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Article

Recreationists' Perceptions of Scenic Beauty and Satisfaction at a Public Forest Managed for Endangered Wildlife

Ramesh Paudyal [1], Taylor V. Stein [1,*], Holly K. Ober [2], Mickie E. Swisher [3], Eric J. Jokela [1] and Damian C. Adams [1]

[1] School of Forest Resources and Conservation, University of Florida. PO Box 110410, Gainesville, FL 32611, USA; rpaudyal@ufl.edu (R.P.); ejokela@ufl.edu (E.J.J); dcadams@ufl.edu (D.C.A)
[2] North Florida Research and Education Center, University of Florida. 155 Research Road. Quincy, FL 32351, USA. holly.ober@ufl.edu
[3] Department of Family, Youth & Community Sciences, University of Florida. PO Box 110310, Gainesville, FL 32611, USA; mesw@ufl.edu
* Correspondence: tstein@ufl.edu; Tel.: +(352) 846-0860

Abstract: Prescribed burning and other active forest management treatments have been proven to be essential for maintaining suitable habitat conditions for many wildlife species, including the federally endangered red-cockaded woodpecker (RCW). This study examines the perception of forest management treatments of recreation users participating in various activities (hunting, hiking/backpacking, camping, off-highway vehicle riding, and canoeing/kayaking) in terms of scenic beauty and recreation satisfaction. We used photographic images to capture various forest management treatments of different intensity levels and times after treatments, and assessed users' perception of scenic beauty and recreation satisfaction. Results indicated variation among users participating in different recreation activities, but that good quality RCW habitat offered both higher scenic beauty and higher recreation satisfaction than poor quality habitat for most user groups. Finally, recreation satisfaction was statistically equal to perceived scenic beauty from both good and poor-quality RCW habitats for most of the user groups, thus suggesting the importance of scenic beauty on forest sites in determining recreation users' attainment of visit satisfaction. Findings conclude that forest sites developed as good quality RCW habitat in the present state also offer quality experience to recreation users, thus supporting multi-objective forestry practices in public forests.

Keywords: forest beauty; outdoor recreation; graphic elicitation technique; controlled burning; red-cockaded woodpecker, Ocala National Forest

1. Introduction

The red-cockaded woodpecker (*Leuconotopicus 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 [1]. Even though the species is protected under the Endangered Species Act of 1973, managers face challenges to increase its abundance to levels high enough for recovery to occur. The primary threat to RCW is lack of suitable habitat [1]. RCWs are territorial cooperative breeders that live in family groups, called clusters [2]. The birds require old pines, mostly of the age of 60 to 80 years for cavity excavation and basal area of about 9.2 m^2/ha with minimum midstory for the cluster [3,4] and can tolerate only less than 2.3 m^2/ha of the hardwood overstory within the cluster [3]. Also, the foraging habitat requires an open structure with intermediate density of pine, minimum or absent hardwood midstory, and abundant diverse herbaceous groundcovers [5]. Frequent, low intensity fires perpetuated these conditions historically [6,7]. Some researchers have found that public

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perception of scenic beauty of pine forest increases with increases in the size of trees and decreases with presence of downed wood and groupings of trees [8-10]. It is likely that visitors see RCW habitats as scenically acceptable for recreational use because RCWs require large, mature trees for habitat critical to its survival.

Prescribed burning and tree harvesting play important roles in maintaining suitable habitat conditions for RCWs [11]. These forest management treatments are effective in maintaining ecologically healthy ecosystems and habitat for not only RCW, but also for many other wildlife species dependent on southern pine forests, including gopher tortoise (*Gopherus polyphemus*). Research related to public perception of landscape aesthetics, however, has shown that people do not always perceive ecologically healthy ecosystems as aesthetically pleasing and acceptable [12-16]. These findings suggest that southern pine forests that have undergone recent prescribed burning could be relatively unattractive to recreation users. However, public perception research has also found that perceived scenic beauty of forest sites is much higher a few years after burning than at the pre-fire level [17]. It is important to know how recreation users perceive scenic beauty and recreation satisfaction from forest sites maintained as RCW habitat that have undergone prescribed burning.

