furthermore, the gardening status questions were only asked during the months of October, November, December, and January—one to four months after the gardening season had ended. In contrast, the depressive symptoms questions asked respondents to consider their psychological health during the past two weeks. These differing time frames likely weaken the relationship between gardening and depression. Had the depression questions been asked during the gardening season, this study might have found more significant differences in depression mean scores when comparing the current gardeners with non-gardeners or past gardeners.

Finally, due to the phrasing of the BRFSS disability questions, it is possible that individuals were included in this study as having a disability because they felt limited in their activities due to “mental or emotional problems” (Centers for Disease Control and Prevention, 2006). The decision to include all individuals reporting a disability was made in order to remain consistent with methods used in *Healthy People 2010* (U.S. Department of Health and Human Services, 2000) and other reports (Rimmer, 2007; Strine et al., 2009; Utah Department of Health, 2003).

## **Conclusion**

This study’s results indicated a negative relationship between gardening and depression among individuals with disabilities. Results showed that current gardeners have significantly lower depression scores than non-gardeners. However, current gardeners did not have significantly lower depression scores than past gardeners and past gardeners did not have significantly lower depression scores than non-gardeners. Future experimental studies exploring the strength, duration, and causal direction of this relationship are recommended.

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## CHAPTER 4

**RESULTS AND CONCLUSION**

The purpose of this thesis was to identify the relationship of outdoor recreation and gardening with depression among individuals with disabilities. In order to do so, two separate studies were conducted; one focusing on outdoor recreation and depression, the other concentrating on gardening and depression. The individual and combined results of these studies are discussed in this chapter along with thesis conclusions.

**The Relationship Between Outdoor Recreation and Depression**

The results of this first study found a significant negative relationship between outdoor recreation participation and depression among individuals with disabilities, albeit rather weak. The multiple regressions found the negative relationship between outdoor recreation participation and depression to be very flat ( $B = -0.004$ ,  $CI = -0.006$  to  $-0.001$ ). This flatness could be largely due to the different scales used for the two variables (i.e., 0-365 for outdoor recreation, 0-24 for depression). The disproportion in scales might also explain why a substantial increase in outdoor recreation frequency (e.g., from never to 4 times a week) is associated with a disproportionately small reduction in mean depression score (e.g., from 6.66 to 4.11) as found in the ANOVA. However, it is important to note that a 2.5 point reduction in the depression index score is equivalent to approximately 12 less reported days of a particular depression symptom (or a combination of various symptoms over a few days) during a 2-week period.

The ANOVA indicated that the lowest mean depression score was found among those participating in outdoor recreation 4 to 6 times per week ( $M = 4.11$ ,  $SD = 4.30$ ) and

that all recreation participation frequency groups had lower mean depression scores than those never participating in outdoor recreation. However, significance was not found for those participating daily ( $M = 5.02$ ,  $SD = 4.80$ ) or yearly ( $M = 5.67$ ,  $SD = 5.43$ ).

As the literature review indicated, age, income, and employment status was also related to depression. However, the relationship between outdoor recreation participation and depression remained significant in the multiple regressions and logistic regression when controlling for these variables. Also, when controlling for the age in the two-way ANOVA, this study found no significant interaction between age and outdoor recreation participation. However, there was a significant relationship between mean depression scores and the different age categories.

### **The Relationship Between Gardening and Depression**

The linear regression indicated that there exists a significant negative relationship between mean depression scores and gardening among individuals with disabilities. However, the multiple regressions found that age, income, education, and employment status accounted for the majority of variance found in the depression index scores making gardening's relationship with depression no longer significant. This loss of significance might be attributed to the number of variables that were controlled for and their correlations with recreational and leisure activities such as gardening.

The independent-samples  $t$  test findings indicate that the lowest mean depression score was found among those who have gardened within the past 12 months. This cohort of current gardeners had significantly lower depression mean scores than those who have never gardened. Lifetime gardeners (past and current gardeners) also had a significantly

lower mean depression score than non-gardeners. However, when past gardeners were tested alone against non-gardeners, their mean score was lower but the difference was not found to be significant. Furthermore, no significance in means was identified when current gardeners were compared to past gardeners. This means that the depression scores of past gardeners is neither significantly less than non-gardeners, nor significantly more than current gardeners.

The mean depression scores of current gardeners ( $M = 5.27$ ,  $SD = 5.09$ ) were 2.7 points lower than non-gardeners ( $M = 7.97$ ,  $SD = 6.29$ ). By reverting these points into the original BRFSS scoring of the *Anxiety and Depression* module, 2.7 less points would equate to about 8-13 days of not experiencing a particular depression symptom during a 2-week period.

In both studies, the multiple regression tests that produced significant results also identified a relatively small effect size (e.g.,  $R^2$  change = .007 and .003). This means that outdoor recreation and gardening respectively accounted for only 0.7% and 0.3% of the change in depression index scores. Though these tests are significant, the very small effect sizes suggest that other variables are more accountable for the overall changes in depression among participants. Some of these variables include age, income, and employment status which had an effect size of 11% and 22% in the outdoor recreation and gardening studies, respectively.

