MOTIVATIONAL, FOREST MANAGEMENT, AND CLIMATIC FACTORS AFFECTING OUTDOOR RECREATION PARTICIPATION AND EXPERIENCE IN FLORIDA

By

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To my beloved wife for her love, support, and inspiration

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LIST OF ABBREVIATIONS

ACF	Autocorrelation Function
AFM	Activity Focused Management
AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
AR	Autoregressive
ARIMA	Autoregressive Integrated Moving Average
BBM	Benefit Based Management
BIC	Bayesian Information Criterion
CFI	Confirmatory Fit Index
EFM	Experience Focused Management
FNST	Florida National Scenic Trail
FTA	Florida Trail Association
IPCC	Intergovernmental Panel on Climate Change
MA	Moving Average
NF	National Forest
OFM	Outcome Focused Management
OHV	Off Highway Vehicle
ONF	Ocala National Forest
PACF	Partial-Autocorrelation Function
RCW	Red-Cockaded Woodpecker
RMSEA	Root Mean Square Error of Approximation
ROS	Recreation Opportunity Spectrum
SARIMA	Seasonal Autoregressive Integrated Moving Average
SBE	Scenic Beauty Estimation

SMS	Scenery Management System
SRMR	Standardized Root Mean Square Residual
UF	University of Florida
USDA	United States Department of Agriculture
USFS	United States Forest Service
WMA	Wildlife Management Area

Abstract of Dissertation Presented to the Graduate School
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By

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This study identifies various factors affecting outdoor recreation participation and visitors' experience in Florida National Scenic Trail (FNST) and certain managed areas along the FNST. Analysis of motivations and site attribute preferences and market segments of FNST visitors revealed five domains of motivations, four domains of site attribute preference, and four market segments which differed significantly in terms of users' preferences, characteristics, and demographics. Complex structural relationships found among motivations and site attribute preferences suggest a need to manage forest and recreation areas according to the experiences visitors expect to attain rather than according to the recreation activities they are engaged in.

Results also indicated that at least one-third of recreation users held some sort of misconception about prescribed burning and its effect on forest health, wildlife, and scenery. Likewise, analysis of recreation users' perception of scenic beauty and recreation satisfaction indicated that the higher people's perceived scenic beauty of recreation sites, the more likely they will be satisfied with their recreation. Findings suggest that recreation users' appreciation of aesthetics of forest sites and attainment of

desired recreation experience can be enhanced by improving their knowledge about the importance of prescribed burning in forest and wildlife habitat management.

Analysis of factors associated with the daily use volume of the FNST indicates that past use levels serve as key explanatory factors of future use. Also, temperature, relative humidity, gas price, and weekend and public holidays significantly affect daily visits to FNST. Days with average temperature of 4 – 23°C seems to bring large numbers of visitors, and average temperature range of 10 – 12°C seems to be most favorable daily temperature to recreate in FNST. Days with heavy rainfall or high heat index are likely to impact recreation use level negatively of not only the same day, but also the next day, even if the following day has normal weather conditions.

Overall, findings indicate that marketing programs should be specific to capture motivations and preferences of each visitor typology to attract visitors with diverse motivations. Outreach programs should target visitors lacking knowledge of prescribed burning and facilitate knowledge transfer among the users. Managers of facilities that require staffing and other resources management should expect less visitation on days following extreme weather conditions.

CHAPTER 1
INTRODUCTION

Various factors could affect people's outdoor recreation participation and experience. Most nature-based recreation participation research has focused on wildland settings – areas relatively far from human development, which include wilderness areas (McFarlane, Boxall, & Watson, 1998), national parks (Warzecha & Lime, 2001), or other recreation areas in remote areas of the western United States (Budruk, Virden, & Waskey, 2009; Stein & Lee, 1995). Nature-based recreation studies have also been conducted in the southeastern United States, but they are few in comparison to similar studies from the western United States. As a result, many unique attributes associated with the climate, land, forest, and water in the Southeast have not yet been fully explored. For example, many nature-based areas are relatively small islands surrounded by private land and urban development. Also, it is common that many of these recreation areas are within a few hours driving time for millions of people. Thus, how people in this region, who likely have different relationships with forest and natural areas, perceive, experience, and prefer nature and nature-based activities must be explored.

Likewise, this region includes subtropical ecosystems, and has a warm and humid climate, which potentially makes recreation participation and experience much different in this region than in other parts of the U.S. Weather extremes (e.g., heat index, wind- and precipitation extremes) are frequent in this region and specifically in Florida. Such extremes significantly affect outdoor recreation decisions and can challenge recreation mangers with unpredicted shifts in demand and resource use, loss of potential profit, and difficulties in administrative scheduling (Manning & Powers, 1984;

Yu, Schwartz, & Walsh, 2009). Effect of weather and climate on outdoor recreation is a well-researched topic (Aylen, Albertson, & Cavan, 2014; Beaudin & Huang, 2014; Becken & Hay, 2007; de Freitas, 2015; Hewer, Scott, & Gough, 2015; Li & Lin, 2012; Nicholls, Holecek, & Noh, 2008), but there are limited studies of this kind from this region. Short winters, long hot and humid summers and frequent weather extremes suggest that weather and climate may significantly affect outdoor recreation participation in Florida, but how and to what extent remains unknown.

Similarly, Florida has one of the 11 national scenic trials in the United States. It traverses several managed areas across the state and offers a variety of recreation experiences to visitors. However, we have limited understanding about users' demographic and recreation profiles, experience preferences, and choices of destinations on this trail. Given the physical settings (topography) and variation of ecosystems (swamps, mangroves, scrubs, pinelands) in Florida, recreation experiences people attain from the Florida National Scenic Trail (FNST) probably differ from what people experience in other scenic trails like the Appalachian National Scenic Trail. Therefore, findings related to this topic based on studies of other scenic trails are difficult to generalize for this setting. Context relevant information about users' needs and preferences is essential for partner agencies like the US Forest Service (USFS) and Florida Trail Association (FTA) to maintain and market this trail.

Finally, the southeastern U.S. is rich in the longleaf pine ecosystem, which supports habitat for many endangered and ecologically important keystone species, such as red-cockaded woodpecker (*Picoides borealis*) and gopher tortoise (*Gopherus Polyphemus)*. These longleaf ecosystems also offer attractive destinations for outdoor

recreation. However, longleaf forests and some associated wildlife species, including the red-cockaded woodpecker (RCW), prefer frequent burning to thrive, which may be aesthetically unappealing for recreation users because of temporary negative effects of fire on scenery (Gobster, 1999; Ryan, 2005; USDA Forest Service, 1995). People may consider fire as an obstacle to attaining the experience they desire because of lack of knowledge and understanding about prescribed burning. Information about recreation users' knowledge and perception about prescribed burning and its association with their recreation experience is therefore important for managers to practice multi-objective forestry on public lands.

The overall goal of my research is to understand how visitors make decisions about their recreation choices in Florida's nature-based recreation areas and how various factors, such as forest management and weather, affect their perceptions and decisions. Specifically, it examines how visitors' participation, experience preference, and perceptions are related to the specific characteristics of Florida's natural areas and the environment. To achieve this broad goal, the dissertation addresses three major research questions.

Research Questions

1. What are the types and characteristics of visitors to Florida National Scenic Trail, and how do visitors' motivations to participate in outdoor recreation relate to their preferences of various site amenities?

2. How does the management of natural areas using prescribed burning for endangered species habitat (e.g., RCW) relate to recreationists' perceptions of quality of recreation opportunities in forested settings?

3. How do temporal and climatic factors affect daily outdoor recreation visits to a long distance scenic trail in Florida?

Dissertation Format

This dissertation is organized into five chapters that include three studies. Chapter 1 provides a general background about the problem and research questions that are answered in this dissertation. This chapter then explains the format of the dissertation and the diagrammatic structure of chapters (Figure 1-1).

Chapter 2 examines salient motivations and site attribute preferences of FNST visitors. It then identifies market segments of visitors and presents the characteristics of segments in terms of visitors' motivations, site preferences, recreation characteristics, and demographics. This chapter also examines the multi-dimensional relations between motivations and site attribute preferences using structural equation modeling.

Chapter 3 examines recreation users' knowledge of prescribed burning and perception of scenic beauty and recreation satisfaction from forest sites representing typical RCW habitats in Ocala NF. This chapter presents multiple approaches to understand associations among activities users chose to participate in, knowledge of prescribed burning, perception of scenic beauty, and attainment of recreation satisfaction.

Chapter 4 identifies the favorable and preferable range of temperature for trail activities in Florida. It compares two modeling approaches, timeseries and count data, to examine the association of recreation participation with climatic factors like temperature and precipitation and other factors like the day of the week and gas price. Best fit time series model showed that weather extremes not only affect same day recreation participation but also the next day even if the day has favorable weather conditions. Finally, Chapter 5 presents a summary of conclusions and implications drawn from these three studies.

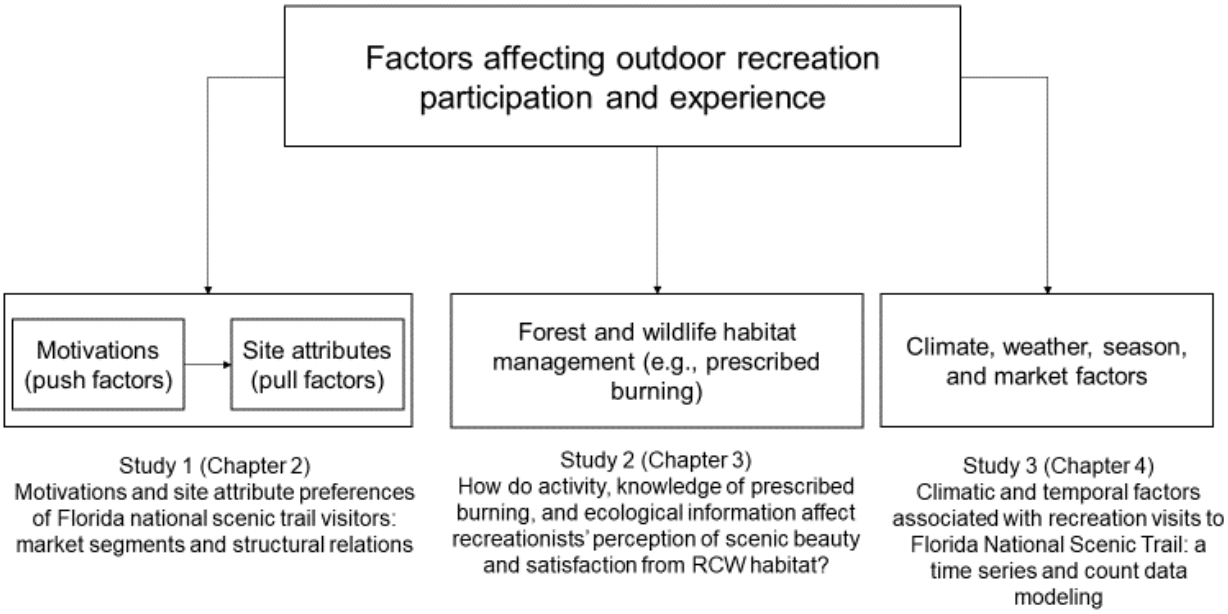

Figure 1-1. Diagrammatic structure of dissertation chapters

CHAPTER 2
MOTIVATIONS AND SITE ATTRIBUTE PREFERENCES OF FLORIDA NATIONAL SCENIC TRAIL VISITORS: MARKET SEGMENTS AND STRUCTURAL RELATIONS

Background

Hiking is one of the most popular outdoor activities in the U.S. A national survey has shown that about one-third of American adults, 79 million people, hiked in 2008 and this number is predicted to increase by 3 – 10 percent by 2060 (Bowker et al., 2012). Among the various recreation destinations, scenic trails provide diverse recreation opportunities for users. The Florida National Scenic Trail (FNST) is one of eleven national scenic trails in the United States. Stretching 1,000 miles (~1600 km) from Big Cypress National Preserve, in the south, to Gulf Islands National Seashore, in the northwest, the FNST traverses through the most beautiful and unique landscapes in Florida. An assessment of visitation from 2003 to 2014 has shown that FNST receives about 350,500 visits per year (Wan, Paudyal, Huntley, & Stein, 2014). However, we have limited knowledge about visitors' motivation for visiting the FNST, their site preferences, and how visitors' motivations to participate in outdoor recreation are associated with attributes of the site like level of development and accessibility.

Researchers have argued that the destination serves as a medium through which socio-psychological needs or outcomes of recreation users could be attained (Crompton, 1979) and that identifying market segments provides a means to match visitors' needs and the management resources available (Kozak, 2002; Smith, Tuffin, Taplin, Moore, & Tonge, 2014). If recreation mangers have a clear understanding of how different site attributes are preferred by various segments of recreation users, they will be able to maintain recreation areas to meet needs and preferences of diverse recreation visitors. Such information can also help to frame effective marketing

messages to attract the visitors. Although each recreation destination has its unique characteristics in terms of site attractions, recreation users choose the site that they perceive as most likely to match with their motivations.

A study conducted earlier with FNST visitors found that almost all visitors were aware that Florida had a national scenic trail, but more than half were unaware that they were recreating on it (Albritton, Denny, & Stein, 2006). Consequently, it is likely that many Floridians are unaware about the exact location of- and recreation opportunities offered by the FNST even if they are using this trail. Hence, developing a better understanding of FNST users' characteristics, motivations, and site preferences is important to develop and implement effective marketing programs. This research uses three approaches to fill this gap in knowledge: 1) Identify the salient motivations and site attribute preferences of FNST visitors, 2) identify the market segments of FNST visitors based on their recreation motivations and site attribute preferences; and 3) examine the structural relations between motivations and site attributes preferences.

Review of Literature

Outcome Focused Management and Push/Pull Theory

Until the early 1970s, the management of recreation resources, services, and facilities in the USA was based on the supply oriented philosophy or Activity-Focused Management (AFM). AFM assumes that providing opportunities for recreation activities like fishing, swimming and camping will bring visitors to recreation sites. Although this management approach was useful for describing the number of people participating in any given activity, this framework did not

answer key important recreation management questions, such as what satisfactions or rewards did participants get from the activity or how could the quality of the experience be enhanced. Beginning in the early 1970s, Driver and his associates initiated research to answer such complex questions by studying how motivations determine one's recreation participation. They developed a conceptual foundation and empirical approaches for testing the role of motivations in outdoor recreation participation (Driver, 1983, 2008; Driver & Tocher, 1970; Moore & Driver, 2005). Their work contributed to the change in management approach from ACF to Experience Focused Management (EFM), which focuses on providing satisfying recreation experiences for visitors. The work of Driver and his associates was based on a psychological perspective, particularly the expectancy valence theory of motivation. Expectancy valance theory suggests that people participate in outdoor recreation because of their desire to achieve specific psychological outcomes, such as satisfaction with the recreation experience (Moore & Driver, 2005). Expectancy valence theory integrates two major concepts, expectancy and valence. Expectancy is the likelihood that an action will lead to a certain outcome or goal, whereas valence is the attractiveness of or anticipated satisfaction with an outcome (Moore & Driver, 2005). Valence and expectancy combine to determine one's recreation behavior, including choice of both recreation activity and site (Andereck, Gard-McGehee, Lee, & Clemmons, 2011).

Beginning in the early 1990s, researchers conceptualized the benefits from recreation, which led to the development of Benefit Based Management (BBM), now known as Outcome Focused Management (OFM). The fundamental concept of benefits includes 1) attainment of a desired condition, 2) attainment of an improved condition,

and/or 3) prevention of an unwanted condition (Driver, 2008; Stein & Lee, 1995). Further, the benefits (outcomes) can pertain to individuals (e.g., attainment of physical and mental health), society at large (e.g., enhanced community pride), the economy (e.g., local economic growth), and the environment (e.g., protection of endangered species). Many researchers have contributed to the development of the OFM approach through understanding of desired outcomes of diverse groups of recreationists and publics (Anderson et al., 2000; Driver, 2008; Kil, Holland, Stein, & Ko, 2012; Moore & Driver, 2005; Stein & Anderson, 2002; Stein & Lee, 1995). For example, Stein and Lee (1995) found connections between the benefits sought by the recreationists and physical, managerial, and social setting characteristics and that recreationists' participate in a variety of activities leading to achievement of multiple benefits. Based on the OFM approach, this research focuses on the benefits related to recreation users' personal desired condition.

Elaborating the concept of motivation, Crompton (1979) developed a theoretical framework called push/pull theory that was initially used in the tourism context and later extended to outdoor recreation participation. Research employing this conceptual framework explains motivations as one of the major determining factors in choosing a tourism or recreation site/activity (Baloglu & Uysal, 1996; Crompton, 1979; Dann, 1981; Kim, Lee, & Klenosky, 2003). As its name implies, push/pull theory suggests that push and pull factors are the important constituents in motivating tourists and recreationists (Dann, 1981). Push factors refer to the internal motives of the individual, while pull factors are the destination features and attractions (McCool & Moisey, 2001). According to

this notion, push and pull factors are conceptually different factors, but they are not independent of each other as travel decisions take place in a two-stage sequential process (Kim, Noh, & Jogaratnam, 2007). Once recreationists declare their recreation intention, based on their intangible or intrinsic desires or motivations like escape from the usual demands of life, rest and relaxation, health and fitness, adventure or social interaction, tangible destination attributes like aesthetics, accessibility and wildlife influence their decisions in selecting a specific site (Baloglu & Uysal, 1996). Thus, push and pull factors are related to two separate decisions made at two separate points in time; one focuses on whether to go whereas the other focuses on where to go (Klenosky, 2002).

Social Marketing

Recreationists are heterogeneous because they exhibit different ranges of attitudes, preferences and behaviors (Needham, Vaske, Donnelly, & Manfredo, 2007). Inherent heterogeneity within the user community in terms of needs and preferences can create challenges for managers in providing diverse benefits. A social marketing strategy has been widely used to promote experience opportunities, services, and facilities of recreation areas to diverse users. The first conceptual definition of social marketing was given by Kotler & Zaltman as the “design, implementation and control of programs calculated to influence the acceptability of social ideas and involving considerations of product planning, pricing, communication, distribution, and marketing research” (Kotler & Zaltman, 1971, p. 12). It is conceptually the same approach as commercial marketing, but its focus is on social benefits rather than commercial profit (Rangun & Karim, 1991). Social marketing primarily seeks to benefit individuals and families or the broader society, but not profits for the marketing organization itself.

Cluster segmentation has been one widely used tool in social marketing to make sense of consumers' beliefs, attitudes, needs, preferences, and behaviors by grouping heterogeneous individuals into homogenous groups (Bright, Manfredo, & Fulton, 2000; Hubert & Gipson, 1996; Kyle, Norman, Jodice, Graefe, & Marsinko, 2007; Needham, 2010; Paudyal et al., 2015). Many researchers have considered motivation as a basis for market segmentation in various contexts of tourism and outdoor recreation (Beh & Bruyere, 2007; Crompton, 1979; Lee, Lee, & Wicks, 2004; Loker-Murphy, 1997; Nyaupane, White, & Budruk, 2006; Park & Yoon, 2009). However, most of these studies neglected to include site attribute preferences on market segmentation.

Likewise, many researchers have examined relationships between motivations (push factors) and site preferences (pull factors) with various other experiential, cognitiv, and behavioral factors. For example, researchers have examined how motivation and site attribute preferences relate to leisure involvement (Kyle, Absher, Hammitt, & Cavin, 2006), satisfaction and destination loyalty (Yoon & Uysal, 2005), support for management practices (Hall, Seekamp, & Cole, 2010), environmental attitudes and behaviors (Kil, Holland, & Stein, 2014), place attachment and future visit intentions (Budruk & Stanis, 2013; Kil, Holland, & Stein, 2015; Kil et al., 2012; Lee, 2009). However, these studies did not examine how push factors and pull factors relate to each other.

Researchers have examined motivations and site preferences of tourists and recreation users to various destinations and have identified various traits of motivation domains and market segments (Beh & Bruyere, 2007; Crompton,

1979; Dillard & Bates, 2011; Iso-Ahola, 1982; Kim et al., 2007; Kim et al., 2003; Loker-Murphy, 1997; Smith et al., 2014; Yoon & Uysal, 2005). For example, through unstructured interviews with a sample from two cities in USA, Crompton (1979) identified nine domains of motivations, which he classified into two broad categories – socio-psychological and cultural. The socio-psychological category included seven domains: (1) Escape from a perceived mundane environment, (2) exploration and evaluation of self, (3) relaxation, (4) prestige, (5) regression, (6) enhancement of kinship relationships, and (7) facilitation of social interaction. Likewise, Loker-Murphy (1997) examined motivations of backpackers to national parks in Australia and found 'meeting local people' and 'excitement/adventure' were the most common motivations. Using cluster analysis, Loker-Murphy characterized four groups of backpackers as achievers,' 'self-developers,' 'social/excitement seekers,' and 'escapers/relaxers.' Similarly, Kim et al. (2003) examined push and pull factors among visitors to six national parks in South Korea. The push factor domains were 'family togetherness and study,' 'appreciating natural resources and health,' 'escaping from everyday routine,' 'adventure,' and 'building friendships.' The pull factor domains were 'key tourist resources,' 'information and convenience of facilities,' and 'accessibility and transportation.' Similarly, Yoon and Uysal (2005) examined push and pull motivations of tourists visiting Northern Cyprus and found that 'safety and fun,' 'escape,' 'knowledge and education', and 'achievement' were the important push factors. 'Cleanness and shopping,' 'reliable weather and safety,' 'different culture,' and 'water activities' were perceived as the major pull factors. Beh and Bruyere (2007) examined travel motivations and among visitors to three national reserves in Kenya. Motivation domains identified were 'escape,' 'culture,'

‘personal growth’, ‘mega-fauna,’ ‘adventure,’ ‘learning,’ ‘nature,’ and ‘general viewing.’ Visitors clustered into three groups, ‘escapists,’ ‘learners,’ and ‘spiritualists.’ Likewise, Smith et al. (2014) segmented Australian park visitors based on the purpose of the visit and activity undertaken at the site. Groups identified were ‘nature experience seekers,’ ‘passive experiencers,’ ‘nature explorers,’ and ‘relaxing socializers.’

As discussed above, both motivation and site attribute preferences are a dynamic and multi-dimensional concept that can vary across individuals and groups as well as among destinations (Kim et al., 2007; Kozak, 2002; Stein & Lee, 1995; Uysal & Hagan, 1993). The findings imply that motivations and site attribute preferences, market segments, and structural relationships between motivations and site preferences found in other study locations and populations may be less meaningful for marketing to FNST visitors. Few previous studies have examined motivations and/or site attribute preferences of FNST visitors and nearby natural areas (non-FNST). However, Albritton and Stein (2007) examined and compared FNST visitors to non-FNST visitors and found that these two groups significantly differed in terms of their recreation motivations and site preferences. Likewise, Albritton and Stein (2008) segmented non-FNST visitors based on their motivations and site preferences in order to develop marketing strategies to attract non-FNST visitors to FNST. Although these studies offered some understanding about the major motivations and site preferences of FNST visitors and market segments of non-FNST visitors, they ignored the heterogeneity that existed among FNST visitors and the relationships between

their motivations and site preferences. Therefore, identifying the market segments of visitors and examining the relationships between individual dimensions of motivation and site preference is important to better understand the purpose, needs, and preferences of visitors to this FNST. Taking a social marketing approach, this study segments a sample of FNST visitors into homogenous subgroups based on their reported recreation motivations (push factors) and importance of site attributes (pull factors) in selecting a recreation site. Then the research examines and contrasts the subgroups based on demographic traits and trip characteristics.

Methods

Research Design and Survey Instrument

The population of interest for this study was recreation trail users in Florida. I first identified major recreation areas along the FNST within an approximate driving distance of two hours from the University of Florida's main campus. Then I selected seven recreation areas randomly and collected data onsite using a questionnaire and index. The study sites included two national forests, two wildlife management areas, a state forest, a state park, and a greenway (Figure 2-1). I collected 353 responses during Fall 2011 – Spring 2014 with a response rate of 89%. Among the study sites, I collected the highest number of responses (37%) from the Ocala National Forest and the least (5%) from the Green Swamp Wildlife Management Area (Figure 2-2).

The study questionnaire and indices included five sections. Section A asked respondents about their current and past hiking experience. Section B included questions related to respondents' knowledge of FNST and its managing organization, the Florida Trail Association. Section C asked about trip expenditures and substitutes.

Section D included items related to site attribute preferences and motivations and section E included demographic questions.

Variable Measurement and Analysis

I assessed recreationists' motivations to participate in outdoor recreation or push factors with 23 items adapted from the Recreation Experience Preference index developed and tested by Driver and colleagues (Driver, 1983; Manfredo, Driver, & Tarrant, 1996). I assessed site attribute preferences or pull factors with an index of 14 items related to setting attributes that describe site characteristics and recreation opportunities. Responses for both push and pull items was a five-point scalar format ranging from 1 (not at all important) to 5 (very important).

I used confirmatory factor analysis to identify the domains of push and pull factors and structural equation modelling to examine the relationships between them in MPlus version 7.4 statistical software. Following Yoon and Uysal (2005), I specified and tested the fit of measurement models (factors or latent variables) of both push and pull factors before examining the structural relations and the fit of a full structural equation model. A latent variable like intrinsic motivation refers to an unobserved variable that can be measured through the multiple observable variables (Byrne, 2001).

I used item total correlation and Cronbach's alpha coefficient (Cronbach & Shavelson, 2004) to assess measurement reliability for each factor. Tests of reliability examine the internal consistency among responses to the variables and provides an indication of whether the items measure a single construct (Vaske, 2008). The item total correlation refers to the correlation between an individual

item score across respondents and the summative score for all items across respondents. A higher item total correlation indicates higher internal consistency and a value close to zero indicates poor internal consistency (Pett, Lackey, & Sullivan, 2003). An item total correlation of ≥0.4 and an alpha coefficient ≥0.7 indicate reliable measure of a respective domain (Leong & Austin, 2006; Vaske, 2008). I dropped any item that either (a) had item total correlation of <0.4 for the respective domain or (b) delating that item would significantly improve the Cronbach's alpha coefficient.

For each measurement model, I deleted items having less than 0.4 factor loadings and re-ran the model (Vaske, 2008; Yoon & Uysal, 2005). A factor loading refers to a correlation between indicator (item) and the factor (latent variable). I repeated the process of deleting weak indicators and re-running the model until a meaningful as well as statistically acceptable model fit was achieved. In this process, I dropped eight motivation items and three site attribute items (Table 2-1 and Table 2-2). I used a ratio of Chi-square to degree of freedom ($\chi 2/df$), Confirmatory Fit Index (CFI), Root mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) to examine whether each measurement and full structural model had good fit with the data. Values of $\chi 2/df$ between 1 and 3, CFI ≥ 0.95, RMSEA ≤0.08, and SRMR ≤0.08 indicate good fit of a model for a given data set (Brown, 2006; Hu & Bentler, 1999; Kline, 2005).

Once the reliable indicators were identified for both push and pull factors, I used cluster analysis to identify the market segments of respondents based on their motivations and site attribute preferences. Ward's and K-means are the two most commonly used clustering algorithms in the tourism and recreation marketing research.

However, there is no clear indication in the literature regarding a standard to choose one method over another (Paudyal et al., 2015). Thus, I compared the results from both methods and chose the Ward's clustering algorithm with Pearson correlation as the distance measure. Ward's minimum variance method is based on a least-square criterion, which minimizes the within-cluster sum of squares and thus maximizes the within cluster homogeneity (Mooi & Sarstedt, 2010).The intuitive interpretation of results from this method provided the most distinct and meaningful market segments (Kotler, 1994; Paudyal et al., 2015). I compared the market segments using Chi-square and ANOVA for demographics and trip characteristics in SPSS 24.0 statistical software. I used eta-square (η^2) to assess effect size on ANOVA test. Effect size should be interpreted as small (η^2=0.01), medium (η^2=0.06), and large (η^2=0.14), as suggested by Cohen (1988).

Results

Descriptive Characteristics of Sample

The average age of the sample participant was 43 (Std. Dev. = 14) years old, 63% were male, and the majority were White (94%). About two-thirds of the respondents (64%) were at least a college graduate, whereas about 10% graduated high school or less. The annual household income was less than $30,000 for about 20% of the respondents, $30,000 – 60,000 for one-third of the respondents, and $90,000 or more for one quarter of the respondents.

Respondents reported that they drove 55 miles (SD=58.5 miles), on average, to reach the recreation site during the trip during which they were interviewed. About half of the respondents (48%) were first time visitors. Among

the return visitors, about half (54%) had made no or limited (1 – 6 times) use of the site in the past year, whereas about 30% had visited the site more than 20 times in the past 12 months. The majority of the respondents (77%) spent one hour to half a day on the trail, whereas about 20% spent more than one day. Likewise, about 60% of the respondents hiked five miles or less, whereas one-quarter of the respondents hiked more than ten miles on the trail in the course of the trip during which they were surveyed.