Further, recovery of RCW populations requires accommodation through expansion of suitable habitat conditions. Although these birds were once distributed nearly continuously throughout the southeastern U.S., they are now present in distinct populations isolated by vast gaps of unoccupied acreage [18]. Foresters use various management treatments to develop a forest site into suitable habitat for RCWs, which is a lengthy process. These treatments may include even- and multi-age management systems to facilitate regeneration, thinning to reduce stand density and to allow growth of the remaining trees, and prescribed burning to suppress the hardwood midstory. Forest sites near and around currently suitable RCW habitat can be in various developmental stages leading to suitable RCW habitat. The public is not always aware of the objectives of these forest management treatments and it is important to understand how recreation users react to them on public forests. This study examines how different recreation activity users perceive scenic beauty and recreation satisfaction from forest sites that offer good quality RCW conditions in the present state, and forest sites that are not yet developed as good quality habitat. Specifically, this study examines the following research questions.

- How do recreation users who participate in different nature-based recreation activities perceive scenic beauty and recreation satisfaction from public forests?
- Do good quality RCW habitat conditions offer higher scenic beauty and recreation satisfaction to recreation users than poor quality RCW habitat conditions?
- Do forests sites perceived to have higher scenic beauty also offer higher recreation satisfaction to users?

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 [19] and Daniel and Vining [20] argued that "scenic beauty" best captures the meaning associated with visual appreciation of the forest environment. Daniel defines scenic beauty as "visual aesthetic quality" [21]. The terms "scenic beauty" and "scenic value" have been used interchangeably in the literature even though Johnson, *et al.* [22] operationalized these terms as two conceptually separate constructs. Others have 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, the term "scenic beauty" refers to Daniel's [21] definition of scenic beauty for forest aesthetic assessment.

In a recreation context, expectancy valence theory suggests that people participate in outdoor recreation to fulfil preferred needs, motivations, or expected experiences [23,24]. The congruence between aspirations and the perceived reality of experiences is defined as recreation satisfaction in this theoretical perspective [25]. In this research context, recreation satisfaction is operationalized as

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the congruence between desired experience and perceived attainment of experience associated with appearance of recreation sites [26].

Although scenic beauty of a forest site could consistently contribute to recreation satisfaction and the desire to visit an area [27], scenic beauty may not be the most important factor in all cases. For example, Tahvanainen, *et al.* [28] 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 and recreation preference. Likewise, Brunson and Shelby [29] examined scenic beauty and acceptability of various forest management practices and found that the 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. [29] Thus, it is possible that different recreation users would perceive recreation quality 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 [21]. However, different cultural and social traits of the observers have also been found to affect evaluation of scenic beauty and recreation quality of forests [19,30]. 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 [19]. One of the strengths of this approach is that it can relate changes in manipulative site characteristics with their impacts on scenic beauty [31]. However, a major criticism of the psychophysical model is its limited ability to produce theoretical explanations of predictor variables. Specifically, it places little focus on psychological processes that mediate the relationship between physical attributes and aesthetic ratings of a site [31]. In addition, the SBE model does not account for the potential variation in scenic beauty perception across publics of different socio-cultural, cognitive, and experiential characteristics. Other researchers have suggested that forest and landscape preference is a function of both the scene characteristics (forest attributes and silvicultural treatments) and human characteristics [32,33]. Therefore, 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 and experiential paradigm involve assessment of forest scenic beauty by human observers taking into account the socio-cultural factors, human-forest interactions, human meanings associated with the forest, experience, and expectations [34,35]. The concept of human interaction with nature refers to what people put into and take away from nature. 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 [34]. Hull and Reveli [35] 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. Nonetheless, there is inconsistency in the literature regarding the effect of experiential and socio-cultural factors on the perception of scenic beauty and recreation quality 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 [19,20,32,36,37]. In contrast, other studies have found significant variations in perception/attitude about scenic beauty and recreation quality across observers of different age groups, genders, and residential settings. For example, one recent study [28] found that middle-aged and older respondents perceived the clearcutting method of reproduction as increasing scenic beauty, whereas younger respondents thought it would decrease scenic beauty. In the same study, rural residents thought that this method of reproduction would have negative impact on scenic beauty while urban residents thought it would improve scenic beauty [28]. Similarly, a national survey of public perception and acceptance of prescribed fire [38] showed that African American and Hispanics were significantly more concerned