Many nature-based activities involve a considerable amount of physical activity and social interaction. Recent studies show that both physical exercise (Teychenne, Ball, and Salmon 2008) and social interaction (Denissen et al. 2008) have positive psychological effects on participants and these two components might help explain the

correlations found between nature-based activities and depression in this study. The potential strength of nature-based activities as a treatment for depression comes as participants experience the positive psychological benefits of physical exercise and/or social interaction while being exposed to the previously explained benefits of a natural environment. By combining two or three positive depression-impacting factors, nature-based activities can serve as a unique vehicle for addressing mood disorders. Future research is recommended in order to enhance this argument.

### **Limitations**

The data used in this study created several limitations that are common when using secondary data sources. First and foremost, the BRFSS survey data allows only for correlational analyses limiting this study's ability to determine any causal relationship between depressive symptoms and outdoor recreation or gardening. Therefore, findings that may appear to indicate that increased participation in outdoor recreation or gardening results in decreased depressive symptoms could just as likely mean that individuals with fewer depressive symptoms are more likely to participate in outdoor recreation or gardening. Since the BRFSS is administered over the phone to non-institutionalized adults, individuals of low socio-economic status or with severe mental or physical might have been inadvertently excluded from the data. As such, this study may not accurately represent persons with extensive disabilities or depressive symptoms. Furthermore, though the BRFSS version of the PHQ-8 has been validated by other studies (Kroenke et al. 2008), the recategorization of data could potentially misrepresent the respondents' intended answers and subsequently skew the results. Finally, the phrasing of the BRFSS

disability questions does not allow this study to identify particular disability types.

Therefore, it is possible that individuals were included in this study as having a disability because they felt limited in their activities due to “mental or emotional problems” (Centers for Disease Control and Prevention 2006). The decision to include all respondents reporting a limitation of any kind is consistent with disability assessment measures used by *Healthy People 2010* (U.S. Department of Health and Human Services 2000) and other relevant reports (Utah Department of Health 2009; Wolf, Armour, and Campbell 2008). However, this decision could possibly confuse the results of this study.

In the first study, the definition used for outdoor recreation activities was very broad and included essentially any activity that was not performed indoors. Though this definition is consistent with other studies (Cordell, Green, and Betz 2009) and does not reduce the significance of this study’s findings, it might impact the transferability of the results to studies employing a stricter definition of outdoor recreation which might not include activities such as organized sports and urban walking (Jensen and Guthrie 2006).

In the second study, the gardening status questions were only asked during the months of October, November, December, and January—one to four months after the gardening season had ended. In contrast, the depressive symptoms questions asked respondents to consider their psychological health during the past two weeks. These differing time frames likely weaken the relationship between gardening and depression. Had the depression questions been asked during the gardening season, this study might have found more significant differences in depression mean scores when comparing the current gardeners with non-gardeners or past gardeners.

## **Recommendations**

The findings of this thesis identify a negative correlation between depressive symptoms and participation in gardening and outdoor recreation. They also create a foundation for several additional studies that can build upon this study while adding clarity to these findings. One future first step would be to conduct an experimental study that identifies causality while limiting confounding demographic factors. Using primary data, future studies should be able to more accurately measure the relationship, and causal direction, between nature-based activities and depression. In order to control for the many demographic variables that cluttered the results of this study, it is recommend that additional studies concentrate on a single demographic that is of particular concern. From this study's review of the relevant literature, target demographics would include older adults over 65 years, sedentary youth, or individuals with a disability due to a recent injury. Additional studies should also be more focused in regards to the type of nature-based activities. Activities currently of interest to this area of study include walking, hiking, camping, bird-watching, and gardening. Studies that explore the duration of time spent participating in nature-based activities in relation to depression would also produce more tangible results. Not only would each of these suggested studies add to the gradually growing literature on the impacts of environmental and behavioral factors on depression, but they will also begin to clarify whether nature-based activities can serve as potential viable treatments for depression among individuals with disabilities.

## CONCLUSION

Considering the findings of these two studies, this thesis concludes that there is a negative relationship between depression and participation in outdoor recreation or gardening among individuals with disabilities. Persons who participated in these activities had overall lower depression scores than those who did not. Among outdoor recreationalists, those participating four to six times per week had the lowest overall mean depression score. Participation in outdoor recreation during the year decreased an individual's odds of having current major depression by a factor of 1.723 when compared to individuals who did not participate in outdoor recreation. Current gardeners averaged 2.7 less depression points than non-gardeners. Future experimental studies are needed in order to fully understand the causal relationship between depression and participation in outdoor recreation and gardening. Additional studies focused on particular demographics, types of nature-based activities, or duration of activity participation are highly recommended in order to understand nature-based activities' role in treating depression among individuals with disabilities.

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