Motivations and Site Attribute Preferences

A confirmatory factor analysis yielded five domains of motivations or push factors: (1) Achievement, (2) Nature and Scenery, (3) Fitness and Relaxation, (4) Social interaction, and (5) Solitude (Table 2-1 and Figure 2-3). Factor 1, Achievement, included four items representing motivations related to using equipment, testing skills, sharing skills with others, and meeting new people. The factor loadings for this factor ranged from 0.63 – 0.74 (Figure 2-3). Factor 2, Nature and Scenery, included three items related to enjoying scenery, experiencing nature, and exploring the area, with factor loadings ranging from 0.72 – 0.80. Factor 3, Fitness and Relaxation, included three motivation items, getting exercise, getting away from the usual demands of life, and feeling healthier, with factor loadings ranging from 0.53 – 0.65 (Figure 2-3). Factor 4, Social Interaction, included two motivation items related to being with a group with factor loadings of 0.61 and 0.75 (Figure 2-3). Finally, Factor 5, Solitude, included three motivation items, such as being away from people and experiencing solitude, with factor loadings ranging from 0.65 – 0.78 (Figure 2-3).

The index mean score of the factor Nature and Scenery was highest ($\bar{X}$=4.6, SD=0.6) suggesting that experiencing or enjoying nature or scenery or exploring the

area was the most important motivation to visit FNST. Fitness and Relaxation ($\bar{X}$=4.4, SD=0.7) was the second most important motivation to visit FNST. Respondents rated Achievement ($\bar{X}$=3.1, SD=1.1), such as using equipment, testing skills, sharing skills, or meeting new people, as the least important motivation to visit the trail (Table 2-1).

A confirmatory factor analysis of site attribute preferences or pull factors yielded four domains: (1) Quality Nature, (2) Consumptive, (3) Convenience, and (4) Arts and Culture (Table 2-2 and Figure 2-3). Factor 1, Quality Nature, included four items related to the environment and nature recreation, such as chance to see wildlife/birds and undisturbed nature, with factor loadings ranging from 0.59 – 0.67. Factor 2, Consumptive, included three site attribute items related to fishing and hunting with factor loadings ranging from 0.67 – 0.92. Similarly, the third pull factor, Convenience, included three items, easy access, closeness, and parking, with factor loadings ranging from 0.51 – 0.71. Finally, Arts & Culture, included two items, interesting small towns and local crafts or handiwork, with factor loadings of 0.64 and 0.81 respectively.

Among the site attributes, settings that offer the opportunity of experiencing quality nature, such as a chance to see wildlife, good environmental quality of air, water, and soil, and wilderness and undisturbed nature, was the most preferred ($\bar{X}$=4.3, SD=0.7) site attribute (Table 2-2). On the other hand, the opportunity for consumptive recreation, such as fishing and hunting, was the least preferred ($\bar{X}$=1.8, SD=1.0) attribute.

Structural Relations among Push and Pull Factors

The structural equation model (Figure 2-3) indicates that the push factor domain Achievement was positively associated with the two pull factor domains Consumptive (0.47, $p<0.01$) and Arts and Culture (0.64, $p<0.01$). Likewise, the push factor domains Nature and Scenery (0.65, $p<0.01$) and Solitude (0.43, $p<0.01$) were positively associated with the pull factor domain Quality Nature. Finally, the push factor domain Fitness and Relaxation was positively associated with the pull factor domain Convenience (0.46, $p<0.1$). On the other hand, the push factor domain Social Interaction was not significantly associated with any of the pull factor domains.

Cluster analysis generated four meaningful and distinct segments of respondents based on their motivations and site attribute preferences: (1) Nature Fit, (2) Passive, (3) Social, and (4) Opportunist (Table 2-3). The cluster segments did not differ in terms of most demographic characteristics (Table 2-4). However, they did differ significantly in terms of recreation characteristics (Table 2-5). The characteristics of each cluster segment are described below.

Nature Fit: The first cluster included 41% of the respondents who were motivated to visit FNST mostly to experience nature and scenery, fitness and relaxation, skills development, and experiencing solitude (Table 2-3). In comparison to other segments, this segment of respondents placed higher importance on recreation settings that offer the opportunities to experience quality nature and wildlife, for example to see wildlife/birds. This segment of respondents had a higher proportion of Whites (Table 2-4) than at least two other segments (Social and Opportunist). Respondents of this segment drove the longest distance to reach the destination, spent the most time, hiked

the farthest on the trail, and rated the highest visit experience relative to the other segments (Table 2-5).

Passive: The second cluster segment included 28% of the respondents who had no clear motivation and site attribute preference to visit the FNST (Table 2-3). They stated low importance for all motivation domains as well as site attribute preference domains. Almost all respondents (99%) in this group were White (Table 2-4) and the majority (57%) were first time visitors (Table 2-4). In addition, respondents in this group spent the least amount of time on the trail and they reported the lowest ratings of the visit experience compared to respondents in other segments (Table 2-4).

Social: The third cluster segment included 24% of the respondents who rated the push factor social interaction, being with members of their group, as important (Table 2-3). This group of respondents gave greater importance to site attributes related to convenience such as easy access, close to home, and parking when selecting a recreation site on the FNST (Table 2-3). Respondents from this segment had lower past use frequency than other segments except Passive. However, this group spent more time on the trail than respondents in other segments except for the Nature Fit segment.

Opportunist: The fourth cluster included 7% of the respondents. They reported higher importance of almost all motivation domains as well as site attribute domains than respondents in other segments (Table 2-3). Particularly, this segment of respondents reported higher importance of recreation settings that offer consumptive recreation experience (e.g., hunting, fishing), convenience

(e.g., close to home, parking), and arts and culture (e.g., local crafts, small towns) than recreation users in other groups. This group expressed higher importance of quality nature as well. In terms of motivation, this segment of respondents had higher motivation of achievement (e.g., use equipment and test skills) as well as social interaction (e.g. be with group). However, other motivations, such as experiencing nature/scenery and solitude, were also highly important. In comparison to the other three segments, this segment included the least proportion of Whites (Table 2-4). Likewise, compared to other segments, this segment of respondents drove the least distance (28 miles) to reach the destination, were mostly return users (74%) and had a higher proportion of individuals (72%) who visited the trail more than 20 times over the past year (Table 2-5). However, this segment of respondents hiked the least and spent less time on the trail than the other segments.

Discussion

The primary aim of this research was to identify motivations (push factors) and site attribute preferences (pull factors) of FNST visitors, identify their market segments, and examine the structural relationships between push and pull factors. Finding of multiple dimensions of both push and pull factors was consistent with the existing body of literature which suggest that visitors have multiple motivations and setting preferences, and there are significant relationships between visitors desired motivations and setting preferences (Kim et al., 2007; Kozak, 2002; Stein & Lee, 1995; Uysal & Hagan, 1993).

The visitor segmentation conducted in this study describes distinctive market segments of visitors that have meaningful and different characteristics in terms of recreation experiences, preferences, and behaviors. The findings of various structural

relations among motivations and site attribute preferences suggest that recreation settings should be managed in terms of how visitors prefer to experience or benefit from a site rather than the activity they choose (Driver, 2008; Stein & Lee, 1995).

It was well known that visitors' preferences of site characteristics are connected to their desired benefits or motivations, and both motivations and site attribute preferences are multi-dimensional concepts (Kim et al., 2007; Kozak, 2002; Stein & Lee, 1995; Uysal & Hagan, 1993). However, most past research focused on motivations or site attribute preferences of visitors to wildland settings – areas relatively far from human development such as wilderness areas, national parks, or other recreation sites in remote areas of the western United States. Thus, there is limited knowledge regarding the specific relationships among the push and pull factors from visitors to forests and recreation areas that are close to urban settlements. This research contributes to the body of knowledge by further explaining these relationships in the push/pull theory in the context of recreation settings that offer close access to nature for millions of people.

Management Implications

Offering preferred experience opportunities in preferred recreation settings improves management's success in enhancing desired positive outcomes for diverse visitors (e.g., personal, social, and economic benefit) and minimizing unwanted outcomes (e.g., conflicts associated with recreation and wildlife management). The findings presented in this study are useful for the FTA and partner agencies in managing existing resources in the FNST to satisfy

expectations of diverse recreation users. Distinct market segments of visitors and structural relations among various domains of motivations and site attribute preferences indicate the importance of manipulating recreation settings – keeping in mind specific motivations and preferences of target visitors.

This study found that nature-focused and fitness related experiences were the major push factors, and easily accessible and less-developed areas were the most important pull factors. Although the FNST will never achieve the high degree of pristine and primitive conditions of other national scenic trails (e.g., Pacific Crest Trail and Continental Divide Trail), it does provide easy access to nature for millions of Florida residents and tourists. The FNST is intentionally planned to traverse through various natural settings through a fairly urbanized state. It provides all users a convenient and easily accessible place to experience nature and attain fitness and relaxation, and this study shows it is serving those user groups. Past research often does not link primitive nature to experiences like fitness, but this research shows that natural surroundings are an important component of the diverse opportunities natural areas close to urban settings can provide.

Since the FNST has a unique role of providing access to nature, further marketing and promotion efforts should be continued to accommodate the diverse audiences who do use and could potentially use the FNST while continuing to maintain the ecological health of the areas. Findings show that most visitors highly value opportunities to experience scenic natural landscapes, undisturbed and tranquil environments, wilderness areas, and native wildlife and bird habitats. Thus, managers must ensure these opportunities are enhanced and sustained. In an urbanized state,

like Florida, high levels of unmanaged recreation use, encroachment of development, invasive species, and many other human-induced changes threaten the qualities of natural environments that make the FNST valuable to existing and potentially new users.

This study found four market segments of FNST visitors who had various motivations, site attribute preferences, and recreation behaviors. Marketing refers to providing a match between visitors' motivations and destination settings where visitors can attain their desired outcome. Thus, managers should continue their efforts of marketing various sections of FNST so that current users continue to use the trail and visit other parts of the trail. Marketing efforts based on these segments could also be useful to attract new users, who are perhaps unaware about the existence of this trail, but have similar recreation motivations as the current users have.

Among the market segments, the Nature-fit seems to be the most lucrative group because this segment included the largest proportion of visitors, they travelled the longest distance from their residence to the destination, spent more time and hiked farther on the trail, and were most satisfied with their experience. Satisfied visitors are more likely to revisit the place (Kil et al., 2012), thus establishing a loyal client base, which will attract more visitors (Kruger, Viljoen, & Saayman, 2017). Thus, Nature-fit segment of visitors is important to the USFS and FTA, as they have the greatest potential to directly benefit the local economies along the FNST. As the structural analysis shows, visitors who would like to enjoy nature/scenery, explore natural areas, and experience solitude are

likely to prefer large primitive or wilderness areas and wildlife habitats. Although these are rare in Florida, they do exist, and this study shows users are motivated to visit these areas. Thus, managing and promoting specific sections of the FNST that offer healthy environmental conditions, are less disturbed, have more wilderness areas, and provide opportunities to see a variety of wildlife and birds, will be effective to retain these lucrative visitors, and attract new visitors having the similar motivations of experiencing fitness and relaxation in natural environments.

The characteristics of the Passive visitor segment was consistent with past research that identified a conceptually similar visitor segment (Mehmetoglu, 2007; Palacio, 1997; Park & Yoon, 2009; Smith et al., 2014). This segment was second largest in terms of size and they drove a long distance to the destination, like the Nature-fit segment did, thus indicating higher potential economic benefit to local economies. However, the visitors of this segment had no clear motivation and site attribute preference to visit the FNST, they spent the least amount of time on the trail, and rated their experience lower than the other segments. Thus, further research is needed, preferably qualitative, to better understand what brings these visitors to the FNST, what experiences motivate them to take part in nature-based recreation, and what attractions will help them to attain their expected experiences. Marketing programs should approach this kind of current and potential visitor with clear information of all the opportunities each section of the trail provides, so that such users can find the site and opportunity of their interest.

The users in the Social segment valued social interaction, such as being with members of their group, as the most desired outcome and they preferred convenience

such as easy access, close to home, and parking when selecting a recreation site on the FNST. Thus, developing large group campgrounds or picnic areas on or near the FNST, close to roads and settlements and with plenty of parking space, will be effective to satisfy current and potential users who prefer to visit in large groups and gain more social experience.

The Opportunist segment, which was similar to the Want-it-all segment found by Park and Yoon (2009), had a wide range of motivations and site attribute preferences. However, unlike Park and Yoon (2009), who found 25% of such visitors in a rural tourism village in Korea, this study found only 7% of such visitors on the FNST. Marketing specific sections of the FNST and associated managed areas that offer a wide range of recreation opportunities to people living nearby from the natural areas could attract such users who have multiple motivations.

Users in both the Opportunist segment and Nature-fit segment placed higher importance on achievement. Such users who are motivated to use equipment, test skills and share knowledge, and meet new people, are likely to choose sections of the FNST that offer good fishing/hunting opportunities like Ocala NF and Green Swamp WMA or areas that have interesting small towns or areas where local crafts and handiworks are popular. Thus, promoting such areas along or near the trail in various sections of the FNST could be beneficial to attract new users having similar motivations for recreation.

Multiple dimensions of both push and pull factors and different preferences of different market segments indicate that a one-size fits all

approach in promotion and marketing will not be effective to all kind of users. Thus, marketing messages should be specific to capture needs and desires of both current and potential users. While doing so, FNST managers should keep in mind the various user typologies (i.e., “Nature-fit”, “Passive,” “Social,” and “Opportunistic”), and their respective motivations and preferences.

Limitations and Future Directions of Research

The push and pull items considered in the instrument of this study do not include all possible dimensions of motivations and site characteristics. A master list of recreation experience preference developed by Driver (1983) includes 300 plus items that represent 39 domains of motivations. However, it was not practical to include all possible domains of motivations in our survey instrument. Keeping this in mind, this study focused on 23 items representing six domains of motivations that were most commonly found in the literature in this field of study. Likewise, 14 items were included to represent various site attributes, which do not represent all the possible attributes of site attraction preferences. Also, motivation is only one of many variables which could affect recreationists’ destination preference (Baloglu & Uysal, 1996). Thus, research that includes possible additional variables, such as visitors’ perceived constraints (Baloglu & Uysal, 1996) or perceived broader positive outcome (e.g., social, economic) to the community (Stein & Lee, 1995) will be more beneficial for agencies in marketing various sections of FNST. There could be other pull factors, important to specific group of visitors, which this study did not include. Future research can use the model developed in this study to further expand our understanding about motivations and site attribute preferences by exploring additional attributes that could attract visitors to FNST.

Although recreation destinations often offer multi-products, they could also offer different experience opportunities during different seasons (e.g., good hiking during winter and good springs experience during summer). In fact, research that compares winter visitors and other season visitors could give better insight about the relations between motivations and site attribute preferences. These differences might be less significant in Florida than in regions where there are stark differences between winter and non-winter seasons, but differences likely exist and should be examined.

Galloway (2012) compared motivation and site preference among the recreation users participating in different activities (e.g., whitewater kayaking, multisport racing, and fishing) and found significant differences. Thus, comparing the structural relations between motivations and site attribute preferences across various recreation activity users will be an additional contribution to the body of knowledge. Research has found the same but different sizes of market segments in two different times (Fix & Taylor, 2011), thus suggesting that recreationists' motivations and site preferences could change over time. Comparing motivations and site preferences, their structural relations, and cluster segments over different time periods could offer more robust knowledge on this topic.

The visitor segments identified here offers a representative profile of recreation users of the FNST, which provides insights for developing marketing programs. However, the sample may not represent the visitors to all sections of the FNST as only visitors to Central and North-central sections were included. Thus, future research should consider taking representative samples from all

sections of FNST, which will offer a more holistic picture of recreation users' expected experiences and site preferences.

In conclusion, consistent with the previous research, different destination attributes are found to be preferred by users with various motivations to participate in outdoor recreation. However, this research adds to the body of knowledge by presenting relationships among users' motivations and site attribute preferences from a context of urban parks and recreation areas. Relationships between motivations and site attribute preferences are different than that found in previous research from rural contexts. For instance, research conducted in rural contexts have found that recreation users motivated for achievement would want primitive and hard to access areas and adventurous activities. However, this study found users motivated for achievement, such as testing and sharing knowledge and skills and meeting new people, are likely to choose destinations that offer fishing or hunting opportunities or towns that are small and culturally interesting or are popular for handicrafts. Findings presented in this study are unique and could be applicable to urbanized regions where nature-based recreation opportunities are within a short distance to millions of people. FNST managers should continue their efforts to enhance and sustain natural environments along the trail while maintaining easy access and parking spaces to attract users having various motivations and preferences. As shown in this research, a segmentation of visitors based on motivations and site attribute preferences serves as a useful marketing tool as it offers information regarding specific markets to focus in relation to available site attractions. Agencies should maintain and promote FNST keeping in mind various typology of

users, as shown in this research, in terms of their motivations, site attribute preferences, and recreation behaviors.

Table 2-1. Index mean and measurement reliability of motivations domains of users of the Florida National Scenic Trail.

Motivation domains and items (push factors)	Index mean (SD)	Reliability (Cronbach's alpha)
Achievement	3.1 (1.1)	0.79
To use my own equipment		
To test my skills and abilities		
To share my skills and knowledge with others		
To meet new people		
Nature & Scenery	4.6 (0.6)	0.79
To enjoy the scenery		
To experience nature		
To explore the area		
Fitness & Relaxation	4.4 (0.7)	0.69
To get exercise		
To get away from usual demands of life		
To feel healthier		
Social Interaction	3.7 (1.1)	0.67
To be with members of my group		
To be with people who enjoy the same things I do		
Solitude	3.8 (1.0)	0.76
To be on my own		
To be away from people		
To experience solitude		

Values in parenthesis indicate standard deviation. The following items were dropped from the measurement model of push factors because of factor loading, or item total correlation <0.4.

To learn about natural history of the area
To learn more about the nature
To experience new and different things
To have thrills and excitement
To be close to nature
To enjoy the smells and sounds of nature
To do something with my family
To relax physically

Table 2-2. Index mean and measurement reliability of site attribute preferences (pull factor) domains of users of the Florida National Scenic Trail.

Site attribute domains and items (pull factor)	Index mean (SD)	Reliability (Cronbach's alpha)
Quality Nature	4.3 (0.7)	0.67
Chance to see wildlife/birds		
Good environmental quality of air, water, and soil		
Wilderness and undisturbed nature		
Consumptive	1.8 (1.0)	0.84
Good fishing		
Good big game hunting		
Good small game hunting		
Convenience	3.4 (1.0)	0.65
Easy access to the area/being easy to get to		
Close to home		
Available parking		
Arts & Culture	2.4 (1.1)	0.69
Interesting small towns		
Local crafts or handiwork		

Values in parenthesis indicate standard deviation. The following items had factor loading or item total correlation <0.4. Thus, were dropped from the measurement model of pull factors.

To see the natural water features
Good camping
Historical, military, or archeological sites

Table 2-3. Comparison of cluster segments by motivations and site attribute preferences of users of the Florida National Scenic Trail.

Domains	Index mean	Cluster segments				Tuckey's post-hoc	Effect size (η^2)
		A Nature-fit (41%)	B Passive (28%)	C Social (24%)	D Opportunist (7%)		
Motivations (Push Factors)							
Achievement	3.1 (1.1)	3.8 (0.8)	2.2 (0.9)	2.8 (0.9)	3.8 (0.9)	A,D>C>B	0.41
Nature & scenery	4.6 (0.5)	4.8 (0.4)	4.6 (0.6)	4.5 (0.5)	4.6 (0.6)	A>B,C,D	0.05
Fitness & relaxation	4.4 (0.7)	4.7 (0.5)	4.3 (0.8)	4.3 (0.6)	4.4 (0.7)	A> B,C,D	0.06
Social interaction	3.7 (1.1)	3.8 (1.0)	2.8 (1.1)	4.2 (0.7)	4.1 (0.8)	C,D>A>B	0.23
Solitude	3.8 (1.0)	4.3 (0.6)	3.5 (1.1)	3.0 (0.8)	4.1 (0.9)	A,D>B>C	0.30
Site Attribute Preferences (Pull Factors)							
Quality Nature	4.3 (0.7)	4.5 (0.7)	4.2 (0.6)	3.9 (0.7)	4.3 (0.8)	A,B,D>C	0.07
Consumptive	1.8 (1.0)	1.6 (0.8)	1.6 (0.9)	1.7 (0.8)	4.1 (0.8)	D>A,B,C	0.34
Convenience	3.4 (0.9)	3.3 (0.9)	3.1 (1.0)	3.6 (0.8)	4.0 (0.9)	D>C>A,B	0.06
Arts & Culture	2.4 (1.1)	2.3 (1.0)	2.4 (1.0)	2.1 (0.9)	4.2 (0.8)	D>A,B,C	0.18

Values in parenthesis indicate standard deviation. Effect size should be interpreted as small (η^2=0.01), medium (η^2=0.06), and large (η^2=0.14).

Table 2-4. Comparison of cluster segments by demographic characteristics of users of the Florida National Scenic Trail.

Demographics	Sample average	Cluster segments				Sig.
		Nature-fit	Passive	Social	Opportunist	
Age (years)	43.1 (14.5)	44.0 (13.9)	44.8 (15.7)	39.4 (13.6)	43.8 (15.5)	
Gender (%)						n.s.
Male	63.4	62.4	60.8	68.1	63.2	
Female	36.6	37.6	39.2	31.9	36.8	
Race/Ethnicity (%)						
Hispanic	3.2	4.3	-	5.8	-	
White	94.1	96.4	98.7	87.7	82.4	***
African American	3.0	1.8	1.3	6.2	5.9	n.s.
Other#	4.1	1.8	2.6	7.7	11.8	**
Education (%)						n.s.
High school or below	8.2	9.5	5.2	8.7	10.5	
Some college	28.1	31.0	18.2	30.4	42.1	
College graduate	37.4	35.3	40.3	39.1	31.6	
Some graduate school or above	26.3	24.1	36.4	21.7	15.8	
Income (%)						n.s.
Less than 30,000	18.4	17.1	14.3	26.1	15.8	
30,000 - 59,999	33.0	34.2	31.2	33.3	31.6	
60,000 - 89,999	24.1	23.9	24.7	21.7	31.6	
90,000 or more	24.5	24.8	29.9	18.8	21.1	

#Other: American Indian, Native Hawaiian, and Asian American; Sig. = significance. ***Significant at 1% level; **Significant at 5% level; n.s. = not significant

Table 2-5. Comparison of cluster segments by recreation characteristics of users of the Florida National Scenic Trail.

Recreation characteristics	Sample average	Cluster segments				Sig.
		Nature-fit	Passive	Social	Opportunist	
Distance drove (miles)[$]	54.9 (58.5)	63.9 (60.8)	61.1 (63.1)	42.3 (52.5)	27.5 (27.4)	**
Visit experience[#]	8.6 (1.4)	8.9 (1.1)	8.3 (1.6)	8.6 (1.3)	8.8 (1.6)	
Past trail use (%)						***
First time visitors	47.9	52.1	57.0	36.2	26.3	
Return visitors	52.1	47.9	43.0	63.8	73.7	
Past year use (% of return visitors)						*
None	11.7	10.7	11.8	14.6	7.1	
Low (1-6)	42.8	42.9	47.1	48.8	14.3	
Medium (7-20)	15.9	21.4	17.6	9.8	7.1	
High (>20)	29.7	25	23.5	26.8	71.4	
Time spent (%)						***
1 hour or less	28.7	24.1	38	19.1	52.6	
Few hour - half a day	46.8	37.1	51.9	61.8	31.6	
One whole day	5.7	9.5	1.3	2.9	10.5	
More than one day	18.8	29.3	8.9	16.2	5.3	
Miles Hiked (%)						**.
Less than a mile	9.6	8.6	8.9	10.4	15.8	
1 - 5 miles	49.8	43.1	58.2	50.7	52.6	
5 - 10 miles	15.7	14.7	16.5	19.4	5.3	
> 10 miles	24.9	33.6	16.5	19.4	26.3	

[$]Out of state visitors (9.8%) not included; #visit experience measurement scale ranged from 1 to 10, with 10 being best experience; Sig. = significance. ***Significant at 1% level; **Significant at 5% level; *Significant at 10% level.

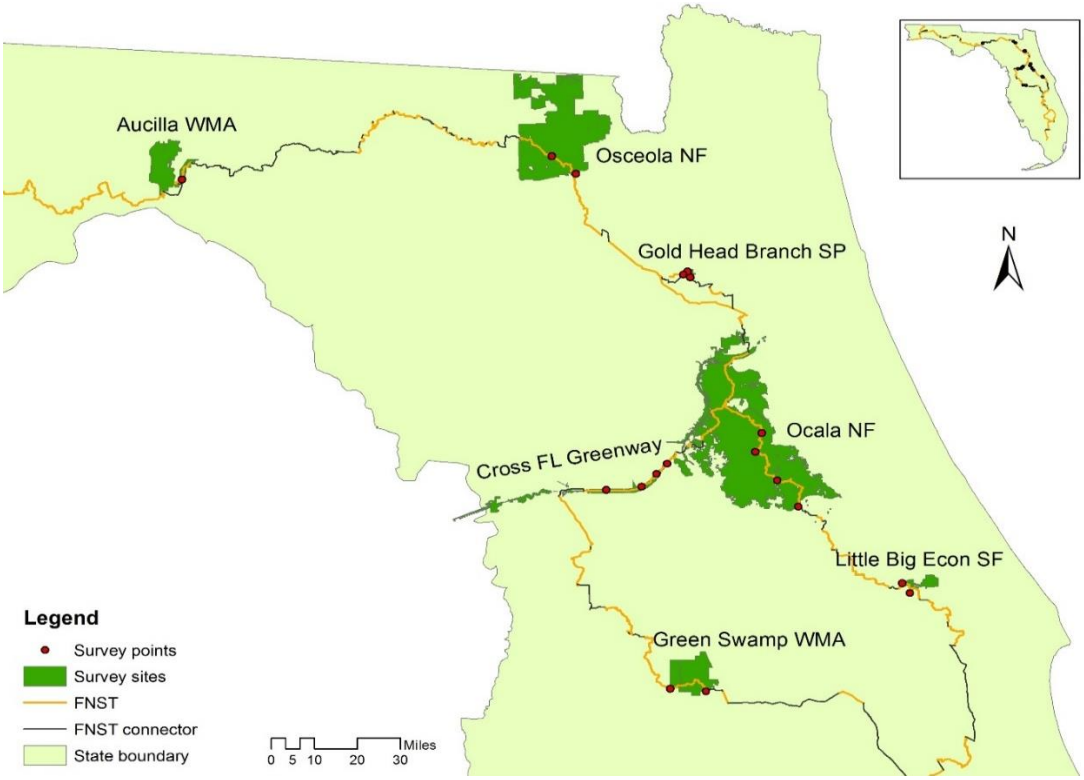

Figure 2-1. Study area and survey sites in Florida, USA.

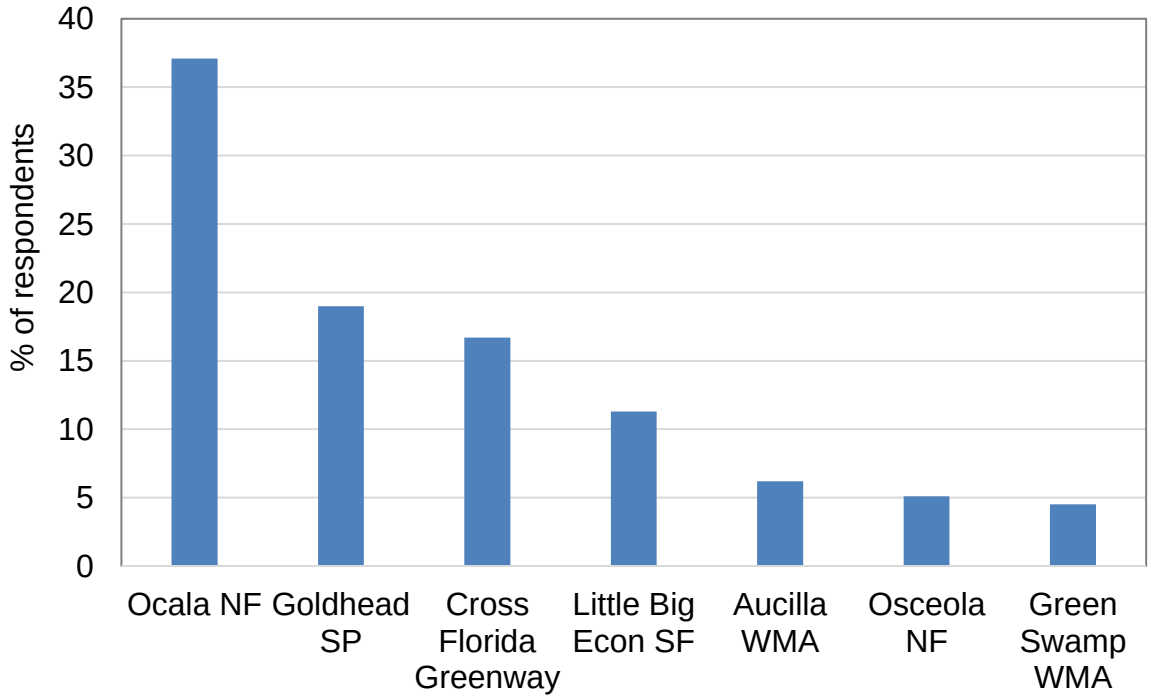

Figure 2-2. Proportion of respondents by survey sites in Florida, USA.