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about the impact of prescribed fire on aesthetics and harm to wildlife than Caucasians. Likewise, visitors with a greater number of previous visits to a site were found to prefer areas that fit more primitive recreation opportunity spectrum (ROS) classes than visitors with fewer previous visits [39]. This implies that frequent visitors could avoid sites that exhibit a higher proportion of visible human disturbances like prescribed burning. 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. This scenario is highly relevant because managers of federal lands are mandated to manage in such a way that habitat is enhanced for federally endangered species, and thus the principals of improving conditions for these species guide management of large acreages of public lands. Examination of perceived scenic beauty and recreation satisfaction across various activity users who have different purposes for their recreation visits remains a little-researched topic. As a result, it is important to know how the purpose of recreational visits (participation in different recreation activities) are related to perception of scenic beauty and recreation satisfaction from forest sites maintained as RCW habitat.

This study follows the cognitive and experiential paradigm of landscape aesthetic perception, borrowing methodological techniques from the psychophysical paradigm, to examine how the recreation activity people chose and quality of RCW habitat affect users' perceptions of scenic beauty and recreation satisfaction. Specifically, the following hypothesis were tested.

- Hypothesis 1 (H_1): Recreation users who participate in different nature-based recreation activities have different levels of perceived scenic beauty and recreation satisfaction.
- Hypothesis 2 (H_2): Good quality RCW habitat offers higher scenic beauty and recreation satisfaction to recreation users than poor quality RCW habitat.
- Hypothesis 3 (H_3): Forest sites perceived to have higher scenic beauty also offer higher recreation satisfaction and vice versa in both good quality habitat and poor-quality habitat.

2. Materials and Methods

2.1. Research Design and Survey Instrument

The target population of interest in this study included outdoor recreation users of managed public natural areas in Florida. The accessible or study population was adult outdoor recreation users to Ocala National Forest (ONF), a 1,570 km^2 property located in central Florida, USA. Onsite data collections were made from recreationists 18 years or older that were encountered at trailheads or in parking lots of various recreation areas in ONF from April 2016 to February 2017. If the party included two or more people, the individual with the most recent birthday was invited to complete the questionnaire and index [40]. Among the 242 recreation users approached onsite, 209 agreed to take the survey, a response rate of 86.0%.

Researchers face many challenges in assessing recreation users' immediate perception of scenic beauty and recreation satisfaction as influenced by various management conditions like prescribed burning of forest sites. Presenting respondents with photographs exposes people to various site conditions in less time than on-site contact and minimizes the logistical burden of transporting people to sites [19,29]. Most past studies used photographs to assess scenic beauty of forest sites from college students or the public in an indoor setting, assuming that people's perception of scenic quality is mostly determined by visual inputs [41]. However, those studies did not capture the potential effect of onsite experience on perception of scenic beauty and recreation satisfaction of various forest conditions. This research also used photographs, but assessment of scenic beauty and recreation satisfaction were obtained from on-site recreation users.

A total of 48 pictures were taken from various forest sites in ONF using a digital crop sensor SLR camera. The pictures represented typical RCW habitat and its surrounding areas with diverse tree sizes, densities, and ground cover at various times after prescribed burning and other management treatments employed, such as regeneration cutting. The same settings and brightness (1/250 sec. f/8

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35mm, auto ISO, flash off) were maintained for all pictures to minimize the effect of camera settings on the visual quality of pictures. In the first round, 24 pictures were selected to capture various management treatments, times after treatment, tree size, stand density, and ground cover. Then in the second round, 12 pictures (Figure S1) were selected randomly for visitor assessment. Finally, 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 plastic sleeve, was prepared for respondents' assessment of scenic beauty and recreation satisfaction. After the questionnaires were completed, a panel of six experts in silviculture and wildlife habitat in southern forests were asked to select the four pictures that best represented good quality RCW habitat conditions and the four pictures that represented the poorest quality RCW habitat conditions in the current state. Three pictures from each category (total six) that produced the greatest consensus were selected for analyses.