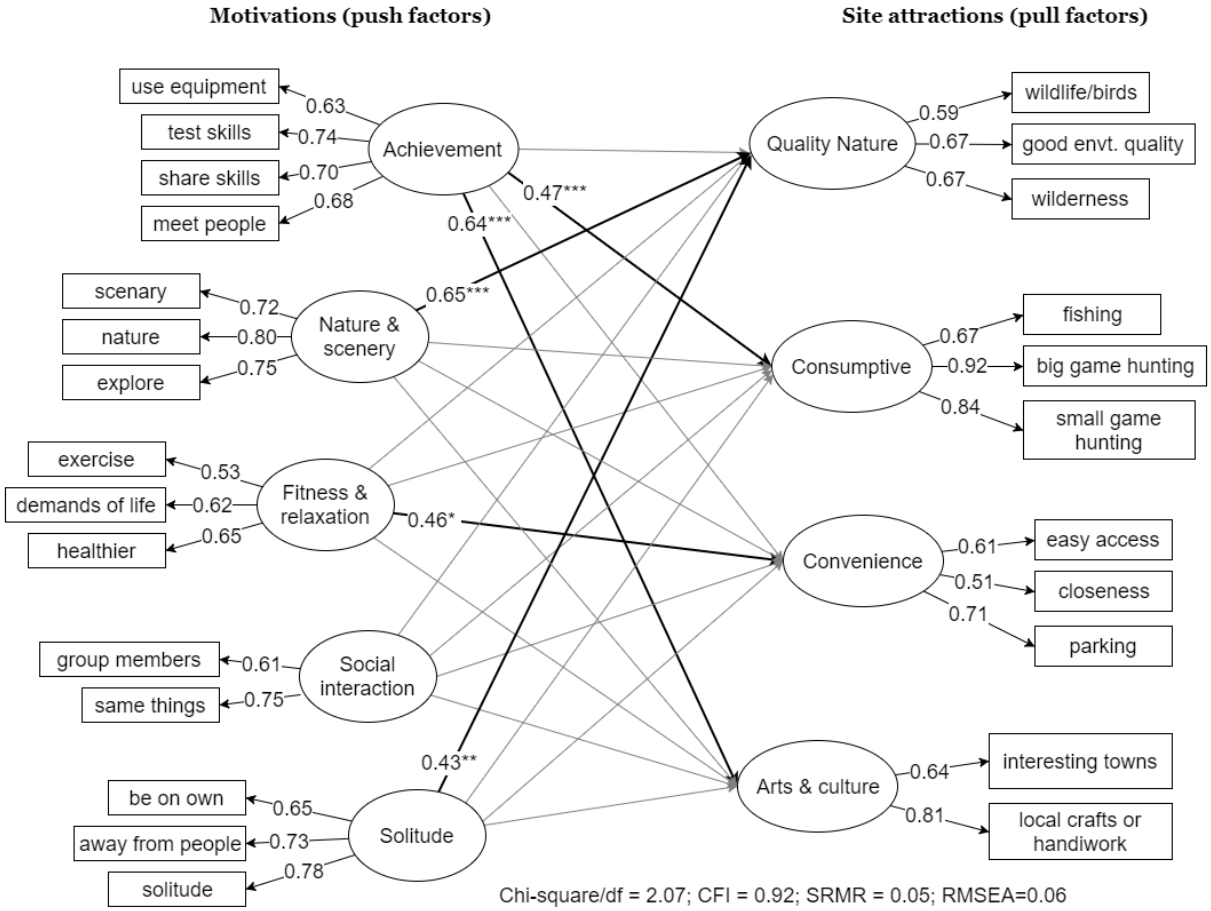

Figure 2-3. Measurement models and structural relations among motivations (push factors) and site attribute preferences (pull factors) of users of the Florida National Scenic Trail.

Note: Bold lines indicate statistically significant structural relations. ***Significant at 1% level; **Significant at 5% level; *Significant at 10% level.

CHAPTER 3
HOW DO ACTIVITY AND KNOWLEDGE OF PRESCRIBED BURNING AFFECT RECREATIONISTS' PERCEPTION OF SCENIC BEAUTY AND RECREATION SATISFACTION FROM RED-COCKADED WOODPECKER HABITAT?

Background

The red-cockaded woodpecker (*Picoides borealis*) is a federally designated endangered keystone species of bird in the United States. This bird has a high ecological value as at least 27 species of vertebrates have been documented to use red-cockaded woodpecker (RCW) cavities either for roosting or nesting (US Fish and Wildlife Service, 2015). Even though the species is protected under the Endangered Species Act of 1973, managers face challenges to increasing its abundance to levels high enough for recovery to occur. The primary threat to RCW is lack of suitable habitat. Research has shown that prescribed burning and tree harvesting play important roles in maintaining suitable habitat condition for RCW (Ramirez & Ober, 2014).

Prescribed burning and tree harvesting treatments are effective to maintain ecologically healthy ecosystems and habitat for many wildlife species, including RCW. However, researchers have also found that people do not always perceive prescribed burning as aesthetically pleasing and acceptable (Gobster, 1999; Ribe, 1999; Ryan, 2005; USDA Forest Service, 1995; Williams & Cary, 2002). Human dimensions literature in various other contexts (e.g., climate change) indicates that knowledge is not the strongest determinant of people's perception toward climate change. It is important to know whether knowledge about the ecological importance of prescribed burning would be likely to affect visitors' perception of scenic beauty and recreation satisfaction from forests that require burning and other management (e.g., thinning) to maintain habitat for wildlife (e.g., RCW).

Research reports about the publics' knowledge of the ecological importance of fire and fire management in the southern United States are significantly fewer (12%) in comparison to the western United States (52%) (Toman, Stidham, McCaffrey, & Shindler, 2013). In addition, the research regarding recreationists' knowledge of prescribed burning, and how this knowledge affects recreationists' perception of scenic quality and recreation experience, is limited. Knowledge about whether the type of recreational activity affects visitors' perception towards prescribed burning is also limited; for example, whether hunters perceive prescribed burning differently than hikers. This study examines recreationists' knowledge about prescribed burning and perception of scenic beauty and recreation satisfaction from forest sites maintained as RCW habitat in Florida. This research answers the following questions.

1. Do the activities people choose to participate in relate to their knowledge of prescribed burning and perception of scenic beauty and recreation satisfaction from forests sites requiring frequent burning?
2. Does providing ecological information about prescribed burning improve recreation users' perception of scenic beauty and recreation satisfaction from forest sites requiring frequent burning?
3. How does knowledge about prescribed burning affect recreation users' perception of scenic beauty and recreation satisfaction from forest sites requiring frequent burning?

Conceptual Framework

Past studies have suggested that public perceptions of forest and landscape aesthetics involve complex relationships between affective perception of visual stimuli and cognitive perception of approval (Ribe, 2002). However, there is not yet a well-developed consensus among psychologists regarding activation of human affective perceptions and cognitive perceptions. Some psychologists have argued that affective reactions are pre-cognitive and they occur without extensive cognitive processing

(Zajonc, 1980). Based on this hypothesis, people make affective perception, such as scenic beauty, sooner and with greater confidence than cognitive judgments, such as acceptability of management treatment or realization of recreation experience (Zajonc, 1980). On the other hand, some scholars have argued that affect can be both pre- and post-cognitive (Lerner & Keltner, 2000). Thus, when there is absence of conditioning knowledge or information, affective perception of visual stimuli, such as scenic beauty, may not necessarily be different from more cognitive perception, such as acceptability of landscape management (Ribe, 2002; Zajonc, 1980). When perceptions of acceptability are only partly affective but mainly cognitive, these two perceptions may differ significantly (Ribe, 2002). Using this theoretical framework, this study examines whether providing ecological information about prescribed burning would affect visitors' perception of aesthetic and recreation quality of forest sites representing various times after burning.

Scenic Beauty and Recreation Satisfaction

The landscape perception literature has used terms "scenic beauty," "landscape quality," "visual quality," "scenic quality," or "natural beauty" to refer to the aesthetic component of the environment. However, Daniel and Boster (1976) and Daniel and Vining (1983) argued that "scenic beauty" best captures the meaning associated with visual appreciation of forest environment. Daniel defines scenic beauty as "visual aesthetic quality" (2001, p. 270). In addition, the terms "scenic beauty" and "scenic value" have been used interchangeably in the literature. However, Johnson, Brunson, and Kimura (1994) operationalized these terms as two conceptually separate constructs. Authors suggested that the relationship between these two constructs are not entirely clear because the construct, "scenic value," gives different meanings in

different contexts (economics and psychological). In this study, use of the term “scenic beauty” refers to Daniel’s definition of scenic beauty for forest aesthetic assessment.

In recreation context, expectancy valence theory suggests that people participate in outdoor recreation because of their hope to fulfil preferred needs, motivations, or expected experiences (Manning, 1999; Moore & Driver, 2005). The expectancy valence theory is an outcome of integrating two major concepts, expectancy and valence. Expectancy is the likelihood that an action will lead to a certain outcome or goal whereas valence is the attractiveness of, or anticipated satisfaction with, an outcome (Lawler, 1973). Thus, valence and expectancy combine together to determine one’s choice of recreation activity and site (Andereck et al., 2011). In this theoretical perspective, the degree of congruence between aspirations and the perceived reality of experiences is defined as recreation satisfaction (Bultena & Klessig, 1969, p. 349). In this research context, I operationalize recreation satisfaction as the congruence between desired experience and perceived attainment of experience associated with appearance of recreation sites (Graefe & Burns, 2013).

Although scenic beauty of a forest site could always contribute to recreation satisfaction and desire to visit an area (Sevenant & Antrop, 2009), scenic beauty may not be the major factor of importance in every case. For example, Tahvanainen, Tyrväinen, Ihalainen, Vuorela, and Kolehmainen (2001) examined perceived scenic beauty and recreation preference of five forest management practices: small clear cutting, thinning, removal of undergrowth, natural state, and traditionally managed cultural landscape. Results showed no clear association between scenic beauty rating and recreation preference. Likewise, Brunson and Shelby (1992) examined scenic

beauty and acceptability of various forest management practices and found that old-growth forest setting rated highest and clear-cut rated lowest in terms of both scenic beauty and acceptability for recreation. However, acceptability rating of each forest management practice was higher when the setting was considered a place to hike than when it was considered as a place to camp (Brunson & Shelby, 1992). Thus, it is possible that different recreation users would perceive scenic beauty and recreation value of forest management practices in wildlife habitats differently.

Studies have shown that the physical characteristics of forest attributes such as tree density and forest type account for a significant proportion of the variance in public perception of scenic beauty (Daniel, 2001). However, different cultural and social traits of the observers have also been found to affect evaluation of scenic beauty and recreation value of forests (Buhyoff & Leuschner, 1978; Daniel & Boster, 1976). Based on extensive review of the literature, Zube, Sell, and Taylor (1982) identified four dominant paradigms in landscape perception: the expert paradigm, the psychophysical paradigm, the cognitive paradigm, and the experiential paradigm.

In the expert paradigm of assessing landscape aesthetics, forest and landscape experts assess visual quality of landscape features in terms of color, form, line, and texture and classify forest and landscape into high, medium, and low visual quality categories (USDA Forest Service, 1995). This expert-based approach of landscape aesthetics was integrated into the Scenery Management System (SMS), a forest management framework developed by USDA Forest Service. The SMS offered an integration of forest and landscape aesthetics with other biological, physical, and social/cultural resources in the planning processes. Expert-based assessment of

landscape aesthetics, however, was heavily criticized for lacking adequate levels of precision, reliability, and validity (Daniel & Vining, 1983). One of the major drawbacks associated with this approach was that the public were not involved in the assessment.

The psychophysical, cognitive, and experiential paradigms assume that scenic beauty is an output of interactions between the physical appearance of the forest and the viewers' psychological, cognitive, and experiential processes. These paradigms involve the untrained public in the assessment of scenic beauty and acceptance of management practices. These paradigms are found to achieve greater reliability and validity than the expert paradigm (Brown & Daniel, 1987; Daniel, 2001).

The psychophysical approach to landscape scenic beauty evaluation emphasizes the use of mathematical modeling (scenic beauty estimation [SBE] model) to examine relationships between objectively quantifiable site attributes and subjective ratings of the site (Daniel & Boster, 1976). One of the strengths of this approach is that it can relate changes in manipulative site characteristics with their impacts on scenic beauty (Ruddell, Gramann, Rudis, & Westphal, 1989). However, a major criticism of psychophysical models is their limited ability to produce theoretical explanations of predictor variables. In other words, the psychophysical models place emphasis on prediction, with little focus on psychological processes that mediate the relationship between physical attributes of a particular site and its ratings regarding scenic beauty and recreation preferences (Ruddell et al., 1989). Also, the SBE model standardizes scenic beauty ratings of individuals to adjust for potential differences in judgement criteria among the observers (Daniel & Boster, 1976). Therefore, it does not account for the potential variation in scenic beauty perception across publics of different socio-

cultural, cognitive, and experiential characteristics. However, researchers have suggested that forest and landscape preference is a function of both the scene characteristics (forest attributes and silvicultural treatments) and human characteristics (Edwards et al., 2012; Kearney & Bradley, 2011). Thus, it is important to examine the variation in perceived scenic beauty and recreation preferences across recreationists of different experiential, cognitive, and socio-cultural characteristics.

The cognitive paradigm involves assessment of forest scenic beauty by human observers taking the socio-cultural factors, human meanings associated with the forest, experience, and expectations into account (Hull & Reveli, 1989; Zube et al., 1982). Likewise, the experiential paradigm involves assessment of forest scenic beauty through examination of human-forest interactions (Zube et al., 1982). The concept of human interaction with nature refers to what people put into and take from nature. Thus, it is important to have an idea of what people will be doing in their interactions with a landscape to understand the human-nature interactions involved. For example, whether visitors hike or view the scenery will significantly affect the nature-person interaction and, in turn, the user's perception of the aesthetic quality of the site (Zube et al., 1982). Thus, researchers have used cognitive and experiential paradigms to examine which forest attributes are preferred more than others with regard to perceived scenic beauty and recreation preference, but also how socio-cultural and experiential factors are associated with these perceptions.

Socio-cultural and Experiential Factors

Hull and Reveli (1989) argue that a person's immediate purpose in an environment influences the type of information sought and the criteria used to evaluate that environment. They suggest that landscape preferences are learned and depend

upon a person's culture, past experiences, and current purposes. Based on this concept, various researchers have examined the role of socio-cultural and experiential factors on perception of scenic beauty and recreation preferences. However, there is inconsistency in the literature regarding the effect of experiential and socio-cultural factors on the perception of scenic beauty and recreation value of forest sites. Some researchers have found similarities in scenic beauty evaluations of landscapes among persons of different ages, genders, professions, socio-economic status, and cultures (Daniel & Boster, 1976; Daniel & Vining, 1983; Frank, Fürst, Koschke, Witt, & Makeschin, 2013; Kearney, 2001; Kearney & Bradley, 2011). However, other studies have found significant variations in perception/attitude about scenic beauty and recreation value across observers of different age groups, genders, and residential settings. For example, Tahvanainen et al. (2001) found that middle-aged and older respondents perceived clearcutting as increasing scenic beauty, whereas younger respondents thought clearcutting would decrease scenic beauty. In the same study, rural residents thought that clearcutting would have negative impact on scenic beauty while urban residents thought clearcutting would improve scenic beauty (Tahvanainen et al., 2001). Similarly, in a national survey of public perception and acceptance of prescribed fire, Lim, Bowker, Johnson, and Cordell (2009) found that African American and Hispanics were significantly more concerned about the impact of prescribed fire on aesthetics and harm to wildlife than Caucasians. Likewise, Fix, Carroll, and Harrington (2013) found that visitors with a greater number of previous visits to a site were more likely to choose to recreate in areas that fit more primitive recreation opportunity spectrum (ROS) classes than visitors with fewer previous visits. This implies that

frequent visitors could avoid sites that exhibit a higher proportion of visible human disturbances like prescribed burning. However, it is also possible that visitors who visit a site more frequently are more aware of forest management objectives for that site and have different standards of acceptance than less frequent visitors. However, none of the previous studies on forest aesthetic perception focused on management practices specific to habitat management for endangered wildlife species like the RCW. Thus, it is important to know how the recreation activity of participants and other socio-cultural and demographic traits are related to perception of scenic beauty and recreation value of forest sites maintained as RCW habitat.

Knowledge and Information

Studies have found that Florida residents generally exhibit varying levels of knowledge and support toward prescribed burning (Agrawal & Monroe, 2006; Jacobson, Monroe, & Marynowski, 2001; Monroe, Nelson, & Payton, 2006; Thapa, Holland, & Absher, 2008; Wan, Stein, Paudyal, & Colonna, 2014). For instance, Jacobson et al. (2001) assess the knowledge of fire among rural and suburban Florida residents living in counties that experienced severe wildfire events. They found that over two-thirds of respondents accurately answered six technical questions about fire. Over 79 percent of the respondents knew that fire helps improve forest health and 67 percent understood that fire is useful in creating wildlife habitat (Jacobson et al., 2001). In contrast, Thapa et al. (2008) found that two-thirds of visitors to natural areas in Florida knew what a prescribed burn is, but only 25% thought that natural areas in Florida should be burned periodically. Similarly, Wan, Stein, et al. (2014) conducted focus group discussions to assess knowledge of prescribed burning among hunter-residents and non-hunter residents in Northeastern Florida. Both groups of residents had some knowledge about

prescribed burning. However, hunter-residents demonstrated more sophisticated knowledge about prescribed burning, such as benefits to specific vegetation and wildlife species, whereas non-hunter residents expressed more general knowledge, such as benefits to the ecosystem and reduced risk of wildfire (Wan, Stein, et al., 2014).

Despite knowledge and support for prescribed burning, studies have also found that Florida residents express high concern about risk of fire to wildlife (DeLorme, Hagen, & Stout, 2005). A study conducted in Texas has shown that people who believed that prescribed fire creates wildlife habitat and other positive outcomes were more supportive of prescribed burning than others (Rideout, Oswald, & Legg, 2003). This suggests that incomplete knowledge on the part of people who support wildlife management may lead them not to support prescribed burning in public lands because of the perceived negative impacts of fire on wildlife.

The well-known ecologist Aldo Leopold explained the concept of forest aesthetics based on two perspectives, the scenic perspective and the ecological perspective. Although perception of scenic beauty is based on visual appearance alone, an ecological perspective requires acquired knowledge of the dynamic qualities of forest environments and appreciation of both subtle and dramatic changes during forest lifecycles (Gobster, 1994). This perspective emphasizes the importance of ecological information on the perception of scenic beauty and recreation value or acceptability of a given forest or recreation setting.

Some studies have found a positive effect of ecological information on scenic beauty perception and attitudes toward forest management practices (Anderson, 1981; Buhyoff, Leuschner, & Wellman, 1979; Kearney, 2001; Ribe, 1999). For example,

Anderson (1981) found that labels of land use designation significantly affected scenic beauty ratings of forest landscapes. Particularly, observers rated areas labelled “wilderness area” or “national park” higher for scenic beauty than other labels. Areas labelled “commercial timber stands” or “leased grazing areas” received lower ratings of scenic beauty. Likewise, when Kearney (2001) showed pictures of clear-cuts from Midwestern forests and included information about the benefits of birch and jack pine regeneration, she found increased acceptance and visual quality ratings. In contrast to the above findings, some researchers have argued that humans are resistant to changing aesthetic preferences (Daniel, 2001) and that ecological information only improves the acceptance for forest and ecosystem management, not the perception of scenic beauty (Ribe, 1999). Thus, understanding how recreationists perceive scenic beauty and recreation value of forests managed for endangered wildlife species with and without ecological information could expand the body of knowledge on the perception of scenic beauty and recreation experience on lands managed for wildlife species.

Research examining the perception of scenic beauty and recreation value from the perspective of recreation users participating in different activities would expand our theoretical knowledge regarding the relationship between aesthetic preference and acceptance behaviors. Such information would also improve the ability of forest managers to accommodate diverse recreation preferences in managed forests. Specifically, understanding how different recreationists perceive scenic beauty and recreation value of forest management practices intended to maintain habitats for RCW could improve overall understanding of people’s relationship with managed landscapes

and improve the management of lands for multiple objectives. Past studies examined how the public's knowledge of prescribed burning is associated with their support for prescribed burning and found that people with greater knowledge of prescribed burning are more likely to support prescribed burning. However, research is limited regarding recreation users' perception of prescribed burning, effects of prescribed burning on recreation satisfaction, and whether and how knowledge of prescribed burning is associated with perception of forest aesthetics and recreation satisfaction. This study follows cognitive and experiential paradigm of landscape aesthetic perception, borrowing methodological techniques from the psychophysical paradigm in order to examine how the recreation activity people chose affects their perceptions of scenic beauty and recreation satisfaction using RCW habitats as an example. In addition, this study examines how knowledge of prescribed burning varies among participants in different recreational activities and how this knowledge and acquired ecological information affect recreation users' perceptions of scenic beauty and recreation satisfaction from forest sites maintained as habitat for RCW.

Based on the review of literature, I developed and tested four hypotheses.

- Hypothesis 1 (H1): Recreation users who participate in different nature-based recreation activities have different levels of knowledge about prescribed burning.
- Hypothesis 2 (H2): Recreation users who participate in different nature-based recreation activities have different levels of perceived scenic beauty and recreation satisfaction.
- Hypothesis 3 (H3): Providing ecological information about RCW and its habitat requirement significantly improves recreation users' perceptions of scenic beauty and recreation satisfaction.
- Hypothesis 4 (H4): Knowledge of prescribed burning affects perceptions of scenic beauty and recreation satisfaction. Perceived scenic beauty significantly affects recreation satisfaction and mediates the structural relationship between knowledge and recreation satisfaction.

Methods

Research Design and Survey Instrument

The target population of interest in this study included outdoor recreation users of managed natural areas in Florida. The accessible or study population was adult outdoor recreation users to Ocala National Forest. I conducted onsite data collection with recreationists, 18 years or older encountered at trailheads or in parking lots of various recreation areas in Ocala National Forest (ONF) during the period April 2016 – February 2017. If party size was two or more, the individual with the most recent birthday was invited to complete the questionnaire and index (USDA Forest Service, 2013). Among the 242 recreation users approached onsite, 209 agreed to take the survey producing a response rate of 86.0%.

The questionnaire included five sections. Section A included questions related to the respondent's current and past recreation experience. Section B included test of knowledge about prescribed burning and indices of wildlife value orientations and attitudes about-, and intentions to support- prescribed burning. Section C asked respondents to rate scenic beauty and recreation satisfaction from forest sites depicted in 12 photographic images that showed sites at various times after prescribed burning and evidence of other active management practices, such as thinning and clearcutting. Section D included index measuring respondents' motivations for recreation and place attachment. Finally, section E included demographic questions.

A two-stage test of the questionnaire occurred prior to data collection. First, seven graduate and undergraduate students from forestry and natural resource programs at University of Florida provided feedback regarding clarity of the questions, such as wording, ease of comprehension, and meaning of questions. After revising the

questionnaire based on this test, I tested the questionnaire with 42 recreation visitors to Ocala National Forest. With the feedback from respondents regarding ease of comprehension and test of reliability (Cronbach's alpha), ten items intended to measure knowledge and attitude about prescribed burning and intentions to support prescribed burning in public forest were either re-worded or replaced.

Measurement and Analysis

The objective of this study was to understand how participation in outdoor recreation, knowledge about prescribed burning, and receiving ecological information (treatment) affect perception of scenic beauty and recreation satisfaction. The first hypothesis was recreation users who participate in different activities have different levels of knowledge about prescribed burning (H_1). Grouping respondents by recreation activity was critical for testing this hypothesis as almost all respondents reported that they participated in more than one activity. Therefore, I asked respondents to report their first, second, and third major activities and grouped them based on the reported first activity.

Now, to compare knowledge of prescribed burning by activity (H1), I assessed respondents' knowledge about prescribed burning using following seven items.

1. Do you think leaving forests in a natural state is better for wildlife than using active forest management?
2. Have you heard or read about the use of prescribed burning or controlled fire for management of wildlife habitat? (Loomis, Bair, & González-Cabán, 2001)
3. Do you think prescribed burning or controlled fire…
    a. would reduce the chance of high-intensity wildfire? (Loomis et al., 2001)
    b. usually results in the death of the majority of animals in the area? (Loomis et al., 2001)

c. would create long-term negative impact on the scenery in the forest?

d. would improve health of forest?

e. would improve habitat for many wildlife species?

To minimize potential variation in respondents' interpretation of what the terms active forest management and prescribed burning mean, I provided this definition "Active forest management may include prescribed burning, thinning, fertilization, weed control, timber harvesting, and replanting; and prescribed burning refers to any controlled fire intentionally ignited to meet specific land management objectives."

Among the seven items, I adapted three from Loomis et al. (2001), and developed the other four items for this study. Response options were "Yes," "No," and "Don't Know" following (Loomis et al., 2001). Now, to compare among the groups (H1), I calculated a summative knowledge score based on 1 point for correct answers and 0 points for incorrect answers or don't know. I tested the reliability of score by using Cronbach's alpha and item total correlation. Test of reliability examines the internal consistency among responses to the variables and provides an indication of whether the items measure a single construct (Vaske, 2008). The item total correlation refers to the correlation between an individual item score across respondents and the summative score for all items across respondents. An item total correlation of ≥0.4 and an alpha coefficient ≥0.7 indicate reliable measure of a respective domain (Leong & Austin, 2006; Vaske, 2008). I dropped one item, "prescribed burning or controlled fire would reduce the chance of high-intensity wildfire," because it's item total correlation value was less than 0.4. Once this item was dropped, item total correlation of rest of the items ranged from 0.43 to 0.63 and Cronbach's alpha coefficient of the score was 0.79, thus indicating reliability of the score. Then, I obtained composite scores of knowledge for

each respondent by adding scores on each item. Thus, the score for test of knowledge ranged from zero to six.

The second hypothesis was recreation users who participate in different activities perceive scenic beauty and recreation satisfaction from forest sites differently (H_2). There are many challenges for researchers to assess recreation users' immediate perception of scenic beauty and recreation satisfaction from various management conditions (e.g., recent burning, thinning) in forest sites. Using photographs has the advantage of exposing people to various site conditions in less amount of time and it minimizes the logistical burden of transporting people to sites (Brunson & Shelby, 1992; Daniel & Boster, 1976). Most of the past studies used photographs to assess scenic beauty of forest sites from college students or the public in the indoor setting, assuming that people's perception of scenic quality is mostly determined by visual inputs (Kreimer, 1977). However, those researchers did not capture the potential effect of onsite experience on perception of scenic beauty and recreation satisfaction of various forest conditions. Considering this gap in research method, I used photographs but obtained the assessment of scenic beauty and recreation satisfaction from the on-site recreationists.

I took 48 pictures from various forest sites in ONF by using a digital crop sensor SLR camera. The pictures represented typical RCW habitat and surrounding areas with diverse tree sizes and densities, evidences of clearcutting, residuals from thinning, and various times after prescribed burning. To minimize effect of camera exposure on the visual quality of pictures, I maintained the same setting (1/250 sec. f/8 35mm, auto ISO, flash off) for all the pictures. From the 48 pictures, I then manually selected 24 pictures

making sure to capture variation in 1) time after burning, 2) tree size and stand density, 3) ground cover, and 4) mechanical treatments (thinning/harvesting). Lastly, from the 24 pictures, I selected 12 pictures (Figure 3-1) randomly and included them for the assessment. I prepared a photobook with one color picture (10.5 inch by 7.25 inch) on each page, printed on copy paper and laminated with 3 Mil thickness.

Respondents were asked to rate scenic beauty and their likely attainment of recreation satisfaction if they had to recreate on forest sites where surrounding view was as depicted on each picture. Scenic beauty ratings scale was 1 (not at all scenic) – 10 (very scenic) and recreation satisfaction rating scale was 1 (not at all satisfied) – 10 (very satisfied). I adapted a scenic beauty rating scale from Daniel and Meitner (2001), who used a 10 point rating scale as 1 (very low scenic beauty) – 10 (very high scenic beauty). Likewise, adaption of recreation satisfaction rating scale was from Yoon and Uysal (2005), who used 4 point rating scores as 1 (Not at all satisfied) to 4 (very satisfied). To make the rating scores consistent with the scenic beauty rating and to avoid confusion among the respondents, I modified the rating score range to a 10-point scale. I used item total correlation and Cronbach's alpha coefficient to assess reliability of index scores. Cronbach's alpha values were 0.93 for scenic beauty index and 0.91 for recreation satisfaction index, and item total correlation of pictures ranged from 0.49 to 0.80 for scenic beauty and 0.40 to 0.79 for recreation satisfaction, thus suggesting reliability of the scores. Once the scores were tested for reliability, I obtained composite scores of both scenic beauty and recreation satisfaction for each respondent by taking averages of his/her ratings of all pictures.

To test the third hypothesis (H_3), the effect of ecological information on perception of scenic beauty and recreation satisfaction, I randomly divided respondents into two groups – control and treatment. The respondents on the treatment group received the following information, which the control group did not receive.

> "These pictures are taken from different sections of Ocala National Forest where it is managed to maintain habitat for a federally endangered bird, the red cockaded woodpecker [a picture of RCW was shown]. The red cockaded woodpecker is a very important species because their activities provide habitat for hundreds of other species. However, foresters need to apply different management treatments, such as frequent prescribed burning and thinning to maintain suitable habitat for this species."

The only information the control group received was that the pictures were taken from different sections of the Ocala National Forest.

The fourth hypothesis was knowledge of prescribed burning affects perceptions of scenic beauty and recreation satisfaction; and perceived scenic beauty significantly affects recreation satisfaction as well as mediates the structural relationship between knowledge and recreation satisfaction. For this, I fitted a measurement model (confirmatory factor analysis) to obtain a latent score of knowledge. The composite scores of both scenic beauty and recreation satisfaction were included in the structural model as the observed variable. In addition, to control the effect of activity and demographic variables, I also included activities and demographic variables in the model as binary variables (1,0).

I used analysis of variance and equivalent Welch test (for unequal variances) in SPSS 24.0 statistical software to compare knowledge of prescribed burning, perception of scenic beauty, and recreation satisfaction among activity user groups (H_1 – H_2). Likewise, I examined the effect of treatment information on perception of scenic beauty and recreation satisfaction (H_3) by comparing control group and treatment group using

independent sample t-test. For all group comparison tests, I used eta-square (η^2) to assess effect size. Following Cohen (1988), effect size is interpreted as small (η^2=0.01), medium (η^2=0.06), and large (η^2=0.14). I used structural equation modeling in MPlus version 7.4 statistical software to assess the relationships among knowledge of prescribed burning, perception of scenic beauty, and recreation satisfaction (H_4). In this structural model I used confirmatory factor analysis and item total correlations to assess the validity and Cronbach's alpha to assess the reliability of seven items used to measure knowledge. Finally, I used a ratio of Chi-square to degree of freedom (χ^2/df), Confirmatory Fit Index (CFI), Root mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) to examine whether the structural model had good fit with the data. Value of χ^2/df in between 1 and 3, CFI ≥ 0.95, RMSEA ≤0.08, and SRMR ≤0.08 indicate a good fit of model for the given data (Brown, 2006; Hu & Bentler, 1999; Kline, 2005).

Results

Descriptive Characteristics of Sample

Among the 209 responses, categorization of respondents by activity included hiking or backpacking (30%), OHV riding (16%), camping (18%), hunting (12%), and canoeing or kayaking (24%). The average age of the respondents was 42 (Std. Dev. = 14) years old, with 30% of the respondents being less than 30 years old and 14% being more than 60 years old. Proportion of male respondents (71%) was much higher than the female respondents (31%). About half of the respondents (47%) had an education level of Bachelor's degree or higher, whereas 20% had education attainment of high school or below. About 60% of the respondents were fulltime employed, 14% were retired, and about 10% each were self-employed and students (Table 3-1).

In terms of race and ethnicity, almost all respondents reported their race as White (96%) and 8% of the respondents reported their ethnicity as Spanish, Hispanic or Latino (Table 3-1). One third of the respondents had an annual household income of less than $50,000, whereas one quarter of respondents had an annual income of $100,000 or more (Table 3-1).

Knowledge of Prescribed Burning

In general, respondents were knowledgeable about forest management and prescribed burning (Table 3-2). However, only about one-third of the respondents (36%) gave correct answers to all questions asked to assess knowledge. This indicates that almost two-third of the respondents had some sort of misconception about active forest management and prescribed burning. For example, 89% of the respondents said they had heard or read about the use of prescribed burning or control fire for management of wildlife habitat; however, only 52% knew that using active forest management is better for wildlife than leaving forests in a natural state (Table 3-2). Comparison of knowledge index score by recreation activity (Table 3-3) shows hunters were more knowledgeable about prescribed burning than other recreation users, thus supporting my first hypothesis (H_1).

Perception of Scenic Beauty and Recreation Satisfaction

Among the 12 photographic images (Figure 3-1) used to assess respondents' perception of scenic beauty and recreation satisfaction, three pictures received the highest rating of both scenic beauty and recreation satisfaction (Figure 3-2): 1) forest sites with mixed pine trees and hardwood trees (picture 8), 2) a mature pine forest site with saw palmetto of about 2 feet tall and more than two years after burning (picture 6), and 3) a mature pine forest site with evidence of regeneration (picture 11). Likewise, a

recent large clear-cut (picture 5) and a mature pine forest burnt less than a week earlier and with a large burnt open area (picture 4) received the lowest rating of both scenic beauty and recreation satisfaction (Figure 3-2). In general, respondents gave higher ratings of both scenic beauty and recreation satisfaction to forest sites that had mixed species of trees, mature and thinned trees with large depth of view, no recent evidence of burning, sites with lush palmetto, and evidence of regeneration. On the other hand, forest sites with immature and dense trees, recent burning, large clear-cuts, and thinning residues received the lower ratings of both scenic beauty and recreation satisfaction.

Comparison of scenic beauty and recreation satisfaction index scores among activities (Table 3-3) shows significance of group differences for both scores ($p<0.05$), thus supporting my second hypothesis (H_2). Consistent with knowledge of prescribed burning, hunters rated significantly higher scenic beauty than other recreation users. In terms of recreation satisfaction, hunters rated highest recreation satisfaction, followed by hikers/backpackers and OHV users. Campers and those participating in canoeing/kayaking rated the least recreation satisfaction (Table 3-3).

Effect of Ecological Information

Results show no significant effect of treatment information on perception of scenic beauty and recreation satisfaction (Figure 3-3), thus failing to support my third hypothesis (H_3). Index score (1 – 10) of scenic beauty perception from treatment group (6.5) was not statistically different than that from the control group (6.3). Likewise, index score (1 – 10) of recreation satisfaction from treatment group (6.4) also did not differ significantly from the control group (6.0). Thus, results indicated that providing

ecological information about RCW and its habitat requirement was unlikely to affect respondents' perception of scenic beauty and recreation satisfaction.

Structural Relations

The ratio of chi-square and degrees of freedom (1.53), CFI (0.96), TLI (0.95), RMSEA (0.05), and SRMR (0.05), indicated good fit of the full structural model (Brown, 2006; Hu & Bentler, 1999; Kline, 2005). In the measurement model of the latent variable, “Knowledge,” factor loadings ranged from 0.42 to 0.75, thus suggesting a validity of a single factor (Vaske, 2008). The variance explained (square of factor loadings) by the knowledge variable ranged from 18% for the item “Have you heard or read about the use of prescribed burning or controlled fire for management of wildlife habitat” to 56% for the item “Prescribed burning or controlled would improve habitat for many wildlife species (Figure 3-4).

Results of the structural models show that knowledge of prescribed burning significantly affected both perception of scenic beauty and recreation satisfaction (Figure 3-4). With a one-unit increase in knowledge, perceived scenic beauty increased by 0.33 ($p<0.01$) and recreation satisfaction increased by 0.11 ($p<0.05$). Likewise, perceived scenic beauty significantly affected recreation satisfaction (Figure 3-4). With one-unit increase in perceived scenic beauty, recreation satisfaction increased by 0.79 ($p<0.01$). In addition to a small direct effect, knowledge affected recreation satisfaction also indirectly through the mediation effect of scenic beauty. In fact, the indirect effect of knowledge on recreation satisfaction through the mediation effect of scenic beauty (0.27, $p<0.01$) was stronger than its direct effect (Figure 3-4). Thus, results from structural model supported my fourth hypothesis (H_4) that knowledge of prescribed burning affects perceptions of scenic beauty and recreation satisfaction, and perceived

scenic beauty significantly affects recreation satisfaction and mediates the structural relationship between knowledge and recreation satisfaction.

Among the control variables, activity and demographics, hunters were more knowledgeable about prescribed burning (0.58, $p<0.05$) and rated higher scenic beauty (0.38, $p<0.1$) than other recreation users. Hispanics (-0.58, $p<0.05$) and females (-0.36, $p<0.05$) were likely be less knowledgeable than non-Hispanics and males, respectively. Participation in hunting did not associate with recreation satisfaction directly. However, it did associate with recreation satisfaction indirectly through knowledge and scenic beauty perception (0.15, $p<0.05$), thus suggesting that hunters were more likely to attain recreation satisfaction because of knowledge about prescribed burning and higher rating of scenic beauty than other activity users. On the other hand, campers were likely to attain lower recreation satisfaction (-0.21, $p<0.05$) than other activity users.

Discussion

The aim of this research was to better understand how chosen activity, ecological information, and knowledge of prescribed burning affects forest recreation visitors' recreation satisfaction and perception of scenic beauty. This research contributes to the body of knowledge in several ways. First, this study is the first to examine the effect of both information intervention and held knowledge about forest management practices on people's perception of forest aesthetics and recreation satisfaction. Index scores of scenic beauty and recreation satisfaction did not differ and the effect of treatment information was not significant. Although there is controversy in the literature regarding the relationship between affective perception and cognitive perception, this study supports the claim that when conditioning information is absent or not effective, cognitive perception, such as acceptability of landscape management may not be

different from affective perception of visual stimuli, such as scenic beauty (Ribe, 2002; Zajonc, 1980). This finding indicates that the perception of aesthetic beauty of forest and recreation areas is a very important factor for recreation users to attain satisfying recreation experience. Also, the finding that existing knowledge is related to higher perceptions of scenic beauty and recreation satisfaction suggests that improving recreation users' held knowledge about forest management practices, such as prescribed burning, would improve their aesthetic perception and acceptance of forest and recreation areas. On the other hand, information provided at the time of the recreation experience (e.g., information boards or on-site brochures) are likely less effective in manipulating users' recreation experience.

Second, this study offers an important methodological implication regarding using photographs for assessment of forest and landscape aesthetic perceptions and preferences. I used photographs to capture various forest conditions, but unlike most past research, I obtained ratings of both scenic beauty and recreation satisfaction from onsite users. This approach allowed respondents an opportunity to better reflect their perspective to the actual sites while rating the forest sites depicted in the pictures. In addition, this approach allowed researchers to account for users' immediate purpose, such as hiking and camping, while rating forest sites shown on the pictures. Past research often relies on respondents to remember or imagine a recreation visit. Thus, I believe this approach offers more valid and reliable assessment related to perception and preference of forest aesthetics.

Management Implications

This study offers important implications useful for the management of public forests to attain the dual goals of recreation and wildlife habitat management. Hunters,

hikers/backpackers, and OHV users were likely to attain better recreation experiences from forest sites undergoing frequent burning than campers. Thus, promoting hiking/backpacking, hunting, and OHV riding opportunities in RCW habitats (or areas requiring active management) and keeping camping sites away from these areas could result in positive outcomes. By doing so, recreation users' attainment of expected experience will be less impacted by prescribed burning. This will be beneficial to minimize conflict with land management objectives and achieve the multiple objectives of forest management.

This study shows that most recreation visitors understand that healthy forests require burning, but there continues to be some misconceptions about the use of fire as a management tool for the improvement of wildlife habitat. Forest visitors are an easy to access audience that managers can target with education and outreach on this complex ecological topic. Differences in knowledge of prescribed burning across different activities and demographics suggest the need for different approaches in reaching various recreation users. For example, hunters were the most knowledgeable about prescribed burning relative to recreationists engaged in other activities; therefore, managers can usually count on hunters' support for prescribed burning and should focus on transferring these knowledge to other recreation users.

This study shows that the extent to which people accept fire in natural areas relates to their understanding of how that fire affects or benefits a forest. However, simply providing beneficial purposes of prescribed burning will likely not resonate with recreation visitors to public lands. Thus, outreach and education programs should be careful in contextualizing the purpose of fire, with the hope of providing long-term

educational benefits. What information to include in those information programs is also important. Most users of FNST, which pass through ONF, were either visiting to enjoy nature and scenery, or visiting to obtain solitude. Recreation settings having quality nature, wilderness areas, and wildlife habitats were the most important site attraction attributes for these visitors. Thus, prescribed burning education message should focus on how fire improves forest scenery (in long-term), habitat quality for wildlife, and health of the wilderness. In addition, linking prescribed fire to the protection of endangered species will likely improve people's perception of prescribed fire, but even the type of species being used in the message should be selected carefully. Past research has shown that Floridians had higher values and were more familiar with gopher tortoises than RCW (Johnson, 2015). Thus, improving people's familiarity with gopher tortoise, as a focal species, in framing information related to prescribed burning, could be more effective in educational programs.

Limitations and Future Directions of Research

I classified and compared respondents by activity of participation. While doing so, I classified respondents based on their first major activity (at the time of the survey). However, activities people chose to recreate are not always mutually exclusive as users could participate in more than one equally important activity. Although asked to report three activities, in order of importance, certain respondents (about 10%), such as those who hiked, as well as camped, struggled to report one activity as more important than other. Thus, there could be a certain bias in classification of respondents by activity. Future research should consider adopting more effective classification criteria to offer robust conclusions regarding differences associated with the activity people chose to recreate.

I introduced the information treatment during the assessment of perceived scenic beauty and recreation satisfaction, and the treatment was not significant. However, research has shown that providing ecological information can change people's knowledge and attitude about prescribed burning (DeLorme et al., 2005; Loomis et al., 2001; Toman & Shindler, 2006). In this research, I found knowledge of prescribed burning strongly affects recreation satisfaction through the mediation effect of perceived scenic beauty. Thus, future research using treatment information to manipulate knowledge and assessing how that change in knowledge affects perception of scenic beauty and recreation satisfaction would be a noble contribution to the body of knowledge. In addition, I used photographic images representing different times after burning; however, the forest sites were different. Thus, tracking same forest sites before and after burning for multiple years (time lapse photos) and assessing recreation users' knowledge, scenic beauty perception, and recreation satisfaction in longitudinal research setting will offer more robust evidence to confirm findings presented in this study.

In conclusion, this study confirms that forest aesthetic perception and preference is something learned, and it has more to do with a person's immediate purpose in using that environment. Human's aesthetic perceptions and preferences are less likely to change with immediate information intervention, such as information boards; however, held knowledge about forest management practices, such as prescribed burning, could change these perceptions and preferences. To allow users to attain more positive outcome, camping sites should be kept away from RCW habitats (or areas requiring active management). Instead, recreation opportunities can be provided in such sites for

hunters, hikers/backpackers, and OHV users. Hunters were the most knowledgeable about prescribed burning, and they also rated higher scenic beauty and recreation satisfaction of forest sites representing various forms of active management. Thus, agencies should develop hands on programs to facilitate knowledge transfer from hunters to other recreation users.

Table 3-1. Demographic characteristics of adult outdoor recreation users in Ocala National Forest, USA.

Demographic characteristics	% of respondents
Age	
≤ 30 years	30
31 - 45 years	25
46 - 60 years	31
> 60 years	14
Gender	
Male	71
Female	29
Education	
Below High School	1
High School graduate	19
Some College no degree	24
Associate's Degree	9
Bachelor's degree	31
Some Graduate School	3
Master's Degree	11
Doctoral Degree	2
Occupation	
Fulltime employed	59
Retired	14
Student	8
Self employed	10
Race/Ethnicity	
White	96
Black, African American	1
Amer. Indian or Alaska Native	3
Asian	2
Spanish/Hispanic/Latino	8
Household Income	
Under $25,000	13
$25,000 – $49,999	20
$50,000 – 74,999	23
$75,000 – 99,999	19
$100,000 – 149,999	12
$150,000 – 199,999	7
$200,000 or more	3
Not disclosed	4

Table 3-2. Knowledge of prescribed burning of adult outdoor recreation users in Ocala National Forest, USA.

Knowledge questions[$]	% of respondents (N=209)		
	Yes	No	Don't know
Leaving forests in a natural state is better for wildlife than using active forest management	34	52	15
Heard or read about the use of prescribed burning or controlled fire for management of wildlife habitat	89	11	-
Prescribed burning would reduce the chance of high-intensity wildfire	90	2	8
Prescribed burning usually results in the death of the majority of animals in the area	16	76	8
Prescribed burning would create long-term negative impact on the scenery in the forest	21	73	6
Prescribed burning would improve health of forest	84	6	10
Prescribed burning would improve habitat for many wildlife species	72	15	13

[$] For the first, fourth, and fifth items, response option "No" indicates correct answer; for the rest of the items, response option "Yes" indicates correct answer (knowledge). The item "Prescribed burning would reduce the chance of high-intensity wildfire" was dropped for further analysis because of item total correlation value <0.4.

Table 3-3. Comparison of index scores of knowledge of prescribed burning, perceived scenic beauty, and recreation satisfaction by recreation activity of adult outdoor recreation users in Ocala National Forest, USA.

Index scores	Recreation activities					Sample mean	F or Welch Statistic[$]	p-value	Effect size (η2)
	HB	OHV	CAM	HUNT	CK				
Knowledge of prescribed burning	4.3[a]	4.1[a]	4.5[a]	5.4[b]	4.0[a]	5.3	3.9	<0.001	0.06
Scenic beauty	6.3[a]	6.5[a]	6.2[a]	7.4[b]	5.9[a]	6.4	2.6	0.017	0.06
Recreation satisfaction	6.4[a]	6.4[a]	5.7[b]	7.3[c]	5.5[b]	6.1	3.4	0.004	0.08

Knowledge score ranged from 0 – 6 and it indicates summative scores of six items coded as 1, if correct answer, 0 otherwise. Scenic beauty and recreation satisfaction scores represent average scores of ten pictures and values ranged from 1 – 10. Effect size should be interpreted as: small (η^2=0.01), medium (η^2=0.06), and large (η^2=0.14).
abc: different letters indicate significance of group difference in post-comparison test at 5% level. [$]Welch test was used for knowledge index score because of unequal variances. HB:

Hiking or Backpacking, OHV: Off Highway Vehicle, CAM: Camping, HUNT: Hunting, CK: Canoeing or Kayaking.

Figure 3-1. Photographic images used for scenic beauty and recreation satisfaction ratings of adult outdoor recreation users in Ocala National Forest, USA.

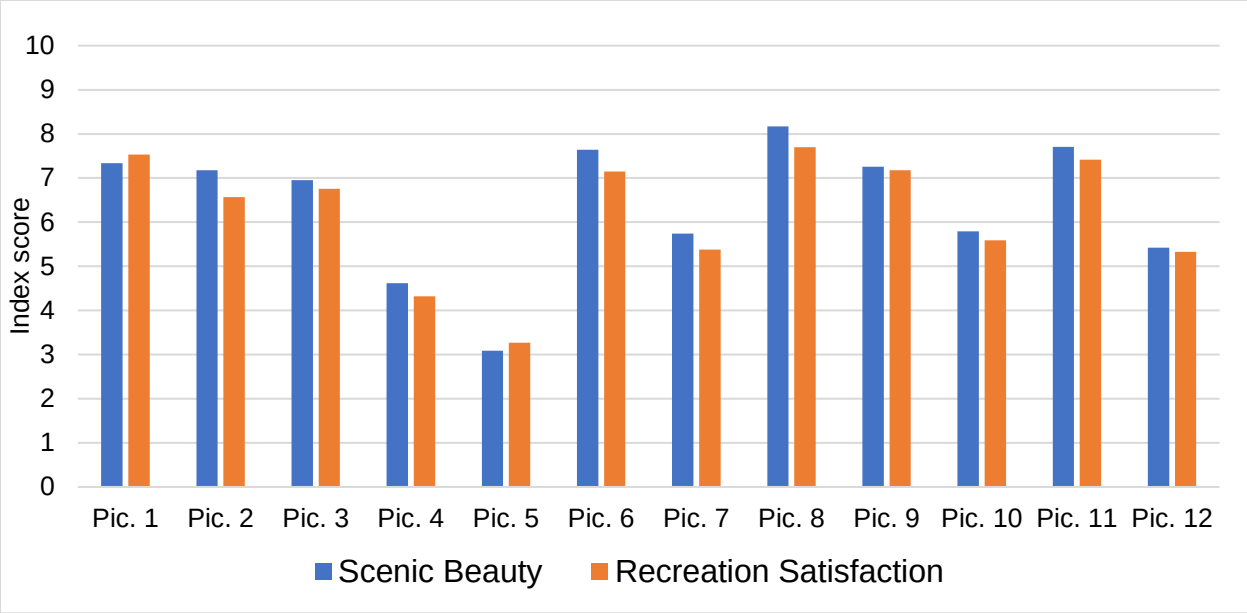

Figure 3-2. Comparison of perceived scenic beauty and recreation satisfaction by pictures representing various forest conditions.

Note: Measurement score ranged from 1 – 10.

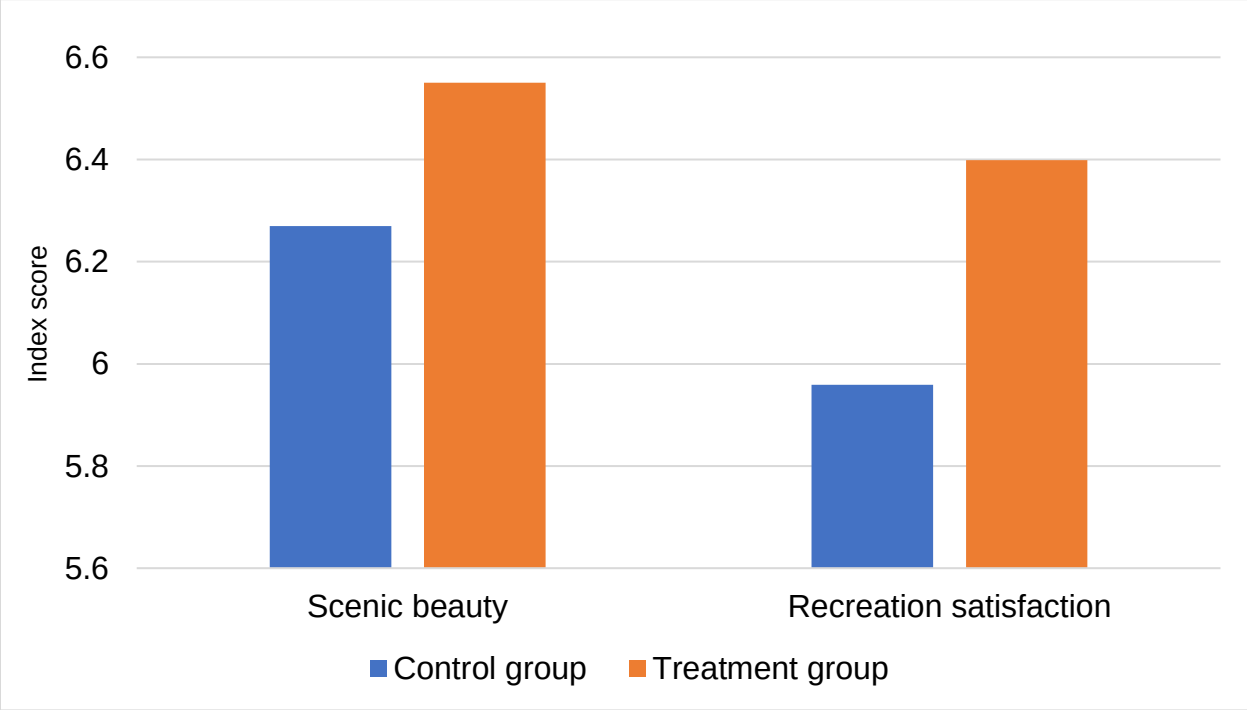

Figure 3-3. Comparison of perceived scenic beauty and recreation satisfaction by treatment groups.

Note: Difference between treatment group and control group was not statistically significant (p>1.0) for both scenic beauty and recreation satisfaction.

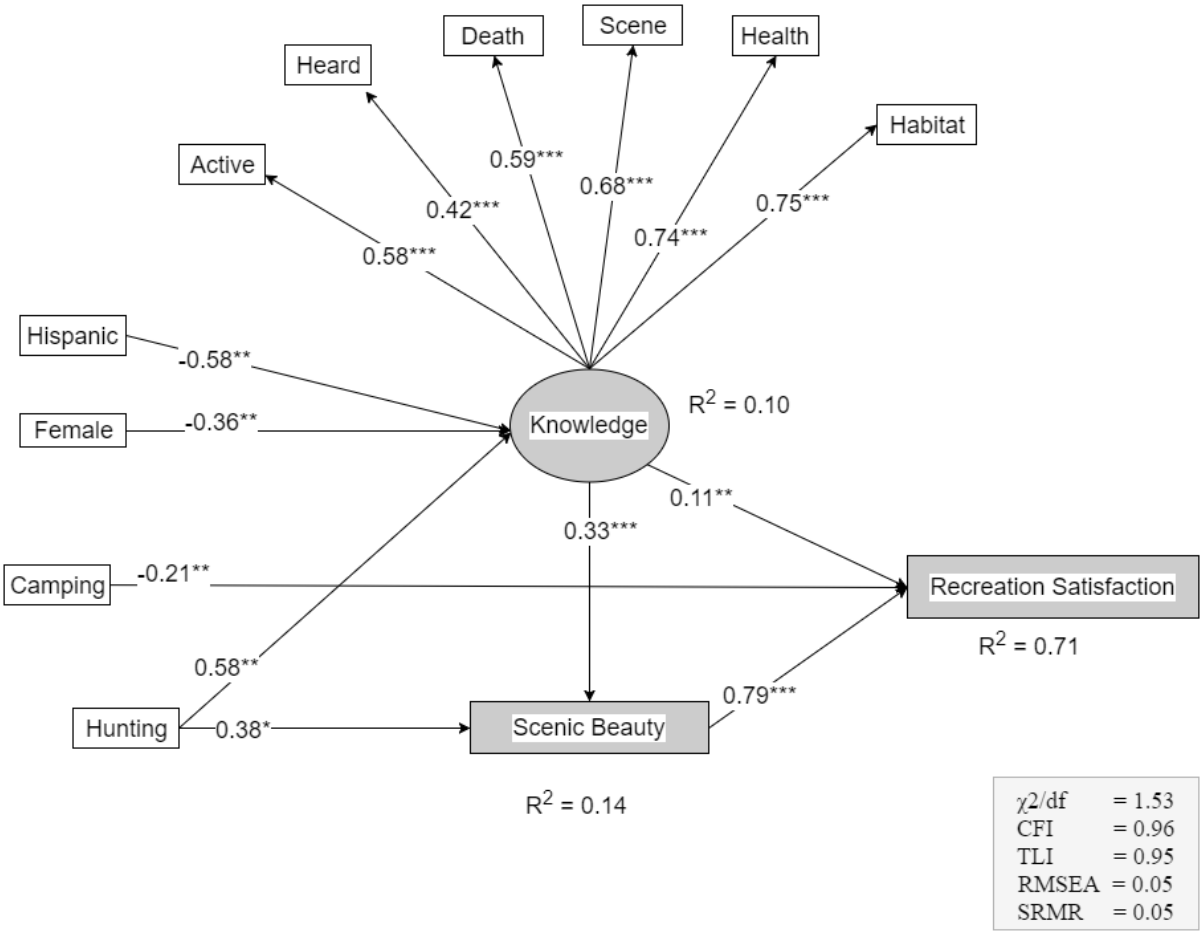

Figure 3-4. Structural relations among knowledge, scenic beauty, and recreation satisfaction, and associations with demographics and activity of participation of adult outdoor recreation users in Ocala National Forest, USA.

Note: Only significant variables were retained in the model. Hispanic, female, camping, and hunting were binary variables. Scenic beauty and recreation satisfaction scores ranged from 1 – 10. Items measuring latent variable, knowledge, were coded as 1, if correct answer; 0, otherwise. One variable wildfire was dropped because of the factor loading being less than 0.4. Values in measurement model of latent variable indicate standardized factor loadings, whereas values in structural models indicate standardized linear regression coefficients. *indicates significance of coefficient in 10% level **indicates significance of coefficient in 5% level and *** indicates significance of coefficient in 1% level.
Active: leaving forests in a natural state is better for wildlife than using active forest management. *Heard*: heard or read about the use of prescribed burning or controlled fire for management of wildlife habitat. *Death*: prescribed burning or controlled fire usually results in the death of the majority of animals in the area. *Scene*: prescribed burning or controlled would create long-term negative impact on the scenery in the forest. *Health*: prescribed burning or controlled would improve health of forest. *Habitat*: prescribed burning or controlled would improve habitat for many wildlife species.

CHAPTER 4
CLIMATIC, TEMPORAL, AND ECONOMIC FACTORS AFFECTING RECREATION VISITS TO FLORIDA NATIONAL SCENIC TRAIL: A TIME SERIES MODELING

Introduction

Environmental (weather and climate[1]), temporal (seasons, months, holidays), and economic factors, such as gasoline price, are among the key factors that affect outdoor recreation participation and experience. Weather may directly affect visitors' utility from their recreation experience. For example, changing temperature, precipitation, and humidity may change visitors' travel planning (e.g., when, where, and why), their choice of tourism/recreation site and activities, and their eventual experience/satisfaction and willingness to revisit the place (Becken & Hay, 2007; De Urioste-Stone, Scaccia, & Howe-Poteet, 2015; Gössling, Scott, Hall, Ceron, & Dubois, 2012). In addition, changes in climate patterns may lead to changes in the populations and the composition of wildlife and vegetation in nature-based recreation areas, and these changes might ultimately affect visitation choice and behavior (Paudyal et al., 2015; Richardson & Loomis, 2004). Also, people tend to have different expectations and levels of tolerance for weather and climatic conditions as they relate to different activities and recreation settings (Hewer et al., 2015; Li & Lin, 2012). In addition to weather and climate, economic factors (e.g., travelling costs) and temporal factors (e.g., seasons, holidays) significantly affect outdoor recreation participation. People tend to travel more during holidays and when expected travel expenses are low.