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, the questionnaire was pilot tested with 42 recreation visitors to ONF.

2.2. Measurement and Analysis

The objectives of this study were to understand how the activity recreationists chose to participate in a given activity and how the quality of RCW habitat affected users' perception of scenic beauty and recreation satisfaction and to determine the effect of scenic beauty on recreation satisfaction. Grouping respondents by recreation activity was crucial to meet these objectives because almost all respondents reported participating in more than one activity. Respondents were asked to list, in order of importance, three major activities they participated in during the day they were interviewed. The respondents were divided into groups based on their primary (first listed) activity.

Respondents were asked to rate scenic beauty and their likely attainment of recreation satisfaction if they had to recreate on forest sites where the surrounding view corresponded to that depicted in each picture. The scenic beauty rating scale ranged from 1 (not at all scenic) to 10 (very scenic) and the recreation satisfaction rating scale ranged from 1 (not at all satisfied) to 10 (very satisfied). Item total correlation and Cronbach's alpha coefficient were used to assess reliability of index scores. Cronbach's alpha values for both scenic beauty and recreation satisfaction indices were ≥0.70 for both sets of pictures, those representing good and poor RCW habitats. Likewise, item total correlation of each picture from each habitat quality was ≥0.40 for both scenic beauty and recreation satisfaction, suggesting that the scores were reliable.

SPSS 24.0 statistical software was used to analyze the data. Analysis of variance or equivalent Welch test (for unequal variance) were used to compare perception of scenic beauty and recreation satisfaction among activity user groups (H_1). Tukey's Post Hoc test or Dunnett's C test (for unequal variances) were used for the multiple comparison test. A paired sample t-test was used to compare between good quality RCW habitat and poor-quality RCW habitat in terms of both scenic beauty and recreation satisfaction (H_2) and for differences between scenic beauty and recreation satisfaction for each RCW habitat quality (H_3) for each recreation user group. For all tests, η^2 was used to measure effect size. According to Cohen [42], effect size should be interpreted as small (η^2=0.01), medium (η^2=0.06), and large (η^2=0.14).

3. Results

3.1. Descriptive Characteristics of Sample

The primary activity reported by respondents (n = 209) was hiking or backpacking (30%), off-highway vehicle (OHV) riding (16%), camping (18%), hunting (12%), and canoeing or kayaking (24%). The average age of the respondents was 42 (Std. Dev. = 14) years, with 30% of the respondents ≤30 years old and 14% ≥60 years old. The proportion of male respondents (71%) was much higher than female respondents (31%). About half of the respondents (47%) had an education level of college

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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. 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. One-third of the respondents had an annual household income <$50,000 US dollars, whereas one quarter of respondents had an annual income ≥$100,000 US dollars.

3.2. RCW Habitat Quality and Perception of Scenic Beauty and Recreation Satisfaction

Among the six photographic images (Figure 1), a forest site with mixed pine and hardwood trees (Picture 4) received the highest rating for both scenic beauty and recreation satisfaction, whereas a recently regenerated stand received the lowest rating for both (Picture 2). In general, respondents rated both scenic beauty and recreation satisfaction higher for 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 and recent burning scored lower for both scenic beauty and recreation satisfaction.

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

Note: SB: scenic beauty, RS: recreation satisfaction, values in [ ] indicate standard deviation. Pictures 3, 5, and 6 represent good RCW habitat and pictures 1, 2, and 4 represent poor RCW habitat in the current state, as voted by the panel of six silviculture and RCW habitat professionals.

Scenic beauty and recreation satisfaction index scores differed among recreation user groups (Table 1) ($p<0.05$) for both good and poor-quality RCW habitats, with a larger effect size for the poor-quality habitat relative to the good quality habitat. Good quality RCW habitat was perceived similarly by hunters and OHV users in terms of scenic beauty and similarly by hunters, OHV users, and hikers/backpackers in terms of recreation satisfaction. In contrast, hunters rated both scenic beauty and recreation satisfaction for poor-quality RCW habitat significantly higher than all other recreation user groups ($p<0.05$). Campers and canoers/kayakers generally scored all conditions low and rated scenic beauty and recreation satisfaction of both good and poor-quality RCW habitats lowest ($p<0.05$). Hikers/backpackers rated scenic beauty of both good and poor-quality RCW habitats as low as campers and canoers/kayakers did, but their ratings of recreation satisfaction from both habitats were as high as those of OHV users.