[1] Weather refers to an atmospheric condition at any given time or place, whereas, climate refers to "an average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands of years" (IPCC, 2007).

Given the dependence of the outdoor recreation and tourism industry on weather, climate, and market factors, fluctuations in weather factors (temperature and precipitation) and economic factors, such as gasoline price, could create unforeseen shifts of demand and supply. Uneven distribution of use over time is one of the most significant problems in outdoor recreation and tourism, which may cause inefficient use of resources, loss of potential profit, difficulties in administrative scheduling, and result in negative impacts to the recreation experience and ecological condition (Manning & Powers, 1984). Thus, unexpected changes in weather patterns, climate, and economy could affect local and regional economies and management of resources.

Weather and climate are among the major economic assets for the tourism and outdoor recreation industry, which, at various times and locations, could be classified along a spectrum of favorable-to-unfavorable (de Freitas, 2003). In general visitors prefer weather range that does not require specific behavioral adjustment (de Freitas, 2015). Thus, it is important to know how weather and climate favor or negatively affect tourism and outdoor recreation at various times and locations. More specifically, information related to what people consider ideal, suitable, acceptable, or unacceptable conditions, and what specific weather and climate-related criteria people use to make recreation choices (de Freitas, 2003) are important.

Most of the previous weather and climate literature which have integrated tourism and outdoor recreation components are superficial, in a way that relationships between weather and outdoor recreation is more assumed than observed or objectively tested (de Freitas, 2003). In addition, most of the existing outdoor recreation and tourism literature that integrated weather or climate are either based on short-term data of

recreation participation and weather, or based on the stated preference to hypothetical scenario of weather and climate (De Urioste-Stone, Le, Scaccia, & Wilkins, 2016; Paudyal et al., 2015; Richardson & Loomis, 2004). One of the challenges to both lines of literature is the lack of availability of daily visits data for an extended time period from diverse park and recreation areas (Aylen et al., 2014).

Activity and destination specific climate information is important for potential visitors with diverse leisure-activity preferences (Yu et al., 2009). Previous research suggests that participation in tourism and outdoor recreation rates are generally higher in summer than winter (McGinn, Evenson, Herring, & Huston, 2007). In locations where the winter season is fairly long and summers are not extremely hot, an increase in temperature in comparison to the long term average is positively associated with activity participation (Aikoh, Abe, Kohsaka, Iwata, & Shoji, 2012). However, these findings cannot be generalized for all regions, including places like Florida, where summers are extremely hot and humid, and winters are mild.

The Florida tourism and outdoor recreation season differs from that of most of the continental United States. For example, summer is the best season for hiking in the northern United States. However, summer in Florida is hot and humid and participation in activities like hiking, mountain biking, camping, kayaking/canoeing, and OHV riding are typically low. On the other hand, unlike northern regions of the nation, winter in Florida is the best season for many activities associated with terrestrial settings. Also, an analysis of ideal climatic conditions for tourism and outdoor recreation over the past 50 years has shown a declining trend in Central Florida, mostly due to the occurrence of more frequent heat indices above 35°C (Yu et al., 2009). Therefore, although it is

obvious that climate and weather affect outdoor recreation participation, we do not know how and to what extent weather factors are associated with outdoor recreation participation in warm weather climates, like Florida.

In addition, literature has thus far neglected to examine the consequences of extreme weather conditions on recreation participation on days following the extreme weather. To fill this gap in knowledge, this study uses time series and count data modeling to examine how weather factors, including temporal factor and gasoline price affect daily outdoor recreation visits. Specifically, this research aims to answer the following specific research questions.

1. How do weather factors (e.g., temperature, precipitation, humidity, heat index) affect daily outdoor recreation participation?
2. Does an unfavorable weather condition of a day affect recreation participation the following day?
3. How are temporal factors (weekend and public holidays) and the market price of fuel associated with recreation participation?

I answered these questions by using a regression modeling approach. For this, I developed a conceptual model as:

$$\mathrm{Y} = f(\mathrm{T}, \mathrm{PPT}, \mathrm{RH}, \mathrm{HI}, \mathrm{WPH}, \mathrm{M}, \mathrm{GP}) \quad (4\text{-}1)$$

Where, Y = daily recreation participation; T= temperature; PPT= precipitation; RH= relative humidity; HI= heat index; WPH = weekend and public holidays; M= months; and GP = gasoline price

Review of Literature

Effect of Weather and Climate

Interaction between tourism/outdoor recreation demand and weather/climate is complex because of difficulty to both predict and manage consequences of changes

(Becken & Hay, 2007; Denstadli, Jacobsen, & Lohmann, 2011; Dubois, Ceron, Gössling, & Hall, 2016). Nonetheless, researchers have examined the impact of weather and climate on outdoor recreation participation around the world. This body of literature examining the effects of weather and climate on tourism and outdoor recreation participation includes, in terms of context and activity, hiking (Li & Lin, 2012), urban trail traffic (Lindsey, Wilson, Rubchinskaya, Yang, & Han, 2007), golfing (Nicholls et al., 2008), skiing (Beaudin & Huang, 2014; Hamilton, Brown, & Keim, 2007; Shih, Nicholls, & Holecek, 2009), physical activity (Chan, Ryan, & Tudor-Locke, 2006; McGinn et al., 2007), beach and public pool visits (Finger & Lehmann, 2012), and visitation to zoos, parks and natural areas (Aylen et al., 2014; Becken, 2013; Richardson & Loomis, 2004). The following review of the literature provides an overview of the existing knowledge about climatic, temporal, and fuel price factors on tourism and outdoor recreation.

Several effects of weather and climate on tourism and outdoor recreation have been documented in the literature. First, weather and climate affect tourists' and visitors' destination selection (Hamilton & Lau, 2005; Yu et al., 2009). More specifically, weather and climate can impact tourism and outdoor recreation industry by affecting travel and outdoor recreation decisions and tour plans (Steiger, Abegg, & Jänicke, 2016), causing trip cancellation (Tervo, 2008), and affecting duration of stay (Coghlan & Prideaux, 2009). In addition, climate is one of the major factors that shape one's perceived images about the destinations, which in turn determine one's decision about where to go and when to go (Lohmann & Kaim, 1999). Thus, in the tourism and outdoor recreation industry, weather and climate could serve as both an attraction and limitation (Steiger et

al., 2016) or push factor and pull factor (Agnew & Palutikof, 2006). For example, warm temperatures in Florida during the winter could serve as pull factors to attract visitors from other northern states, whereas extreme hot weather during the summer could push Florida residents to other states.

Second, weather and climatic factors affect participation and experience in tourism and outdoor recreation (Denstadli et al., 2011; Yu et al., 2009). Depending upon location, activity, and time, such impacts could be both positive and negative. For example, an unexpected early snowfall could reduce participation in some outdoor activities such as hiking and camping while increasing participation in other activities like skiing, ice skating, and sledding. Also, poor weather conditions could negatively affect visitors' satisfaction with their recreation activity by negatively affecting their attainment of expected experience and perception of value for the money (Coghlan & Prideaux, 2009), ultimately affecting likelihood of future visits.

Third, weather and climate determine seasonality in tourism and outdoor recreation (Butler, 2001; Yu et al., 2009). For example, summer in Florida is extremely warm and humid while winter is dry and clement. As a result, participation in hiking and other land-based activities are high during the winter and much lower during the summer. On the other hand, participations in fresh water-based activities like swimming and tubing in springs are significantly higher during the summer than in the winter, even though spring water temperature remains constant year-round.

A set of climatic factors (temperature, precipitation, humidity) describes the variability in the actual daily weather, whereas the count of number of visitors to a specific site indicates the demand for tourism and outdoor recreation participation

(Agnew & Palutikof, 2006). Researchers have examined impact of weather and climatic factors by modeling the number of recreation visits (daily, weekly, monthly, or yearly to one or multiple places) with various climatic factors. The major significant climatic factors that are identified as affecting outdoor activity participation are temperature, precipitation, humidity, cloud cover, wind speed, and sunlight hours (Aylen et al., 2014; Chan et al., 2006; Hamilton et al., 2007; Li & Lin, 2012; Scott, Gössling, & de Freitas, 2008; Steiger et al., 2016). In the tourism and outdoor recreation context, de Freitas (2003) classified these climatic factors into three categories: 1) thermal (temperature, humidity, and solar radiation), 2) physical (rain and wind), and 3) aesthetic (sunshine and cloud condition).

Temperature has a non-linear effect on participation in land-based recreation, such as hiking, with increase in recreation participation with rise in temperature up to a threshold, and then a decrease with the increase in temperature (Aylen et al., 2014). Researchers have found that tourists and outdoor recreation visitors consider temperature of 20 – 26°C as ideal for various land-based recreation activities (Lise & Tol, 2002; Steiger et al., 2016; Wilson, Nicol, Nanayakkara, & Ueberjahn-Tritta, 2008). The tolerable threshold level of temperature may be activity specific (Li & Lin, 2012). When temperature increases beyond that threshold, even a small increase in temperature could significantly reduce recreation participations (Maddison, 2001).

Precipitation has been found as another important factor to affect outdoor recreation participation (Steiger et al., 2016). Although light and short-period rains are not generally considered as detrimental as temperature, precipitation in the form of snow, showers, and thunderstorm has the potential to greatly affect travel and outdoor

recreation decisions (Hamilton et al., 2007; Morgan & Williams, 1999; Yu et al., 2009). Amount and duration of rain as well as time of the day at which rainfall events occur can pose variable effects on outdoor activity participation. For example, a study conducted in Prince Edward Island, Canada found a rainy day (14 mm of total rain) negatively affected physical activity participation (Chan et al., 2006). Likewise, Scott and Jones (2007) found that morning rains affect golf participation more negatively than afternoon rains.

Clouds and sunshine are less likely to determine whether outdoor recreation activity will take place or not; however, they might negatively affect aesthetics of the destination and lessen recreation satisfaction for certain activity participants (Morgan & Williams, 1999; Yu et al., 2009). For instance, Morgan and Williams (1999) asked a panel of coastal managers and environmental science graduate students to rate aesthetics of various beaches based on a panoramic video. Results showed that cloud cover during the video shoot significantly affected assessors' perceived aesthetics of the beaches. Thus, in recreation sites, where depth of view is important (e.g., mountain and beach), cloud cover could negatively affect recreation.

Even though mild wind gusts could be favorable for outdoor recreation, strong winds could affect outdoor activity participation more severely than the temperature (Hewer et al., 2015; Yu et al., 2009). For instance, a study found strong winds and heavy rain were the most influential factors affecting weather related decision making and onsite behavioral adjustment among campers. As, wind speed interacts with body mass index to affect physical activity (Chan et al., 2006), lean individuals are more likely to be affected by wind speed while participating in outdoor activities.

Although each climatic factor affects tourism and outdoor recreation participation to a different extent, what people experience when outdoors is the combined effect of multiple factors. Research has also shown that tourists and outdoor recreationists consider more than one climatic factor when planning a trip. For instance, Hamilton and Lau (2005) found that 91% of tourists consider more than one climate attribute when they collect climate information about the destination (Hamilton & Lau, 2005). In line with this finding, researchers have suggested including combined experiential climatic factors when developing predictive models (Spagnolo & De Dear, 2003; Yu et al., 2009). For example, Yu et al. (2009) examined tourism-related climatic variations and trends over the past 50 years in central Florida by using the heat index as one of the predictors. A heat index is a measure of the combined effects of temperature and relative humidity on human physiological responses to and perceptions of temperature (Rothfusz, 1990).

Temporal and Economic Factors

Temporal variables (e.g., seasons, months, day of the week, public holidays) affect tourism and outdoor recreation industry by determining short-term seasonality of demands. For instance, people are more likely to plan their trips during the weekends and public holidays than on weekdays. In recreation demand models, it is common to include temporal factors as control variables to explain additional variance in recreation participation (Aylen et al., 2014; Finger & Lehmann, 2012; Shih et al., 2009). For example, Finger and Lehmann (2012) found temperature and precipitation as the significant determinants of daily visits to public pools in Zurich, Switzerland, by controlling the effect of non-weather factors (e.g., weekends and holidays) in the regression model.

Change in market price of goods and service can also affect tourism and outdoor recreation participation. For example, when gasoline price goes high, it can indirectly affect price of other merchandise, and people could minimize their travel expenses to compensate for the additional expenses. Researchers have found a negative effect of gas price on outdoor recreation participation (Napier & Bryant, 1980; Pergams & Zaradic, 2006). For example, Napier and Bryant (1980) examined the potential impact of increasing fuel costs on future outdoor recreation participation in Ohio and found that residents would reduce future participation in outdoor recreation activity if fuel prices continued to increase. Likewise, Pergams and Zaradic (2006) found increasing oil price as one of the factors (others being hours spent on electronic entertainment media) responsible for the decline in per-capita national park visitation in the USA during 1993 to 2003. In the last five years, average daily gasoline price in Florida has fluctuated significantly. However, we have limited information about whether and how this changes in gas price is associated with outdoor recreation participation.

Methods

Study Area

I conducted this study in the Ocala National Forest (ONF) section of Florida National Scenic Trail (FNST). As one of 11 national scenic trails[2] in the United States, the FNST is a federally designated non-motorized recreation trail, which extends over

[2] National scenic trails are 100 miles (~160 km) or longer, continuous, primarily non-motorized routes of outstanding recreation opportunity (National Park Service, 2016) established under the National Trails System Act of 1968. Although either National Park Service or US Forest Service are responsible for administrating each National Scenic Trail, various government and private entities own or manage lands along each National Scenic Trail.

more than 1600 km through the most beautiful, unique landscapes in Florida (Figure 4-1). Out of the total length of the trail, the ONF alone encompasses about 160 km and ONF is one of three and the second largest national forest in Florida.

Data and Variables

I collected data from January 1, 2010 to May 31, 2015. The counts of daily recreation visits were obtained by installing and operating infrared mechanical counters at three trailheads (Lake Delancy, Juniper Spring, and SR 19) in ONF (Figure 4-1). The dependent variable represents the sum of the counts from these three locations. The regressor variables included in the model were various climatic, temporal, and gasoline price factors (Table 4-1).

I obtained daily weather data of the nearest weather station (about 55 km away) from National Climatic Data Center. The climatic regressor variables included in the model were temperature, precipitation, relative humidity, and cold snap. The cold snap in the context of weather in Florida was defined as a dummy variable, if daily average temperature during the winter season was >6°C below the long-term normal. In addition, I included two dummy variables representing suitability of a day for recreation in terms of weather factors. First, I created a variable, “unfavorable day,” as 1, if maximum heat index was ≥ 35°C or precipitation was ≥2.54 cm; and 0 otherwise. Second, I created a variable, “day following an unfavorable day,” as 1, if a day following an unfavorable day had normal weather conditions, 0 otherwise to test whether unfavorable weather conditions on a day would affect recreation participation on the next day. Likewise, I calculated heat index from daily maximum temperature and relative humidity by following the equations developed by Rothfusz (1990) and used by National Weather Service.

In addition to the climatic variables, I included temporal factors (e.g., weekend and U.S. public holidays) and fuel price, which improved the variance explained by the model without causing any multi-collinearity issue. A recent survey has shown that 70% of drivers in the U.S. own gasoline operated vehicles (American Automobile Association, 2016). Thus, state average price/liter for regular gasoline was included in the model. Daily average price of regular gas in the state of Florida was obtained from U.S. Energy Information Administration.

Model Selection

The dependent variable (daily recreation visits) was highly skewed and it included many zero scores (Figure 4-2). Thus, the data did not meet the assumption of the ordinary least squares (OLS) model, which assumes a normal probability distribution. Log transformation was not appropriate because of a large proportion of zero counts in the data. In addition, the dependent variable was time series count data, i.e., the data had properties of both count data (non-negative integer) and time series (temporal dependence). The most commonly used regression models for this kind of data and analysis are either count data or time series models. However, there is no clear standard in the literature regarding the choice between these two competing models as both have their own strengths and weakness. Thus, I used both models and compared the results to identify the best model fit.

Count data model

Researchers have used count data models in analysis of number of trips taken by recreationists to one or multiple sites over a specific period of time (Creel & Loomis, 1990; Scrogin & Berrens, 1999). Creel and Loomis (1990) state that when a dependent variable represent a count data, Poisson and negative binomial regression models with

count probability distribution can perform better than the least square regression models with normal probability distribution. The choice between Poisson and negative binomial model depends upon the dispersion on the data (Yen & Adamowicz, 1993). The Poisson model assumes that the conditional mean and the conditional variance are equal. Many recreation participation data, however, commonly exhibit over-dispersion, i.e., conditional variance exceeds the conditional mean. In that case, if the Poisson model is used, the standard errors of parameter estimates are biased because the Poisson model cannot capture the unobserved heterogeneity (Cameron & Trivedi, 2013; Hilbe, 2011; Yen & Adamowicz, 1993). As in other recreation demand literature, the dependent variable in this dataset also represents the count data, and the variance is considerably greater than the mean. Use of negative binomial regression has been common in recreation participation literature, where the dependent variable was over-dispersed (Bowker et al., 2007; Finger & Lehmann, 2012; Scrogin & Berrens, 1999; Zawacki, Marsinko, & Bowker, 2000).

Following Yen and Adamowicz (1993) and Englin, Holmes, and Sills (2003), the negative binomial probability distribution function can be represented as:

$$Prob\ (Y_i = y_i) = \frac{\tau(y_i+\frac{1}{\alpha})}{\tau(y_i+1)\tau(\frac{1}{\alpha})}\left[(\alpha\lambda_i)^{y_i}(1+\alpha\lambda_i)^{-\left(\frac{1}{\alpha}+y_i\right)}\right] \quad (4\text{-}2)$$

Where, y_i is a non-negative integer, α is the over-dispersion parameter, τ is gamma distribution, λ_i is conditional mean ($E(y_i|x_i)$), and $\lambda_i(1+\alpha\lambda_i)$ = $Var(y_i|x_i)$ is conditional variance. The over dispersion parameter (α) indicates data with significantly greater variance than the mean, thus justifying the appropriateness of the negative binomial regression model. When α is equal to zero, both $E(Y_i)$ and Var(Y_i) are equal to

λ_i; which indicates Poisson model as the more appropriate choice over the negative binomial regression model.

In time series data, an observation at a certain time usually correlates with the observation(s) from a previous time. As a result, the count data models exhibit serial dependence, thus resulting inefficient or biased estimates (Cameron & Trivedi, 2013). One potential option to work with this kind of data would be to include lag(s) of dependent variable as the explanatory variable(s) in the model. Including a lag(s) of the dependent variable in the model infers that the observations are dependent across time. However, the count data model assumes that the observations are independent (King, 1989). Brandt and colleagues (Brandt & Williams, 2001; Brandt, Williams, Fordham, & Pollins, 2000) have argued that if a count regression model includes a lagged dependent variable, the exponentiated coefficient of the lag represents the linear exponential growth rate not the autocorrelation component. Thus, lagged dependent Poisson or negative binomial models are not suitable for stationary time series data.

Time series model

One of the most common approaches to take account of the temporal dependence in the data is to use a time series model. Use of time series model is common in the recreation demand literature (Aylen et al., 2014; Hamilton et al., 2007). Autoregressive (AR) and Moving Average (MA) are two fundamental roots of time series models.

In the AR model, a value at a certain time is regressed on the value(s) from the previous time(s). A general AR model is given as:

$$X_t = \sum_{i=1}^{p} \alpha_i \, x_{t-1} + z_t \tag{4-3}$$

Where, α_i refers to autocorrelation coefficients at lags 1, 2,……,p, and z_t is residual error term.

In MA model, a value at a certain time is a function of average of values at certain previous times.

$$X_t = \sum_{i=0}^{q} \beta_i \, x_{t-i} \tag{4-4}$$

Where, β_i terms are the weights applied to prior values in the time series.

Although some timeseries data are best explained by either AR or MA models, some data require combined AR and MA model, e.g., Autoregressive Integrated Moving Average (ARIMA). Inspection of the plots of autocorrelation function (ACF) and partial-autocorrelation function (PACF) provide a clue for the selection of appropriate timeseries model.

ACF is defined as the correlation between a time series value at time $t(Y_t)$ and its value at time $t-k(Y_{t-k})$, where k= 1, 2, 3…etc. (Montgomery, Jennings, & Kulahci, 2008). Thus, ACF is given as:

$$ACF = \frac{cov(y_t, y_{t-k})}{sd(y_t) sd.(y_{t-k})} \tag{4-5}$$

For stationary timeseries data, the standard deviation is the same at all time on the series. Thus, ACF for stationary timeseries data is:

$$ACF = \frac{cov(y_t, y_{t-k})}{var\ (y_t)} \tag{4-6}$$

In general, a partial correlation is defined as the correlation between two variables after adjusting for the common factor(s) that might be affecting them. Thus, PACF is the autocorrelation between a time series value at time $t(Y_t)$ and its value at time $t-k(Y_{t-k})$ after adjusting for $Y_{t-1}, Y_{t-2}, \dots \dots, Y_{t-k+1}$(Montgomery et al., 2008).

A general equation of PACF is given as:

$$PACF = \frac{cov(Y, Y_{t-k}|Y_{t-1}, Y_{t-2}, \ldots, Y_{t-k+1})}{\sqrt{var(Y|Y_{t-1}, Y_{t-2}, \ldots, Y_{t-k+1}) var(Y_{t-k}|Y_{t-1}, Y_{t-2}, \ldots, Y_{t-k+1})}} \quad (4\text{-}7)$$

The plots of ACF and PACF indicate the possible number of lags. ACF cuts off after lag q for a MA(q) model and PACF cuts off after lag p for an AR(p) model thus suggesting the possible lags for each AR and MA (Table 4-2).

One of the assumptions of the time series model is stationarity of the data. In a stationary time series, the joint probability distribution of the observations $y_t, y_{t+1} \ldots \ldots y_{t+n}$ is equal to the probability distribution of the observations $y_{t+k}, y_{t+k+1} \ldots \ldots y_{t+k+n}$ (Montgomery et al., 2008). Stationarity in the time series data is important because if the mean or variance were changing systematically, the prediction model should take this into account (Aylen et al., 2014). The common approach to achieve stationarity in the non-stationary data are transformation, trend adjustment, and differencing (Montgomery et al., 2008). The most practiced statistical test to check the stationary in the time series data is Augmented Dickey Fuller unit root test (Dickey & Fuller, 1979). The Dickey-Fuller Test for 12 lags (ADF = -4.80, p= 0.01) showed that the null hypothesis of unit root test can be rejected, thus suggesting that the dependent variable in this data does not have a unit root (i.e., the data is stationary).

The ACF plot shows exponential decay after second lag, and the PACF plot shows damped sinusoid after first lag, thus suggesting the possibility of first or second order ARIMA model (Figure 4-3 and Table 4-2). In addition, both the ACF and PACF plots show consistent higher values at the seventh cycle, thus suggesting for a Seasonal (weekly) ARIMA ($SARIMA_7$) model (Brockwell & Davis, 2002; Hamilton et al., 2007). Following Montgomery et al. (2008, p. 283), a seasonal ARIMA model of orders (p, d, q) x (P, D, Q) with a seasonal cycle s is given as:

$$\Phi(B^s)\Phi(B)(1-B)^d(1-B^s)^D y_t = \delta + \Theta(B^s)\Theta(B)\epsilon_t \quad (4\text{-}8)$$

Based on the ACF and PACF plots of dependent variable (Figure 4-3), I tested and compared 15 possible $SARIMA_7$ models with various combinations of AR(p) and MA(q) compared. While there are various model parameters available to compare the competing models, I considered Akaike information criterion (AIC) and Bayesian information criterion (BIC). Among the competing models, the model that has the lowest values of AIC and BIC indicates the best fit model (Cameron & Trivedi, 2013; Montgomery et al., 2008). The SARIMA models (2,0,1) x $(1,0,1)_7$, (1,0,1) x $(1,0,1)_7$, (1,0,0) x $(1,0,1)_7$ were the best three models based on their lowest values of both AIC and BIC (Table 4-3).

Once I identified the best three SARIMA7 models, I introduced the exogenous regressors (Table 4-1) in each model and compared the results. This time the comparison of the models was based on the errors (mean error [ME]), root mean square error [RMSE], and mean absolute error [MAE]) in addition to AIC and BIC. Similar to AIC and BIC, the lowest value of each error term indicates the best fit model (Nau, 2017). Among the three competing $SARIMA_7X$ models, information criteria and errors from SARIMA ((1, 0, 0) $(1, 0, 1)_7$) X) were lowest, thus suggesting this model as the best fitting time series model (Table 4-4).

Once the best fit $SARIMA_7X$ model was identified, I used the same regressors to run a negative binomial regression model and compared the results with the time series model. Between the time series and negative binomial regression, I selected the best model based on information criteria, errors, Ljung-Box test, and squared correlation between actual and predicted values.

Ljung-Box is a goodness-of-fit test to examine whether the time series observations are white noise, i.e., uncorrelated and random with constant variance (Montgomery et al., 2008). In terms of comparison of competing models, the best fit model should resemble white noise. In other words, the autocorrelations of residuals from a best fit model should be no different than zero up to a specified lag. In Ljung-Box test, a higher p-value (>.05) indicates presence of no serial autocorrelations (Montgomery et al., 2008).

The squared correlation between actual and fitted values (R^2CORR), which is equivalent to the multiple R^2 in linear models, indicates percentage of variance in the dependent variable that is explained by the model (Fogarty & Monogan, 2014). Despite the drawbacks that the R^2CORR value can decrease with the addition of regressors, this measure is recommended as a fit index to compare disparate models (Cameron and Trivedi, 2013, 193). Thus, a model that has substantially higher squared correlation of actual and fitted values than the other model more accurately explains the data.

I combined the data for daily visits, daily observations for the climatic factor, and daily gasoline price and stored in an Excel Spreadsheet (version 2016). I computed the analyses and graphs in the R statistical software (version 3.3.2) and R studio using tseries (Trapletti, Hornik, LeBaron, & Hornik, 2017), ggplot2 (Wickham & Chang, 2015), forecast (Hyndman et al., 2017), MASS (Ripley et al., 2013), and AER (Kleiber & Zeileis, 2009) packages.

Results

Descriptive Characteristics of the Variables

During the study period, cumulative daily visits to the study area ranged from zero to 120, with an average of 21 (± 20) visits per day. The average daily visits in 2011

was higher ($\bar{X}$=24±19.5) than in other years (Figure 4-4). Among months, March received the highest number of average daily visits ($\bar{X}$=39±24), followed by February ($\bar{X}$=35±25), and January ($\bar{X}$=33±26), whereas time between June and September received 10 or fewer visits/day (Figure 4-5). Among the days of the week, the average daily visits were highest on Saturday ($\bar{X}$=40±29), followed by Sunday ($\bar{X}$=31±25), whereas the average visits during the weekdays ranged from 13 – 18 visits/day (Figure 4-6).

There was a significant negative correlation between daily visits and average daily temperature ($r= -0.452$, $p<0.05$), indicating a decreased recreation visits with increased temperature (Figure 4-7). Analysis showed an increase of average daily visits with increase in average temperature up to 12°C (Figure 4-8). When average temperature went above 12°C, visit number decreased gradually, with significant drops for temperature above 24°C (Figure 4-8).

Days with average temperature range of 4 – 23°C received at least the mean number of visits (21 visits/day) and 10 – 12°C received the highest daily visits (40 visits/day), thus indicating the former as favorable and later as the most preferable range of average daily temperature for scenic trail use in Florida (Figure 4-8). Likewise, days with an average temperature of more than 27°C received 10 or fewer visits/day indicating this range of temperature as less favorable for hiking. A trend of mean visitations with heat index (feels like temperature) (Figure 4-9) also showed that recreation participation on the scenic trail significantly declined below average when heat index went above 35°C, thus suggesting a significant effect of heat index on recreation participation in Florida.

During the study period, average daily price for regular gas in Florida was significantly lower in 2010 ($\bar{X}$=\$0.73±0.03/liter) in comparison to other years ($p \leq 0.01$). Although annual averages for the rest of the years were almost equal, average daily price fluctuated among the months for each year (Figure 4-10). For instance, the price ranged from \$0.70/lit during summer of 2010 to \$1.03/lit in April 2012, and dropped to \$0.57/lit in January 2015. As data show, most of the peaks in gas price were during the summer time in each year, when recreation visits were low, thus indicating a negative correlation between gas price and recreation participation (Figure 4-10).

Comparison of Best-Fit Time Series and Count Data Model

The significant p-value of the likelihood ratio (LR) test indicates that the negative binomial model was a better fit to the data over Poisson model (Table 4-5). However, when compared to best fit time series model [SARIMA $((1, 0, 0)\ (1, 0, 1)_7)$ X], the overall performance of the time series model was better than that of negative binomial model (Table 4-5, Figure 4-11, and Figure 4-12). First, despite that the negative binomial model had lower values of both AIC and BIC than in the time series model, values of all the error terms (RMSE, ME, and MAE) were lower in the time series model than in the negative binomial model (Table 4-5). Second, the squared correlation between actual and fitted values was significantly higher from the time series model ($R^2 = 0.59$) than from the negative binomial model ($R^2 = 0.52$), thus suggesting a better fit of data with the time series model (Table 4-5). Third, as indicated by Ljung-Box test (Table 4-5), there was presence of a serial correlation among residuals from the negative binomial model ($p<0.001$), whereas no serial correlation was found among residuals from the time series model ($p=0.56$). Fourth, ACF and PACF values of residuals from the time series model were almost equal to zero up to 30th lag, whereas many ACF and PACF

values from the negative binomial model were significantly bigger than zero (Figure 4-11). Fifth, the histogram of residuals from the time series model resembled closeness to normality better than those from the negative binomial model (Figure 4-12). In addition, plots of residuals versus fitted indicated a better fit of data with time series model than negative binomial model (Figure 4-11). Thus, SARIMA (1, 0, 0) $(1, 0, 1)_7$) X was selected as the best fit model for this data.

Regression Results from Final Model

All the time series lag factors, first order auto-regression (AR (1)), seasonal first order auto-regression (AR $(1)_7$), and seasonal first order moving average (MA $(1)_7$) were statistically significant ($p<0.01$), thus indicating the suitability of this time series model to fit the data (Table 4-6). Among the climatic factors, temperature, relative humidity, and cold snap had significant negative effects on visitation numbers. Other factors remaining constant, 1°C increase in average temperature decreased daily recreation visits to the study area by 0.94 ($p<0.001$). Likewise, a one percent increase in relative humidity resulted in a decrease in recreation visits by 0.16 ($p<0.001$). A sudden fall in temperature (cold snap) also had a negative effect. Specifically, a day in winter season received about 11 fewer visits than other days ($p<0.001$) if average temperature was below the long-term daily average by 6°C or more.

Rainfall, as a continuous variable, was not a significant predictor of recreation visits, but effect of rainfall extreme was negatively significant. Specifically, an unfavorable day with 2.54 cm or higher rainfall (24-hour) or maximum heat index of 35°C or higher received about three fewer visits than other days ($p<0.05$), keeping everything else constant (Table 4-6). A day with unfavorable weather conditions negatively affected recreation visits of not only the same day, but also the visits of the

next day, even if next day had normal weather conditions. In other words, a day with normal weather following an unfavorable weather day, also received about five fewer visits than other days ($p<0.001$), all other factors remaining constant. An analysis of frequency distribution of heat index during the study period has shown that about 40% of the total days in a year have heat index above 35°C. This indicates that annual seasonality in land-based recreation in Florida is mostly driven by heat index.

Among the temporal variables and gasoline price, weekends, public holidays, and the month of March (a month with highest average daily visits) were positively associated and gasoline price was negatively associated with the recreation visits. Particularly, everything remained constant, weekend or public holidays received about eight more visitors and a day in March received about 10 more visitors than other days ($p<0.001$). Likewise, number of recreation visits was likely to decrease by about 27 visits per day ($p<0.001$) for every one dollar (per liter) increase in gas price, keeping all other factors constant (Table 4-6).

Discussion

The aim of this research was to examine how climatic, temporal, and economic factors affect outdoor recreation participation in Florida. Past research conducted elsewhere shows that tourists and outdoor recreation visitors consider temperatures between 20 – 27°C as favorable for various land-based recreation activities (Lise & Tol, 2002; Steiger et al., 2016; Wilson et al., 2008). The favorable range of temperature identified in this study was slightly lower than that found in past studies from other locations, which might be due to several reasons. First, the range of favorable and preferable temperature identified in this study was average daily temperature, not the temperature at the time of visits. Second, the perceived (felt) actual temperature might

have been much higher than the measured temperature because of high humidity in Florida. Third, visitors' perceived measure of temperature might have been different than the objective measure of temperature, as outdoor physical activity could more depend on perceived temperature than the objective measures (McGinn et al., 2007).

The finding regarding significance of heat index and heavy rainfall was as expected and is consistent with the finding from other studies (Li, 2008; Yu et al., 2009). Likely of heat related sickness and physical danger associated with stronger storms and possibility of thunder and lightning during the time of heavy rainfall could be the major reason for the significant negative effect of high heat index and heavy rainfall on hiking participation in forest land based recreation settings (Nicholls et al., 2008).

One of the important findings of this study is that an undesirable weather condition tends to negatively affect recreation visitation not only on the day when it occurs, but it also affects visitation on the following day, even if the weather condition on the following day is normal. Such lag effect of weather on recreation participation was also found in studies conducted elsewhere in different recreation contexts. For example, Hamilton et al. (2007) found that the amount of snow seen in town was significantly associated with the number of skiers to the nearby ski areas the next day. However, rainfall is more transitory than snow, and temperature is something that people can feel rather than observe. Perhaps, certain cognitive process lead people to rely on the weather condition on one day to make their recreation decision for the next day. This hypothesis is still unclear and further research is needed.

Results also indicated that trail use volume is likely to decline with the increase in gas price. There is evidence in the literature that when gas prices increases, people will

prefer to drive fewer miles and less travel will occur for recreation participation (Napier & Bryant, 1980; Pergams & Zaradic, 2006). This finding was expected and consitent with the existing literature. Previous research has shown that recreation users to this area drove a one way distance of about 156 km and only 7% of the visitors drove ≤35 km (Paudyal & Stein, 2014); therefore, a gas price increase has the logical affect of decreasing trail use volume.

Research and Management Implications

This research adds to the body of knowledge in two ways. First, it identifies the best approach of modeling long-term data of daily recreation use with weather factors and relevant other temporal (e.g., weekend/public holidays) and market factors (e.g., gas price). Second, it improves our knowledge about the dependence of recreation on weather. Specifically, it moved beyond the obvious result that when it is hot, and/or rainy people do not hike as much, but specific temperature conditions are specified for Florida outdoor recreation, which were previously not examined. Managers should expect a higher use volume to hiking trails when average daily temperature is 6 – 23°C, with most use in days with average daily temperature of 10 – 12°C. The model developed in this study would be useful to the agencies in predicting daily use volume with the information of weather condition and past use volume. Information of near future recreation use volume in relation to weather condition will be useful for staffing and other resources management (Manning & Powers, 1984), which will be beneficial to operate and maintain economically viable recreation facility and maintaining healthy natural resources.

In addition, the finding of delayed response to bad weather conditions has important implications for management and future research. Specifically, if the weather

condition of a day is not favorable, recreation visitation numbers, on the following day, will be significantly fewer, even if the weather condition is within the favorable range. With this understanding, managers will more likely predict use on a day, that might seem favorable, but experience less use because of previous bad weather conditions. Research has shown that recreationists and day visitors usually plan their trip at short notice and adjust their plan according to short-term weather predictions (McEvoy et al., 2006). Thus, more research is needed to better understand why use drops on normal days following days with unfavorable weather conditions. Perhaps certain psychological or cognitive process makes recreation users rely on weather experienced on previous day over forecast for the same day.

This study finds significant negative effect of temperature and precipitation extremes on recreation participation. Change in climate is predicted to increase in frequency of higher maximum temperatures, heat waves, and precipitation extremes in the near future (IPCC, 2001) . An analysis of the past 50 years of weather data of central Florida has shown an increasing trend in frequency of heat indices above 35°C (Yu et al., 2009). Research has shown that mean temperature in Florida has increased between 0.25 and 1.4°C between 1961 and 2000 (Soule, 2005) and is expected to increase 3°C by 2050 and 5°C by the end of the century (Stanton & Ackerman, 2007). In this scenario, model developed in this study suggests that daily recreational visitation in FNST will decrease by 13.43% by 2050 and by 22.38% by end of century only because of increase in temperature. Theses number could even go higher because of delayed response effect identified in this study, as unfavorable weather condition (e.g.,

extreme heat) is likely to decrease recreation participation of not only the same day but also of the following day with normal weather condition.

Research has found a significant decrease in forest and agricultural lands and increase in urban areas (26.6%) in Central Florida during the period of 1995 – 2006 (Hernández, Hwang, Escobedo, Davis, & Jones, 2012). With the increase in human population and associated increase in urban areas, concern has been raised regarding nature deficit disorder among the new generation because of their low outdoor recreation participation (Louv, 2008). Some of the constraints identified for reduced recreation participations were lack of recreation areas nearby, shortage of family time for outdoor activities, increasing amount of time spent with electronic devices (e.g., computer, TV, video games), and decline in park budget and associated increase in park entrances fees (Louv, 2008; Nyaupane & Andereck, 2008; Pergams & Zaradic, 2006). As recreation managers already have challenges to overcome these constraints, negative effect of weather extremes on outdoor recreation participation found in this study could create additional challenges through sole effect or interaction effect with previously identified constraints.

Limitations and Future Research

The dependent variable in this study was the total count of daily visits from three trail heads of a section of FNST in ONF collected over a period of five and half years. The data do not represent the entire use volume of ONF or the entire section of FNST within ONF. There are more than ten official trailheads of the FNST within the ONF, of which three trailheads were selected to install and operate infrared counter to obtain visitors' count. Thus, caution should be taken to interpret the overall use volume of both the ONF and FNST.

Many past studies examined how recreation visitors would adjust their recreation pursuits with change in climate using different hypothetical scenarios (Paudyal et al., 2015; Richardson & Loomis, 2004). However, little is known about how recreation users would adapt to fluctuating weather conditions. Thus, research regarding how recreation users process weather information in their recreation decision and how unforeseen weather would affect recreation decisions could be beneficial to develop theory-based explanation to the yesterday's weather effect on recreation participation.

As found in this study, scenic trail use in Florida is significantly low in summer and fall, and is high during the winter and spring. Florida offers many destinations with natural springs, which are popular during the summer and fall. Thus, it is likely that recreation users go to spring water-based activities (e.g., swimming, tubing) when weather conditions are unfavorable for hiking and similar land based activities. Thus, future research that focuses on how recreation users substitute activity and destinations based on objective or perceived weather condition would be more beneficial to understand net effect of weather on recreation in Florida.

The best-fit time series model explained about 60% of the variance in the dependent variable. Within a same day, weather condition could fluctuate from unfavorable to favorable as the heat index goes down at the evening and heavy rainfall could last just a few hours. Thus, modeling with hourly data, as did by Yu et al. (2009) of both weather and visitation, and considering heat index over temperature could improve the estimation.

To conclude, this study examined how climatic (temperature, precipitation), temporal (weekends, holidays), and economic (gasoline price) factors affect daily

recreation participation in Florida National Scenic Trail. Finding shows that most people recreate in FNST when daily average temperature is 4 – 23°C, with daily average temperature of 10 – 12°C being most preferable. Unfavorable weather condition (extreme heat or heavy rainfall) is found to affect recreation participation of not only the same day but also of the next day, even if weather condition is within the favorable range. Thus, managers of recreation facilities should expect low recreation participation on days following extreme weather conditions and maintain staffing accordingly.

Table 4-1. Descriptive characteristics of independent variables in the model examining daily recreation visits (dependent variable) to Ocala National Forest, USA.

Variables	Definition	Mean	Std. Dev.
Climatic			
Temperature	Average temperature (°C)	21.81	5.80
Precipitation	Daily precipitation (cm)	0.33	1.05
Relative humidity	Relative humidity in %	71.56	9.53
Cold snap	1, if avg. temp. is ≥6°C below the normal in winter; 0 otherwise	0.04	0.19
Unfavorable day	1 if a day had heat index >35°C or precipitation >2.54 cm, 0 otherwise	0.38	0.47
Day following an unfavorable day	1, if next day of an unfavorable day had normal weather; 0 otherwise	0.05	0.23
Economic			
Gas price	Avg. price for regular gas in Florida ($/liter)	0.85	0.11
Temporal			
Weekend & public holidays	1, if weekend or US public holidays; 0 otherwise	0.31	0.46
March	1, if month is March; 0 otherwise	0.09	0.29

Table 4-2. Theoretical characteristics of ACF and PACF for stationary data.

Model	ACF	PACF
$AR_{(P)}$	Exponential decay and/or damped sinusoid	Cuts off after lag p
$MA_{(q)}$	Cuts off after lag q	Exponential decay and/or damped sinusoid
$ARMA_{(p,q)}$	Exponential decay and/or damped sinusoid	Exponential decay and/or damped sinusoid

Note: ACF: Autocorrelation Function; PACF Partial Autocorrelation Function; AR: Autoregressive; MA: Moving Average; Table source: Montgomery et al., (2015)

Table 4-3. AIC and BIC of competing time series models without exogenous regressors.

SN	Model	AIC*	BIC*
1	ARIMA (1, 0, 0) x (0, 0, 1)7	16692.74	16715.09
2	ARIMA (1, 0, 0) x (1, 0, 0)7	16452.83	16475.19
3	ARIMA (1, 0, 0) x (1, 0, 1)7	16078.79	16106.74
4	ARIMA (0, 0, 1) x (0, 0, 1)7	16755.34	16777.69
5	ARIMA (0, 0, 1) x (1, 0, 0)7	16492.95	16515.31
6	ARIMA (0, 0, 1) x (1, 0, 1)7	16117.41	16145.36
7	ARIMA (1, 0, 1) x (0, 0, 1)7	16694.58	16722.53
8	ARIMA (1, 0, 1) x (1, 0, 0)7	16453.21	16481.16
9	ARIMA (1, 0, 1) x (1, 0, 1)7	16072.40	16105.93
10	ARIMA (2, 0, 0) x (0, 0, 1)7	16694.61	16722.56
11	ARIMA (2, 0, 0) x (1, 0, 0)7	16453.40	16481.35
12	ARIMA (2, 0, 0) x (1, 0, 1)7	16074.93	16108.46
13	ARIMA (2, 0, 1) x (0, 0, 1)7	16576.49	16610.03
14	ARIMA (2, 0, 0) x (1, 0, 0)7	16404.05	16437.59
15	ARIMA (2, 0, 1) x (1, 0, 1)7	16029.40	16068.53

Note: AIC: Akaike information criterion; BIC: Bayesian information criterion; *Lowest value indicates the best fit model

Table 4-4. AIC, BIC and errors of best three time-series models with exogenous regressors.

		Information criteria*		Errors*		
SN	Model	AIC	BIC	ME	RMSE	MAE
1	SARIMA ((1, 0, 0) (1, 0, 1)$_7$) X)	15894.17	15972.42	0.08	13.36	9.45
2	SARIMA ((1, 0, 1) (1, 0, 1)$_7$) X)	15895.29	15979.13	0.08	13.36	9.46
3	SARIMA ((2, 0, 1) (1, 0, 1)$_7$) X)	15895.91	15985.33	0.09	13.36	9.45

Note: AIC: Akaike information criterion; BIC: Bayesian information criterion; ME: Mean error; RMSEA: Root mean square error; MAE: Mean absolute error; Regressors(X) are as listed in Table 4-1.
*Lowest value indicates the best fit model

Table 4-5. Model fit comparison of negative binomial and final time-series model.

Fit indices	Models: Negative Binomial	Models: SARIMA $(100,101)_7$ with regressors
AIC	14859.62	15894.17
BIC	14920.10	15972.42
ME	0.08	0.08
RMSE	14.35	13.36
MAE	10.18	9.45
R^2 (original and fitted)	0.52	0.59
Ljung-Box test	242.66 (p<0.001)	10.10 (p=0.43)
LR test	10375.52 (p<0.001)	n/a

Regressors(X) on both models were as listed in Table 4-1.

Table 4-6. Regression results from SARIMA $(100,101)_7$ with regressors model examining daily recreation visits (dependent variable).

Variables	Coefficient	Std. error	Z value	P>|Z|
Climatic				
Average temperature (°C)	-0.94	0.12	-8.08	<0.001
Precipitation (cm)	-0.45	0.29	-1.53	0.120
Relative humidity	-0.16	0.04	-4.13	<0.001
Cold snap (avg. temperature >6°C below long-term normal in winter)	-11.14	2.14	-5.20	<0.001
Unfavorable day	-2.79	1.17	-2.39	0.020
Normal day following an unfavorable day	-4.72	1.35	-3.49	<0.001
Economic			-2.79	
Gas price ($/liter)	-26.58	9.53	3.48	<0.001
Temporal			6.65	
Weekend & public holidays	7.58	2.18	11.61	0.001
March	10.48	1.58	66.01	<0.001
AR(1)	0.26	0.02	-31.96	<0.001
$AR(1)_7$	0.94	0.01	8.41	<0.001
$MA(1)_7$	-0.76	0.02	-8.08	<0.001
Intercept	73.63	8.76	-1.53	<0.001

AR(1): 1st order auto-regression, $AR(1)_7$: Seasonal (weekly) 1st order auto-regression; $MA(1)_7$: Seasonal (weekly) 1st order moving average; Unfavorable day: (heat index >35°C or Precipitation >2.54 inch)

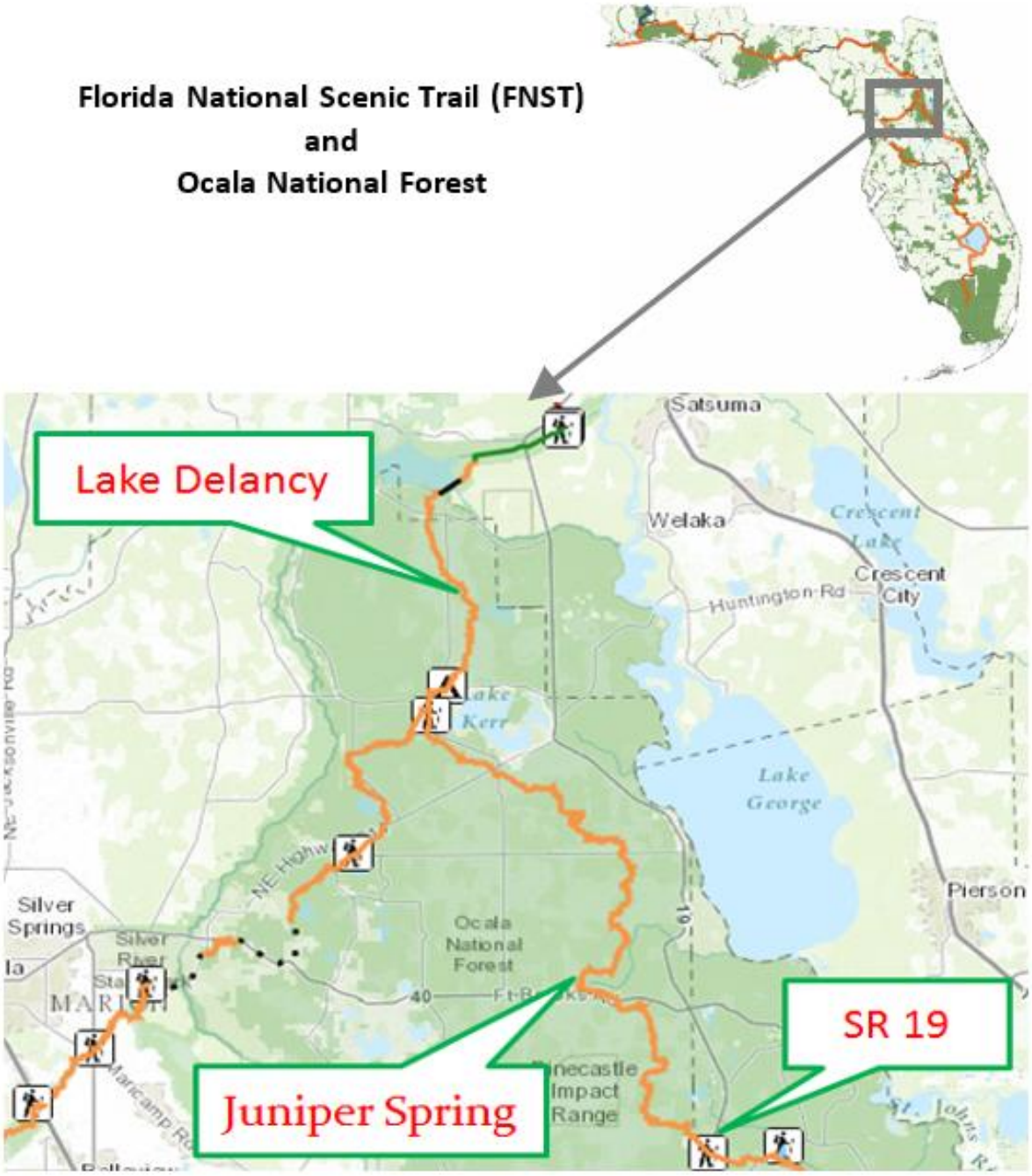

Figure 4-1. Study area with sampling locations at Ocala National Forest Section of Florida National Scenic Trail, in Florida, USA.

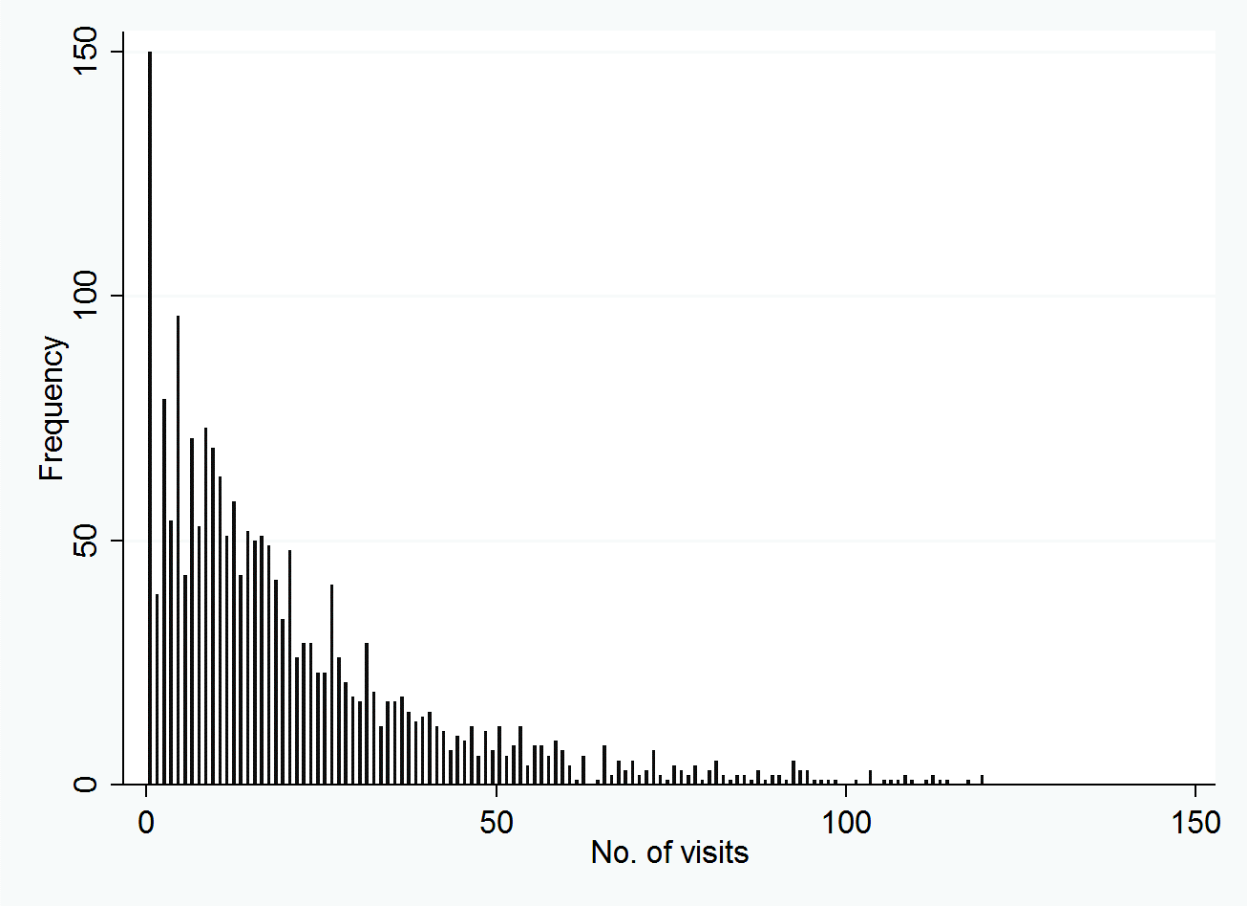

Figure 4-2. Frequency distribution of average daily visits to Ocala National Forest Section of Florida National Scenic Trail (dependent variable), USA.

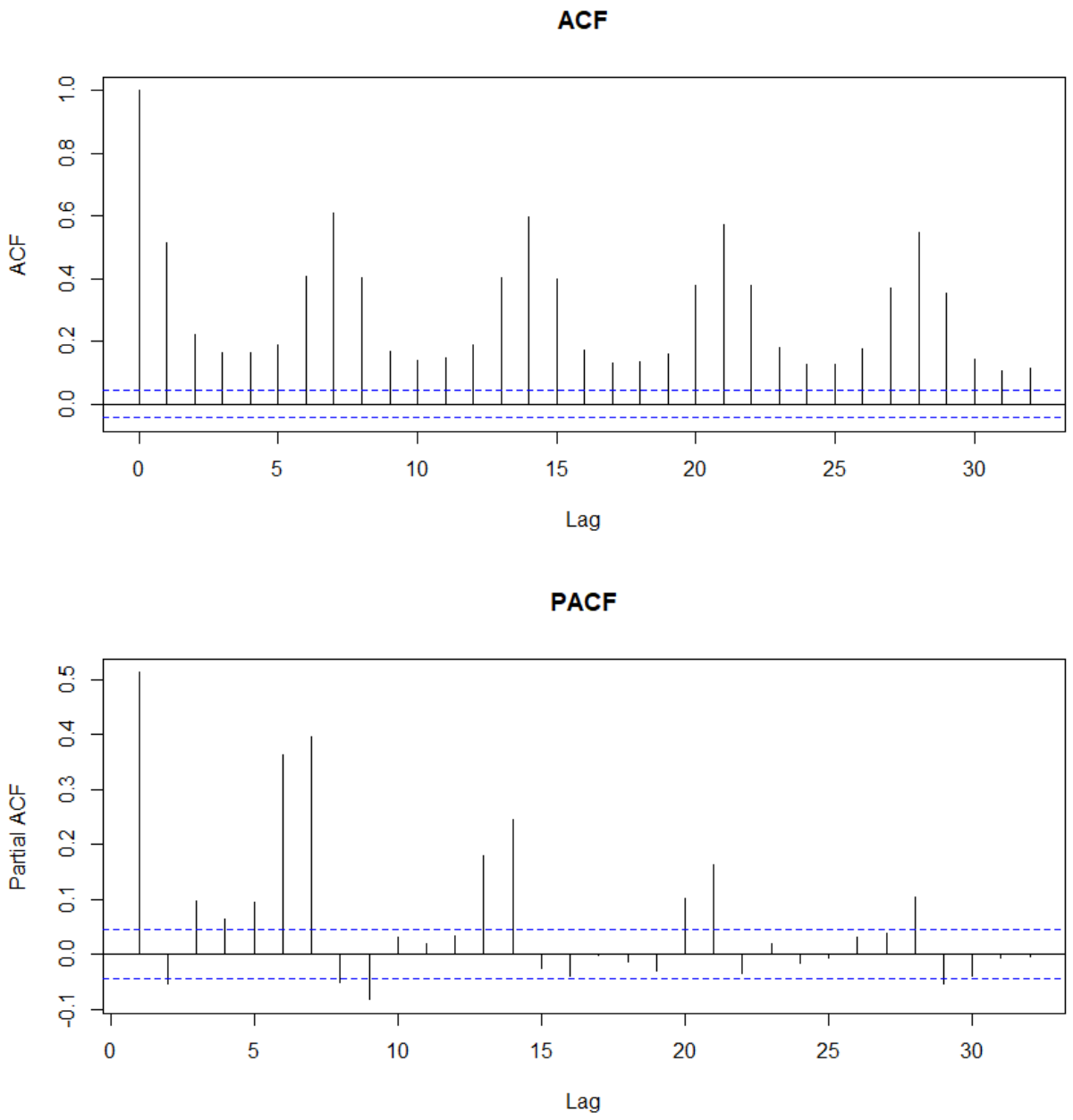

Figure 4-3. Autocorrelation function (ACF) and Partial autocorrelation function (PACF) of dependent variable.

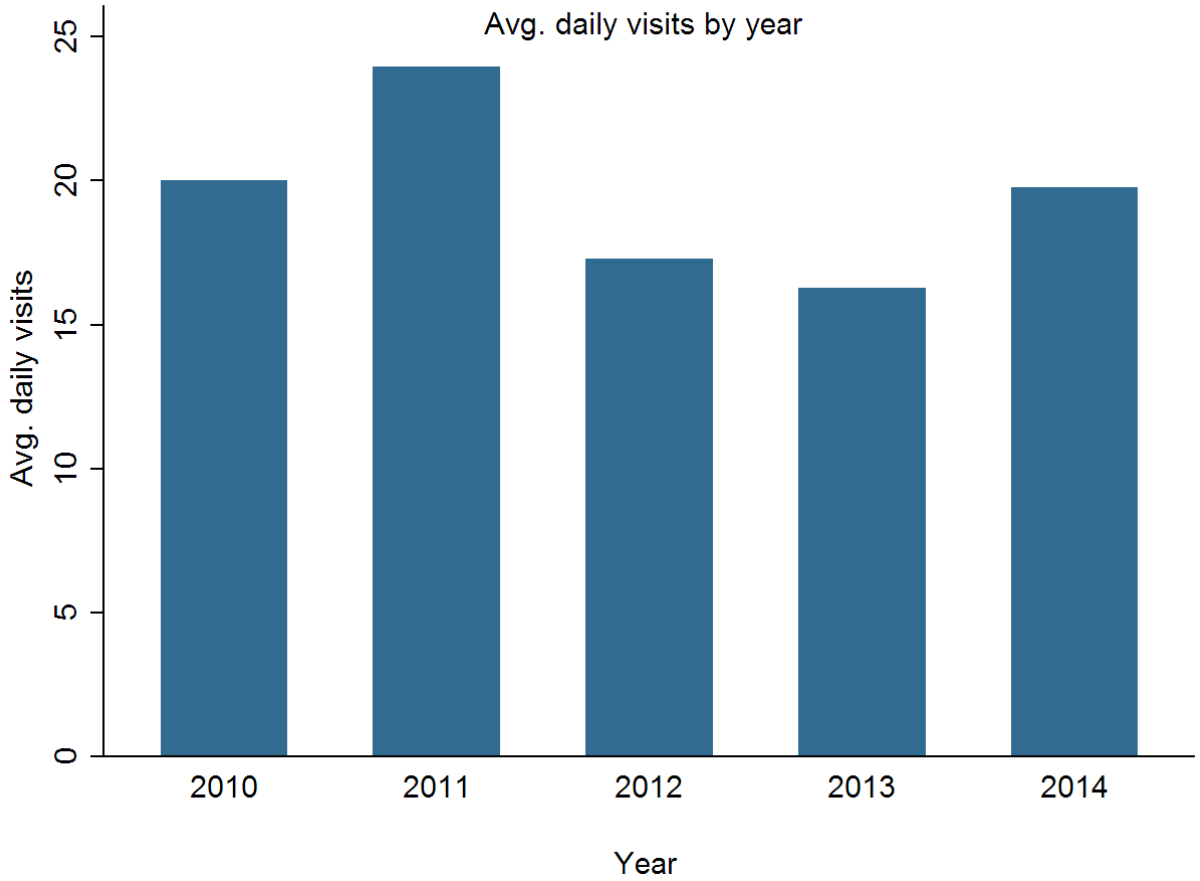

Figure 4-4. Average daily visits to Ocala National Forest Section of Florida National Scenic Trail by year.

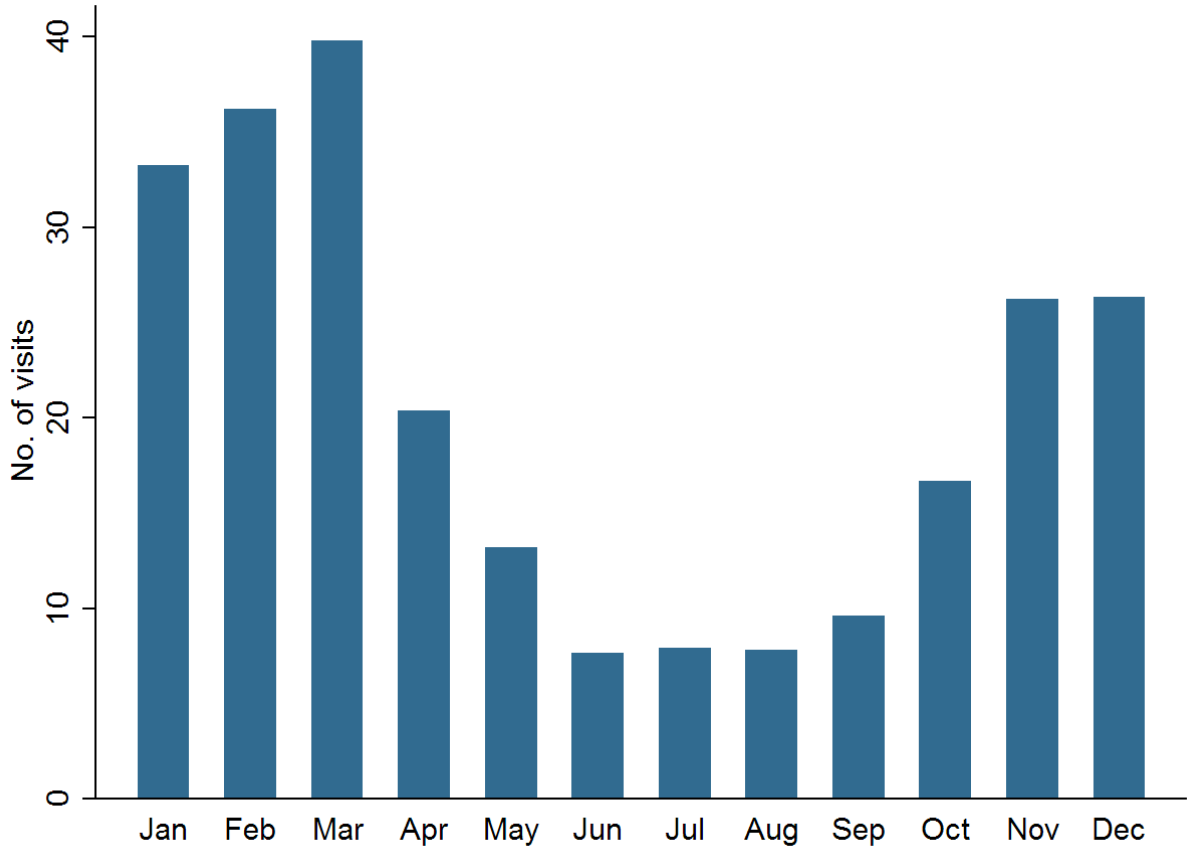

Figure 4-5. Average daily visits to Ocala National Forest Section of Florida National Scenic Trail by months.

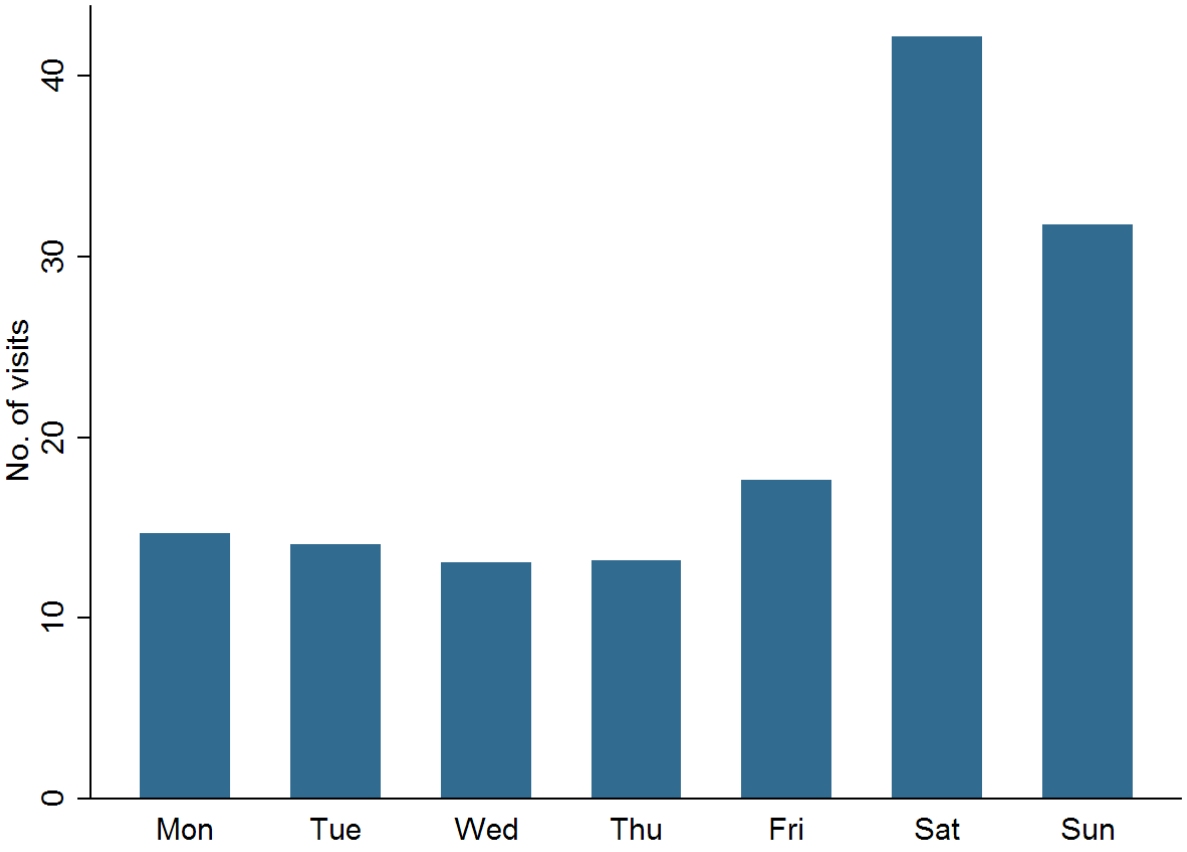

Figure 4-6. Average daily visits to Ocala National Forest Section of Florida National Scenic Trail by day of the week.

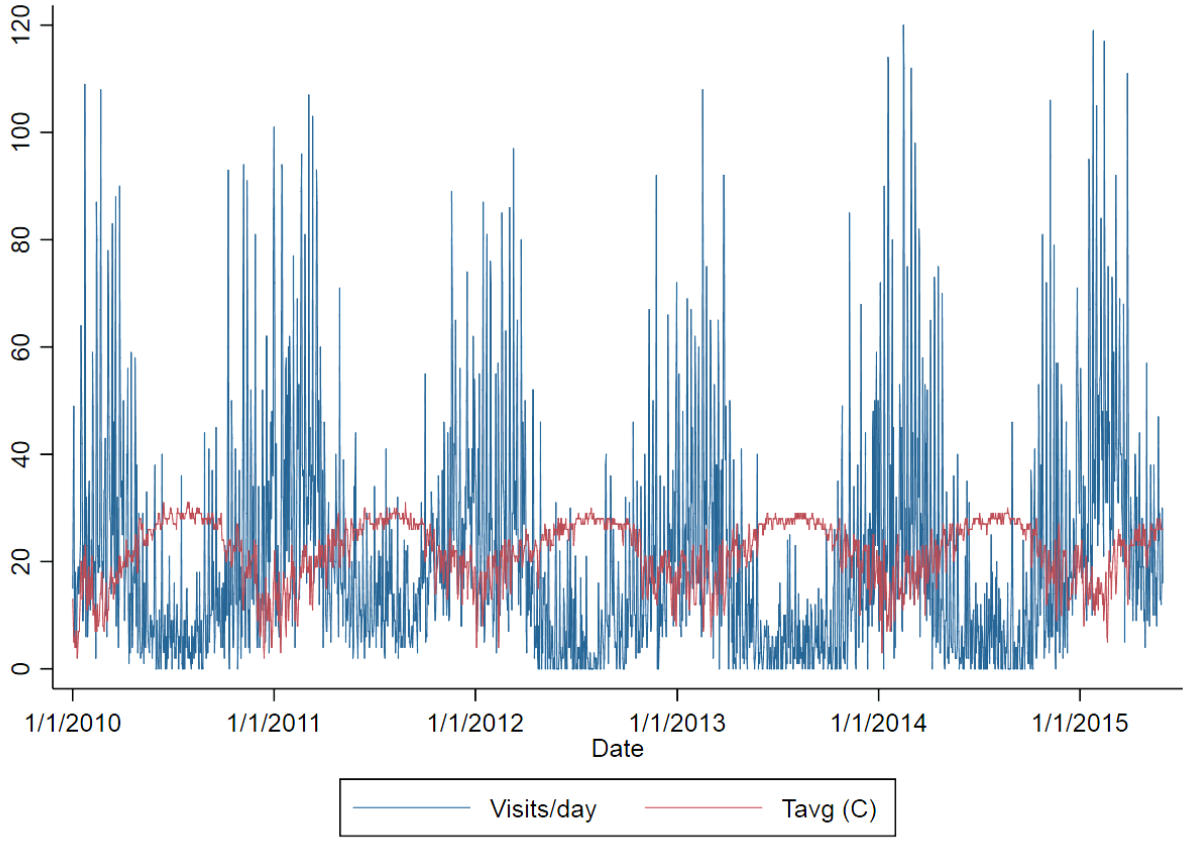

Figure 4-7. Average daily visits to Ocala National Forest section of Florida National Scenic Trail and daily avg. temperature (°C) during the period of January 1, 2010 to May 31, 2015.

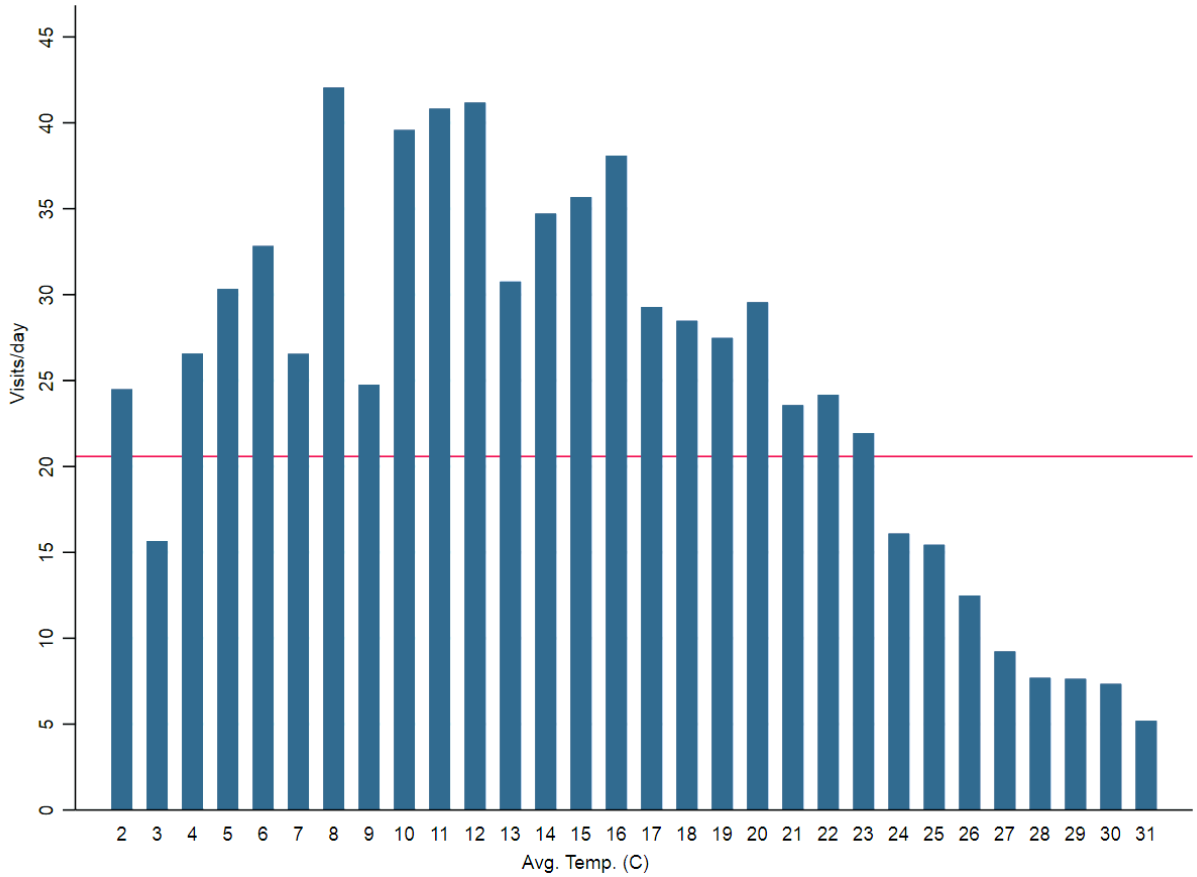

Figure 4-8. Average daily visits to Ocala National Forest section of Florida National Scenic Trail by various ranges of average daily temperature (°C) during the period of January 1, 2010 to May 31, 2015.

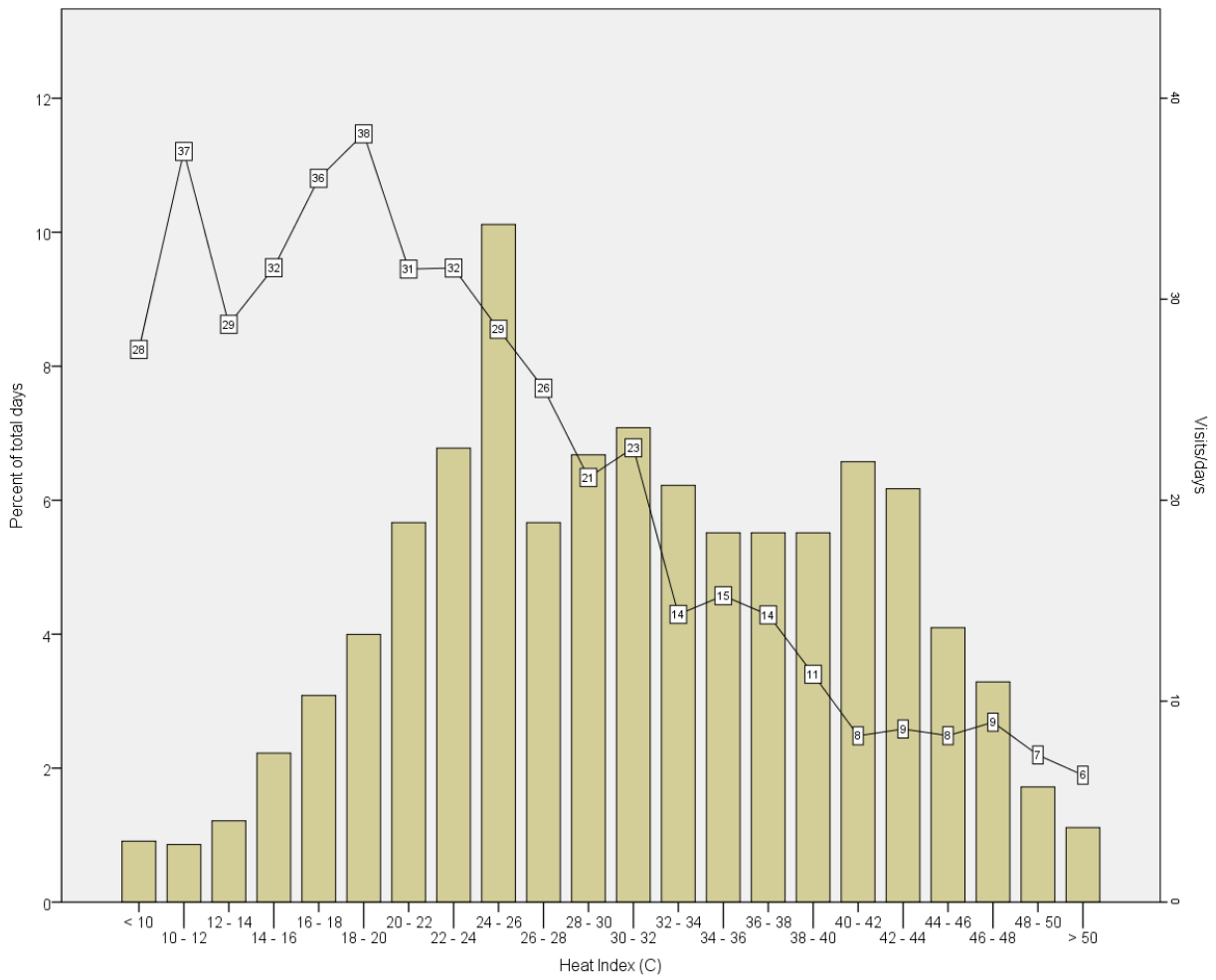

Figure 4-9. Occurrence of various heat index values (left axis) and mean recreational visits (right axis) in Ocala National Forest section of Florida National Scenic Trail during the time-period of January 1, 2010 to May 31, 2015.

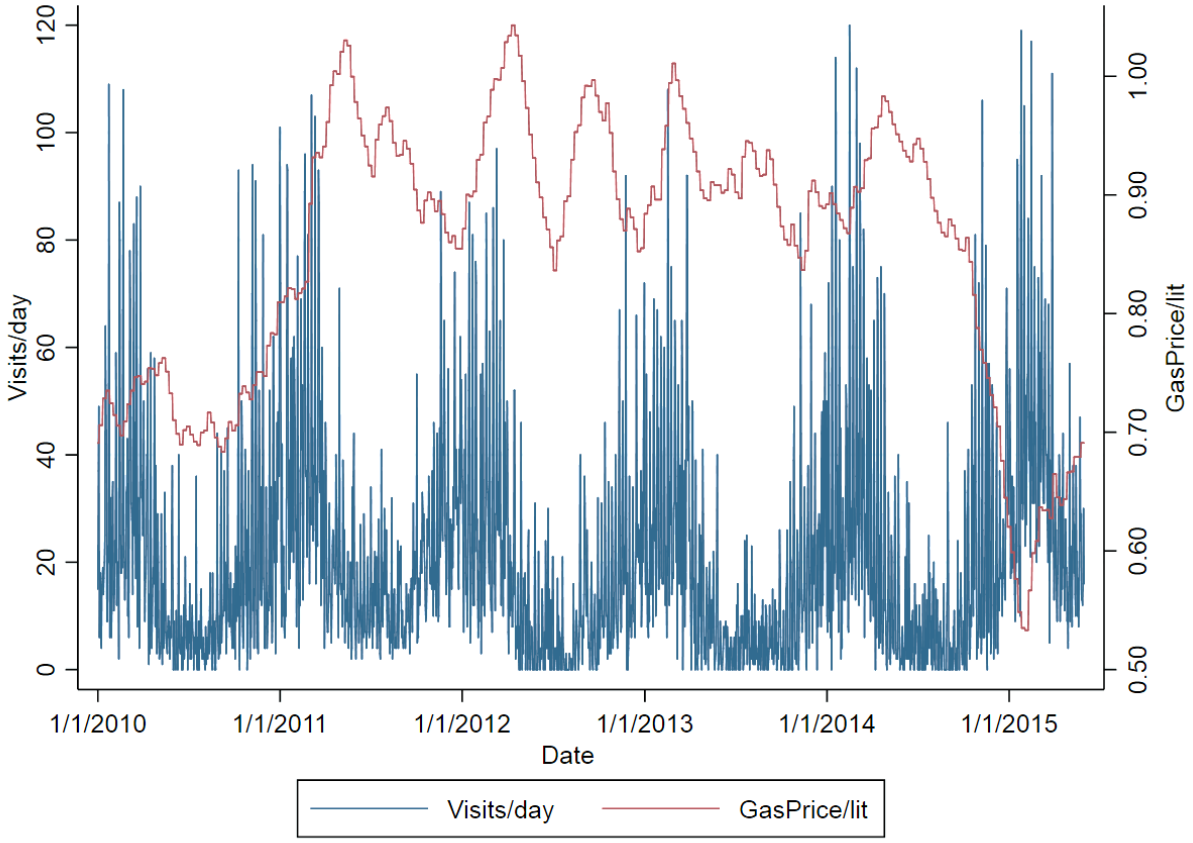

Figure 4-10. Average daily visits to Ocala National Forest section of Florida National Scenic Trail and average daily price for regular gas in Florida during the study period of January 1, 2010 to May 31, 2015.

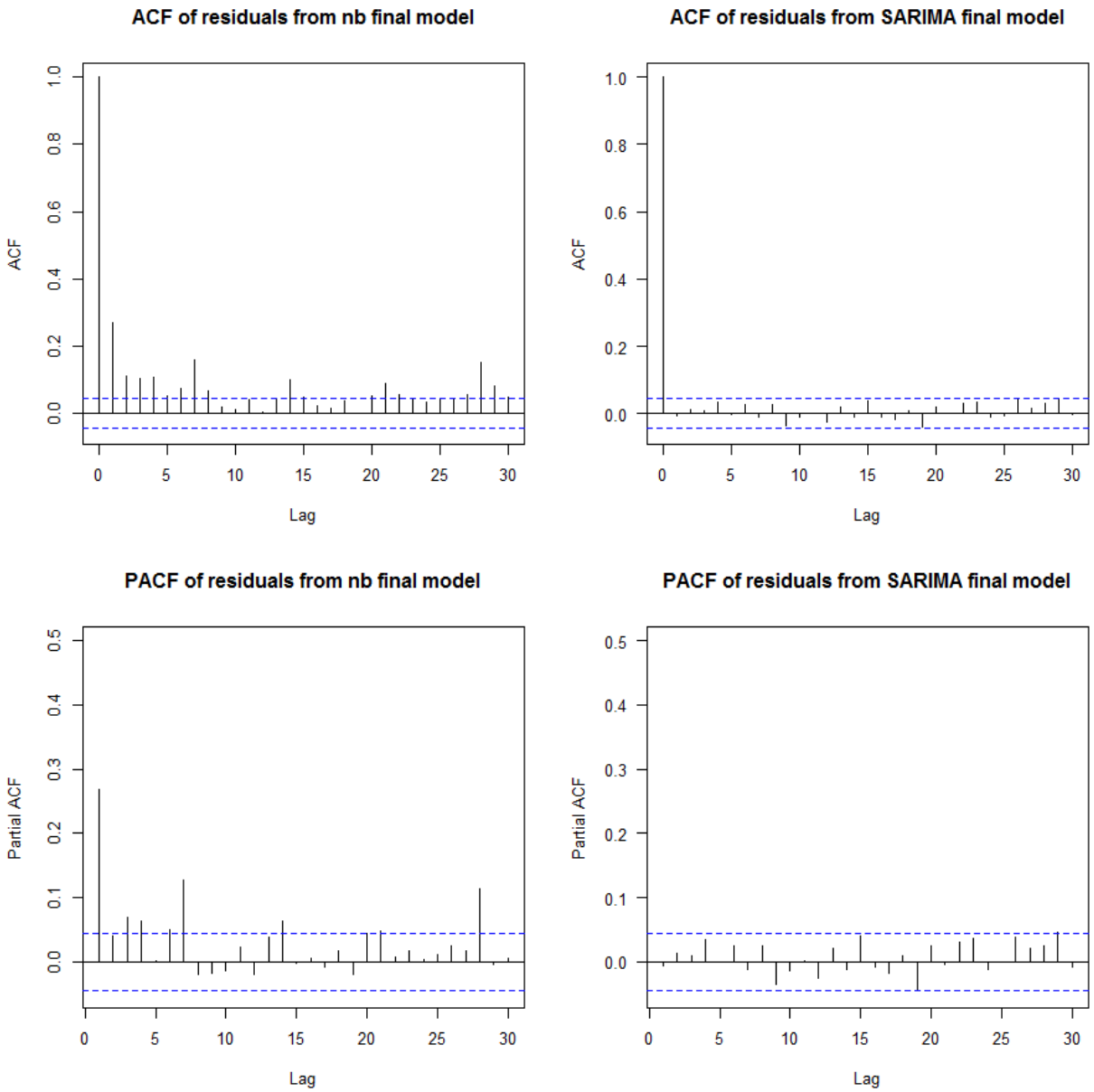

Figure 4-11. Autocorrelation function (ACF) and Partial autocorrelation function (PACF) of residuals from final negative binomial regression model and timeseries SARIMAX ((1,0,0) $(1,0,1)_7$ with regressors) model.

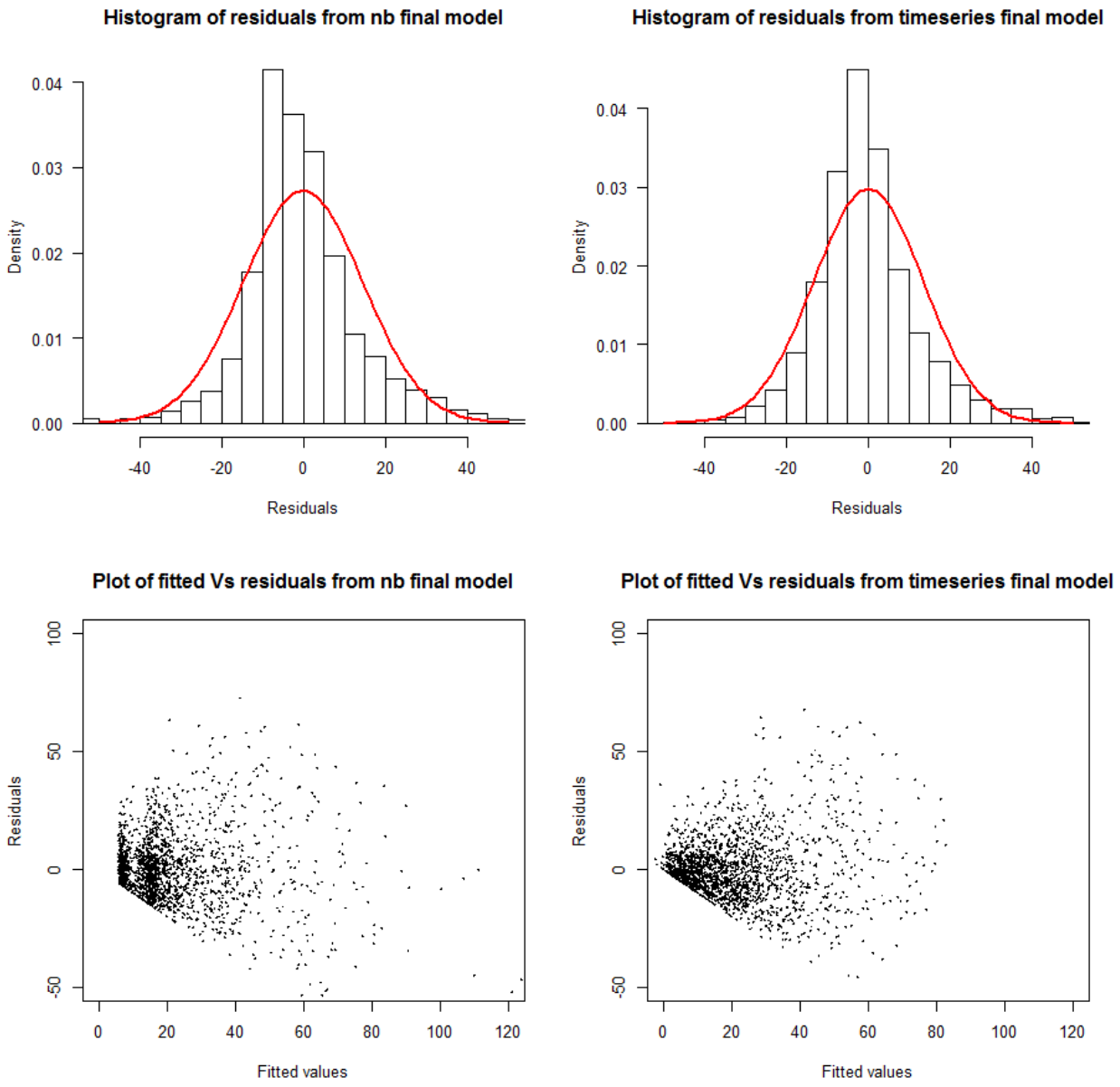

Figure 4-12. Histograms of residuals and plots of fitted Vs residuals from final negative binomial regression model and timeseries SARIMAX ((1,0,0) $(1,0,1)_7$ with regressors) model.

CHAPTER 5
CONCLUSION

Knowledge about various factors affecting outdoor recreation participation helps management agencies conserve and maintain natural resources and recreation service and facilities to satisfy needs and preferences of diverse visitors. I examined various factors affecting outdoor recreation participation and experience of visitors to the FNST and various managed areas in Florida. For this I divided these factors into three sets, 1) recreation motivations and site attribute preferences, 2) climatic (temperature, humidity), temporal (weekends, holidays), and economic factors (gasoline price), and 3) forest management (prescribed burning). To examine the effects of these three sets of factors, I conducted three separate studies, which I presented in three chapters.

The second chapter of this dissertation identified motivations and site attribute preferences, examined structural relations between them, and identified market segments of FNST visitors. In third chapter, I used the cognitive and experiential paradigm approach to examine how activity of recreation participation, knowledge of prescribed burning, ecological information treatment, and demographic factors affect perception of scenic beauty and recreation satisfaction, by taking RCW habitat as an example case. Finally, research discussed in the fourth chapter attempted to understand effects of climatic factors (temperature, precipitation, humidity), temporal factors (day of the week, month), and economic factors (gasoline price) on recreation participation in FNST.

Findings presented in this dissertation offer better understanding about how people living in the urbanized regions, such as Florida, perceive,

experience, and prefer nature and nature-based activities. Unlike in the West and other rural states, most nature-based recreation areas in the southeastern region are relatively small islands surrounded by private land and urban development, and are close to millions of people. Most nature-based recreation research, however, focused in wildland settings – areas relatively far from human development, such as wilderness areas, national parks, and recreation areas in remote areas of the western U.S. As a result, there are limited number of research of this kind from urban park and recreation area settings. In this context, this dissertation provides various important implications applicable to Florida and other developed areas, to attain dual goals of wildlife management and providing satisfying recreation opportunities for people living close from park and recreation areas.

First, this research confirms the previous findings that recreation motivations and site attribute preferences are both multidimensional concepts and various domains of motivations relate with various domains of site attractions (Kim et al., 2007; Kozak, 2002; Stein & Lee, 1995; Uysal & Hagan, 1993). In other words, various recreation users prefer various setting characteristics depending upon their recreation motivation. The research adds to the body of knowledge by identifying certain relationships between motivations and site attribute preferences that are unique and applicable to urban parks and recreation areas. For instance, unlike previously known, this study shows that recreation users being motivated for achievement (test skills, share skills, meet new peoples) do not necessarily prefer rural and secluded wilderness settings or areas that offer opportunities of challenging experiences. In urban parks and recreation areas, users are likely to attain such experience from natural areas that offer hunting

and fishing opportunities and sections of trails that pass through interesting small towns and places popular for arts and handiworks. In addition, managers can provide satisfying experience to large proportion of visitors by managing wildlife and bird viewing opportunities, maintaining natural environment, and tranquility in parks, trails, and recreation areas, where visitors can experience nature and attain fitness and relaxation. However, managers should also keep in mind of various typology of recreation users, in terms of their motivations and site attribute preferences, and maintain wide variety of opportunities. For instance, experiencing solitude was most importance for some users, and attaining social interaction was most important for some other users.

Second, this research finds that perceived scenic beauty of forest and recreation areas significantly affect users' attainment of recreation satisfaction. To maintain healthy longleaf pine ecosystem and manage habitat for keystone species (RCW and gopher tortoise) foresters prescribe controlled burning every two to three years of rotation. This research shows that most recreation visitors understand that healthy forests require burning, but there were also some misconceptions about the use of a fire as a management tool for the improvement of wildlife habitat and scenery of forest in long term. Thus, the temporary loss of scenery because of prescribed burning is likely to negatively affect recreation satisfaction of many users, especially those who place higher importance to experiencing natural environment and scenery. Improving recreation users' held knowledge about forest management practices, such as prescribed burning, seems to improve users' aesthetic perception and

acceptance of forest and recreation areas. Thus, agencies should develop outreach and extension programs to improve recreation users' understanding about prescribed burning. Outreach and extension message that focus on benefit of prescribed burning on improvement of wildlife habitat, and post fire positive effect on forest aesthetics, with demonstration of examples, could be effective to improve recreation users' knowledge of prescribed burning. In addition, improving recreation users' familiarity to key stone species, such as RCW and gopher tortoise, and their dependence on fire, could be beneficial in offering satisfying recreation experience to visitors.

Third, this research improves our understanding about dependence of outdoor recreation participation on weather conditions, specifically in Florida. Finding shows that most trail uses in Florida are during the days when average daily temperature is 4 – 23°C, and days with temperature of 10 – 12°C were most preferred. Best fit time series model showed that daily recreation use of FNST is negatively affected by temperature and precipitation extremes and gasoline price. In addition, a bad weather condition (extreme heat or heavy rainfall) is likely to negatively affect not only the same day recreation use volume, but also of the next day. Specifically, if the weather condition of a day is not favorable, recreation visitation number, on the following day, will also be significantly fewer, even if the weather condition is within the favorable range. This finding is a noble contribution to the body of knowledge. Although, socio-psychological factors associated with this phenomenon are not yet clear, and more research is needed, mangers should expect fewer recreation users on days following extreme weather conditions, and should plan and manage staffing and other resources accordingly.

APPENDIX A
QUESTIONNAIRE FOR RECREATION MOTIVATIONS AND SITE ATTRIBUTE PREFERENCES SURVEY

Florida Outdoor Recreation Visitor Study

To be completed by surveyor if interview given on-site:
Surveyor: _____ **Date:** _____
Site: _____ **Time:** _____
Access Point: _____

SECTION A: CURRENT AND PAST HIKING EXPERIENCE

1. Was this your first time on this particular trail? ____Yes (Go to question 4) ____ No (Go to question 2)

2. In what year did you make your first visit? _____

3. Over the past year, how many times have you used this trail?
   ___None ___13-20 times
   ___1-6 times ___21-30 times
   ___7-12 times ___ more then 30 (#___)

4. About how long did you spend on the trail?
   ____1 hour or less ____Half a day ____More than 1 day (_____number of days)
   ____A few hours ____One whole day

5. If you spent more than one day in the area, where did you stay overnight?
   [] At a nearby hotel/condo
   [] At a campground off the trail
   [] In an established campground along the trail
   [] In a nearby residence of friends or family
   [] I live in the area

6. Approximately how many miles did you travel on the trail during this visit?
   [] Less than a mile [] 3-5 miles [] More than 10 miles (# of miles _____)
   [] 1-2 miles [] 6-10 miles

7. **Hand the participant the activity card, Ask:** From this list of activities, please rank the 3 activities that best describe the reason you visited the trail today?
   1st _____ 2nd _____ 3rd _____

8. Including yourself, how many people were you with?
   _____Total number of people (___#males, ___#females)
   _____Number of people under 18

9. What type of group are you traveling with? _____

10. How did you learn about this trail? **(Check all that apply)**
    [] Friends or Family [] Roadside Signs [] Magazine, please specify___
    [] I live nearby & saw the trail [] Guidebook [] Website
    [] Brochure [] Newspaper Article [] Don't remember / Not sure
    [] Other, please specify _____

11. On a scale of 1 to 10, with 10 being the perfect experience, how would you rate your experience on this trail? _____

12. If you did not rate your trail experience as a 10, why not?
_____
_____

13. Are there any other improvements you would like to see on the trail?
_____

SECTION B	TRAIL AND TRAIL ORGANIZATIONS IN FLORIDA

For this section we would like to understand what you know about trails and trail organizations in Florida.

14. What is the name of the trail you are now hiking on?
_____
[] If "FNST" → **Go to question 15**

[] If correct alternative name for trail → Ask if they know any other names
If yes and say FNST, **go to question 15**
If no or incorrect, **go to question 16**
[] If incorrect, "no" or "I don't know" → **Go to question 16**

15. Other than this trail, have you hiked any other sections of the Florida National Scenic Trail?
[] Yes → Please name the sections(s) hiked: _____
[] No
16. Are you familiar with the Florida Trail Association?
[] Yes → If yes, how did you learn about the Florida Trail Association? (check all that apply)
[] Friends or family [] Newspaper article
[] Website, please specify _____
[] Guidebook [] Brochure
[] Travel agent [] Don't remember, not sure
[] Magazine, please specify _____
[] Roadside signs
[] Other, please specify _____
[] No

17. Are you a member of the Florida Trail Association?
[] Yes → If yes, how long have you been a member?
[] 1 year or less [] 6-10 years
[] 2-5 years [] More than 10 years
[] No, but have been a member in the past for about _____years
[] No, not at all

SECTION C	RECREATION EXPENDITURE AND SUBSTITUTE

Now we would like to learn about your recreation expenditures and preferred alternative activities.

18. Was visiting the FNST a sole or major purpose of your trip from home?
[] Yes
[] No, but it was one of many equally important reasons
[] No, it was just an incidental stop or spur of the moment decision
19. Approximately how long did you drive from your home (or hotel) to this trail?

One-way distance _____ (miles)
One-way travelling time ___/ ____ (hours/min)

20. What type of vehicle did you use to travel to this trail? (Check one)
[] Full-size Pick-up/SUV [] Small Pick-up/SUV [] Small Car
[] Medium-sized Car [] Large Car/Van

21. Was this vehicle a hybrid? [] Yes [] No

22. How many people travelled in the same vehicle with you? _____# of people (including yourself)

23. Can you tell us how much money you spent on the following items in this trip? If you are in a multiple day trip, please provide the amounts you expect to spend on each items.

Items	**[] Expenditure so far OR [] Expected expenditure**
Fees/Stamps/Entrance	$
Transportation (gas, etc.)	$
Restaurants/bars	$
Groceries	$
Hiking equipment and supplies	$
Lodging (hotel, campground)	$
Guide service	$
Souvenirs/gifts	$
Miscellaneous	$

24. If you could not hike on this section of trail on a typical day, what would you do instead? **(Check one)**
[] Go to another trail in Florida for hiking. If so, how many miles (one way) from your residence? _____**(Go to question 25)**
[] Go out of state for hiking. If so, how many miles (one way) from your residence? _____ **(Go to question 25)**
[] Go somewhere else in Florida for another activity. If so, how many miles (one way) from your residence? __ **(Go to question 28)**
[] Stay home **(Go to NEXT SECTION)**
[] Go to work **(Go to NEXT SECTION)**

25. If you decided to hike somewhere else,
Which trail would you prefer to use? Name or location_____
How long would you spend hiking there? _____/_____ (days/hrs)
How much out of pocket money would you expect to spend? ($)_____

26. In comparison to your alternate hiking site, how would you rate the expenses in this section of FNST?
[] More exensive by approximately $_____
[] Less expensive by approximately $_____

27. In comparison to your alternate hiking site, how would you rate the following for this section of the FNST?

Proximity	1 (Very far)	2	3	4	5 (Very close)
Environmental quality/site attraction	1(Poor)	2	3	4	5 (Excellent)
Facilities/services	1(Poor)	2	3	4	5 (Excellent)

(Go to NEXT SECTION)

28. If you decided to go somewhere else in Florida for another activity, other than hiking,
What would be your preferred alternative activity? _____
How much time would you spend doing that activity? _____/_____(days/hours)

How much out of pocket money would you expect to spend? ($)_____

(Please hand the second set of pages to the visitor to fill out on their own.)

SECTION D	RECREATION EXPERIENCE PREFERENCE AND BENEFITS

29. Please indicate how important each item below was in choosing your leisure destination for this trip.

Reason for Visit	Not at all important		Neutral		Very Important
Historical, military, or archeological sites	1	2	3	4	5
To see the natural water features	1	2	3	4	5
Wilderness and undisturbed nature	1	2	3	4	5
Good fishing	1	2	3	4	5
Good big game hunting	1	2	3	4	5
Easy access to the area/being easy to get to	1	2	3	4	5
Good environmental quality of air, water, and soil	1	2	3	4	5
Close to home	1	2	3	4	5
Interesting small towns	1	2	3	4	5
Good small game hunting	1	2	3	4	5
Chance to see wildlife/birds	1	2	3	4	5
Good camping	1	2	3	4	5
Local crafts or handiwork	1	2	3	4	5
Available parking	1	2	3	4	5

30. People go to particular areas and participate in recreation activities for any number of reasons. Please indicate how important each experience was for you during your visit to this area today.

Experiences	Not at all important		Neutral		Very Important
To enjoy the scenery	1	2	3	4	5
To relax physically	1	2	3	4	5
To do something with my family	1	2	3	4	5
To get exercise	1	2	3	4	5
To explore the area	1	2	3	4	5
To experience nature	1	2	3	4	5
To be on my own	1	2	3	4	5
To use my own equipment	1	2	3	4	5
To learn about natural history of the area	1	2	3	4	5
To be away from people	1	2	3	4	5
To have thrills and excitement	1	2	3	4	5
To learn more about the nature	1	2	3	4	5
To meet new people	1	2	3	4	5
To test my skills and abilities	1	2	3	4	5
To enjoy the smells and sounds of nature	1	2	3	4	5
To get away from usual demands of life	1	2	3	4	5
To share my skills and knowledge with others	1	2	3	4	5
To be with members of my group	1	2	3	4	5
To be close to nature	1	2	3	4	5
To be with people who enjoy the same things I do	1	2	3	4	5
To experience new and different things	1	2	3	4	5
To experience solitude	1	2	3	4	5
To feel healthier	1	2	3	4	5

31. People see different benefits from their recreation experience. Please indicate your agreement with the following recreation benefits. My recreation experience today will…….

Benefits	Strongly disagree		Neutral	Strongly agree	
Reduce health maintenance costs	1	2	3	4	5
Improve outdoor oriented lifestyle	1	2	3	4	5
Increase family or friend bonding	1	2	3	4	5
Provide positive contributions to local-regional economy	1	2	3	4	5
Improve functioning of individuals in family or friends	1	2	3	4	5
Help increase local tourism revenue	1	2	3	4	5
Reduce social isolation	1	2	3	4	5
Improve economic benefits through increased work productivity	1	2	3	4	5
Improve parenting skills	1	2	3	4	5
Help improve local economic stability	1	2	3	4	5

SECTION E	DEMOGRAPHICS

We would like to ask a few questions about you, your background, and your past experiences. This information will be used for statistical analysis only, and all information will remain strictly confidential.

32. I am [] Male [] Female

33. Which of the following best describes your status?
[] Married [] Divorced
[] Single [] Widowed

34. How many children currently reside in your household? _____

35. What is the highest level of education you have completed? (please mark one)
[] Eighth grade or less [] Some College [] Graduate Degree or beyond
[] Some High School [] College Graduate
[] High School Graduate or GED [] Some Graduate School

36. Are you presently… **(Please mark all that apply)**
[] Employed Full Time [] Unemployed [] Retired [] Part Time Student
[] Employed Part Time [] Full Time Homemaker [] Full Time Student

37. If employed part time, how many hours a week do you work? _____hours/week

38. What is your profession or occupation? _____

39. What year were you born? _____

40. What race or ethnic group(s) would you place yourself in? (please mark all that apply)
[] African American [] Hispanic or Latino [] Asian American
[] Native Hawaiian or Pacific Islander [] American Indian or Alaskan Native [] White

41. What was your approximate total household income, before taxes this past year?
[] Less than $10,000 [] $40,000 to $49,999 [] $80,000 to $89,999
[] $10,001 to $19,999 [] $50,000 to $59,999 [] $90,000 to $99,999
[] $20,000 to $29,999 [] $60,000 to $69,999 [] $100,000 or more
[] $30,000 to $39,999 [] $70,000 to $79,999

42. Zip Code: _____

43. Do you have any comments you would like us to know?

APPENDIX B
QUESTIONNAIRE FOR PRESCRIBED BURNING AND AESTHETIC PREFERENCE SURVEY

Informed Consent

Hello,

The purpose of this study is to examine recreation experience and preference of recreation visitors to public lands in Florida and understand how recreationists perceive scenic beauty and recreation value of different forest management practices. It takes about 10 minute to complete this survey. Your participation in this study is completely voluntary, you have the right not to answer any specific questions and you may withdraw your consent at any time. There are no "correct" or "incorrect" answers in the questionnaire, so express your true feelings.

There is no anticipated risk or direct benefit to participants. However, indirect bbenefits for visitors participating in this survey include the opportunity to have their input on improving recreation planning and management of recreation services and facilities in public forests. The survey is anonymous; we would like to assure that your answers will not be connected with you in the analysis and reporting of results.

Will you participate in this study?

Are you 18 years old or older?

IF YES: Thank you! *[Then continue with survey]*
IF NO: Thank you for your time! *[Then randomly select next respondent]*

If you have any questions concerning this study, please contact:

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Whom to contact about your rights as a research participant in the study:
UFIRB Office
Box 112250
University of Florida,
Gainesville, FL 32611-2250
Phone: (352) 392-0433

Outdoor Recreation Experience & Forest Management Perception Survey 2016

Surveyor: _____ **Date:** _____

Site: _____ **Time:** _____

SECTION A: CURRENT & PAST RECREATION EXPERIENCE

44. Was this your first visit to this forest site? __Yes (***Go to question 3***) __ No (***Go to question 2***)

45. Over the past year, how many times have you visited this forest site?
    - [] None
    - [] 1 – 5 times
    - [] 6 – 10 times
    - [] 11 – 15 times
    - [] 16 – 20 times
    - [] More than 20 times

46. About how long did you spend in this forest site during your current trip?
    - [] 1 hour or less
    - [] A few hours
    - [] Half a day
    - [] One whole day
    - [] More than 1 day (# of days____)

47. **Hand the participant the activity card, Ask:** From this list of activities, which activity best describes the reason you visited this forest today? _____ If other(s) specify_____

48. Including yourself, how many people are you with?
    Total_____ Adult males _____Adult females_____ Boys (under 18) ____ Girls (under 18) ____

49. What type of group are you traveling with?
    ___Alone ___Friends ___Family ___Friends & Family ___Organized Group ___Other

50. Approximately how many miles (or hours) did you drive to reach this destination?
    ____miles ____hours

51. On a scale of 1 (Not at all satisfied) to 10 (Very satisfied), how would you rate your recreation experience on this forest site today? _____

52. Based on your recreation experience today, how would you rate the overall scenic beauty of this forest site on a scale of 1 (not at all scenic) to 10 (very scenic) _____

53. On a scale of 1 (very unlikely) to 5 (very likely), how likely are you to revisit this forest site within next 12 months? _____

SECTION B	ECOLOGICAL KNOWLEDGE, VALUE ORIENTATION & ATTITUDE

In this section we would like to know your opinion about management of natural forest areas and wildlife habitat in public lands, like the Ocala National Forest. The information you provided will be useful for land management agencies to prioritize visitors' need and preferences.

Please note, active forest management may include prescribed burning, thinning, fertilization, weed control, timber harvesting, and replanting. Prescribed burning refers to any controlled fire intentionally ignited to meet specific land management objectives.

B 1. Please answer the following question in “yes” or “no.” If you do not know, say, “Don’t know”

Statements	**Yes**	**No**	**Don’t know**
Do you think leaving forests in a natural state is better for wildlife than using active forest management?			
Have you heard or read about the use of prescribed burning or controlled fire for management of wildlife habitat?			
Do you think prescribed burning or controlled fire …	**Yes**	**No**	**Don’t know**
would reduce the chance of high-intensity wildfire?			
usually results in the death of the majority of animals in the area?			
would create long-term negative impact on the scenery in the forest?			
would improve health of forest?			
would improve habitat for many wildlife species?			

B 2. Please answer the following questions on a scale of 1 (Absolutely Not) to 5 (Absolutely Yes)

Statements **Do you think….**	**Absolutely Not**		**Neutral**		**Absolutely Yes**
all living things are part of one big family?	1	2	3	4	5
fish and wildlife are on earth primarily for people to use?	1	2	3	4	5
wildlife should have rights similar to the rights of humans?	1	2	3	4	5
humans should manage fish and wildlife populations so that humans benefit?	1	2	3	4	5
we should strive for a world where there is an abundance of fish and wildlife for hunting and fishing?	1	2	3	4	5
hunting is cruel and inhumane to the animals?	1	2	3	4	5
Do you….					
feel a strong emotional bond with animals?	1	2	3	4	5
care about wildlife as much as you care about people?	1	2	3	4	5

B 3. To what extent do you disagree or agree with the following statement?

Statements	**Strongly disagree**		**Neutral**		**Strongly agree**
Forest managers should periodically burn public pine forests to maintain habitat for wildlife	1	2	3	4	5
Public land managers should prioritize maintaining habitat for wildlife over providing recreation opportunities	1	2	3	4	5
All fires, regardless of origin, should be put out as soon as possible	1	2	3	4	5
Forest managers should avoid using prescribed fire because of the potential health problems to people from smoke	1	2	3	4	5
Prescribed burning should be allowed on public lands even if scenery will be negatively affected	1	2	3	4	5
Prescribed fire is too dangerous to be used	1	2	3	4	5
Prescribed burning is a waste of money	1	2	3	4	5

B 4. If you get an opportunity to participate in a planning meeting about management of a public forest in your area, how likely are you to SUPPORT each of the following management options?

Statements	Very unlikely		Neutral		Very likely
Create habitat for endangered birds and animals	1	2	3	4	5
Burn the forest in a controlled way every two – three years of rotation	1	2	3	4	5
Exclude recreation activities in certain areas to promote habitat for wildlife	1	2	3	4	5
Use thinning (reduce the number of trees) to minimize competition among the plants	1	2	3	4	5
Clear cut (remove all the trees) in certain areas to establish longleaf pine plantation	1	2	3	4	5

SECTION C	SCENIC BEAUTY & RECREATION SATISFACTION

In this section, we would like to know your perception about different forest scenes. **(Hand the picture album to the respondent)**. These pictures are taken from different sections of this forest where it is managed to maintain habitat for a federally endangered bird, the red cockaded woodpecker. **(Show the RCW picture to the respondent).** The red cockaded woodpecker is a very important species because their activities provide habitat for hundreds of other species. Foresters need to apply different management treatments, such as frequent prescribed burning and thinning to maintain suitable habitat for this species.

For each of these pictures, we ask you two different questions. The first question asks you to rate the **scenic beauty** (visual aesthetic quality) of the forest site. The second question asks you **how satisfied** do you think you would be doing this recreation activity (primary activity you are here for today) if the surrounding view is as shown on the picture.

Picture #	**C1. How do you rate the scenic beauty of this forest site? 1 (not at all scenic) – 10 (very scenic).**	**C2. How satisfied do you think you would be doing this recreation activity if the surrounding view is as shown on this picture? 1 (not at all satisfied) – 10 (very satisfied).**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

[] Pre-scanned

SECTION D	RECREATION EXPERIENCE PREFERENCE AND PLACE ATTACHMENT

D 1. People go to particular areas and participate in recreation activities for any number of reasons. Please indicate how important each experience was for you during your visit to this area today.

Experiences	Not at all important		Neutral		Very Important
To enjoy the scenery	1	2	3	4	5
To do something with my family	1	2	3	4	5
To get exercise	1	2	3	4	5
To explore the area	1	2	3	4	5
To be on my own	1	2	3	4	5
To learn about natural history of the area	1	2	3	4	5
To learn more about the nature	1	2	3	4	5
To test my skills and abilities	1	2	3	4	5
To get away from usual demands of life	1	2	3	4	5
To share my skills and knowledge with others	1	2	3	4	5
To be with members of my group	1	2	3	4	5
To be with people who enjoy the same things I do	1	2	3	4	5
To experience solitude	1	2	3	4	5
To feel healthier	1	2	3	4	5

D 2. Please indicate your level of agreement with each of the following statements

Statements	Strongly Disagree		Neutral		Strongly Agree
I am very attached to Ocala National Forest	1	2	3	4	5
I get more satisfaction out of visiting Ocala NF than from visiting any other forest	1	2	3	4	5
Ocala NF means a lot to me	1	2	3	4	5
I enjoy visiting Ocala NF more than any other forest	1	2	3	4	5
I have a special connection to Ocala NF and the people who use it for recreation	1	2	3	4	5
I would not substitute any other forests for the type of recreation I do in Ocala NF	1	2	3	4	5
I identify strongly with Ocala NF	1	2	3	4	5
Recreation in Ocala NF is more important than recreation in any other forest	1	2	3	4	5

SECTION E	DEMOGRAPHICS

Now, we would like to ask a few questions about you. This information will be used for statistical analysis only, and all information will remain strictly confidential.

E 1. Should I mark you “Male,” “Female,” or “Other”?
[] Male
[] Female
[] Other

E 2. Which of the following best describes your marital status?
[] Married
[] Separated
[] Divorced
[] Widowed
[] Never Married

E 3. How many children currently reside in your household? _____

E 4. What is the highest level of education you have completed? (please mark one)

[] Eighth Grade or Less
[] Some High School
[] High School Graduate
[] Some College no degree
[] Associate's Degree
[] Bachelor's degree
[] Some Graduate School
[] Master's Degree
[] Professional Degree
[] Doctoral Degree

E 5. What was your area of study (e.g., major or program) for your highest degree? (Only if highest level of education is Associate Degree or higher) _____

E 6. Are you presently… (Please mark all that apply)
[] Employed Full Time
[] Employed Part Tim
[] Self-employed
[] Unemployed
[] Homemaker
[] Retired
[] Full Time Student
[] Part Time Student

E 7. What is your profession or occupation? _____

E 8. What year were you born? _____

E 9. Are you Spanish / Hispanic / Latino?
[] No, not Spanish / Hispanic / Latino
[] Yes, Mexican, Mexican American, Chicano
[] Yes, Puerto Rican
[] Yes, Cuban
[] Yes, other Spanish / Hispanic / Latino (Specify) _____

E 10. With which racial group(s) do you most closely identify? (Please check ALL that apply)
[] White
[] Black, African American
[] Amer. Indian or Alaska Native
[] Asian Indian
[] Chinese
[] Filipino
[] Japanese
[] Korean
[] Vietnamese
[] Other Asian (Specify) _____
[] Native Hawaiian
[] Guamanian or Chamorro
[] Samoan
[] Other Pacific Islander (Specify) ___

E 11. What was your approximate total household income, before taxes this past year?
[] Under $25,000
[] $25,000 – $49,999
[] $50,000 – 74,999
[] $75,000 – 99,999
[] $100,000 – 149,999
[] $150,000 – 199,999
[] $200,000 or more
[] Don't know

E 12. Zip Code: _____

E 13. Do you have any comments you would like to share?

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BIOGRAPHICAL SKETCH

Ramesh is a natural resources social scientist and a nature photographer from Nepal. His research interest includes a broad spectrum of human dimensions of natural resources, recreation, and climate change. Over the past 12 years, Ramesh worked as a freelancer and researcher in projects that involved a large variety of stakeholders, including buffer zone forest users and farmers in Nepal to hunters and anglers in the United States, and diverse contexts, including climate change risk perception to recreation experience and ecotourism.

Ramesh holds one master's degree in forest resources from University of Georgia and one other in environmental science from Nepal. During his last four years as a PhD student, Ramesh led and assisted in several projects related to outdoor recreation in Florida and ecotourism in Nepal. He also served as a co-instructor and teaching assistant for variety of courses. After accomplishment of PhD, Ramesh aims for a career in academia and dreams to be a research University faculty in the future.

Other than conducting research and teaching, Ramesh has been involved in various service, leadership, and professional development positions. For instance, Ramesh served as treasurer of Forestry Graduate Student Organization (FGSO) from 2016 – 2017, coordinated Southeaster Recreation Research Conference (SERR) in 2016, and assisted to organize Forestry Graduate Student Symposium in 2017. Considering, his notable contribution to research, teaching, and service, Ramesh was awarded with 'Outstanding PhD student of the Year' by the School in 2017. Nature and wildlife photography is Ramesh's most entertained passion and he wishes to carry this passion together with his career goal in academia.