Peer-reviewed version available at Forests 2018, 9, 241; doi:10.3390/f9050241

Table 1. Comparison among recreation user groups in terms of perceived scenic beauty and recreation satisfaction of good and poor-quality red-cockaded woodpecker habitat in Ocala National Forest, Florida, USA.

	Average	Hiking/ backpacking	OHV riding	Camping	Hunting	Canoeing/ kayaking	Effect size
Good quality habitat							
Scenic beauty	7.5	7.5[a]	8.1[b]	7.2[a]	8.2[b]	7.2[a]	0.05
Recreation satisfaction	7.2	7.5[a]	7.6[a]	6.6[b]	8.0[a]	6.7[b]	0.05
Poor quality habitat							
Scenic beauty	6.1	5.8[a]	6.7[b]	6.0[a]	7.4[c]	5.6[a]	0.12
Recreation satisfaction	5.8	5.8[a]	6.2[a]	5.2[b]	7.5[c]	5.3[b]	0.12

Comparisons between good and poor-quality RCW habitat within each recreation user group (Table 2) indicates that good quality RCW habitat offers higher scenic beauty and recreation satisfaction to recreation users than poor quality RCW habitat. All recreation activity user groups except hunters scored both scenic beauty and recreation satisfaction higher for good quality habitat than for poor quality habitat ($p<0.05$). Hunters also reported higher scenic beauty for good quality RCW habitat than poor quality habitat, but they were less discerning in that they reported attaining similar recreation satisfaction from both good and poor-quality habitats.

Table 2. Comparison between good and poor-quality red-cockaded woodpecker habitats in Ocala National Forest in terms of recreationists' perceived scenic beauty and recreation satisfaction.

Recreation activities	Scenic Beauty				Recreation Satisfaction			
	Good habitat	Poor habitat	Diff.	Effect size	Good habitat	Poor habitat	Diff.	Effect size
Hiking/backpacking	7.5	5.8	1.6***	0.68	7.5	5.8	1.7***	0.62
OHV riding	8.1	6.7	1.4***	0.49	7.6	6.2	1.4***	0.42
Camping	7.2	6	1.2***	0.35	6.6	5.2	1.4***	0.34
Hunting	8.2	7.4	0.8**	0.17	8	7.5	0.5	-
Canoeing/kayaking	7.2	5.6	1.6***	0.59	6.7	5.3	1.4***	0.49

***significant at 1% level, **significant at 5% level

All activity users except campers and canoers/kayakers scored recreation satisfaction and scenic beauty the same for both good and poor-quality RCW habitats (Table 3). Campers, however, reported significantly lower recreation satisfaction than perceived scenic beauty in both habitat qualities ($p<0.05$). Canoers/kayakers rated significantly lower attainment of recreation satisfaction than perceived scenic beauty in good quality habitat ($p<0.05$), but their rating of recreation satisfaction was not statistically different from perceived scenic beauty in poor quality habitat. These results indicate a strong association between perception of scenic beauty and attainment of recreation satisfaction conditional upon activity of user groups and quality of RCW habitat.

Peer-reviewed version available at Forests 2018, 9, 241; doi:10.3390/f9050241

Table 3. Comparison of perceived scenic beauty and recreation satisfaction from good and poor-quality red-cockaded woodpecker habitat in Ocala National Forest.

Recreation activities	Good quality RCW habitat				Poor quality RCW habitat			
	SB	RS	Diff.	Effect size	SB	RS	Diff.	Effect size
Hiking/backpacking	7.4	7.5	0.1	-	5.8	5.7	0.1	-
OHV riding	8.1	7.6	0.5	-	6.7	6.2	0.5	-
Camping	7.2	6.6	0.6**	0.14	6	5.2	0.8***	0.18
Hunting	8.2	8	0.2	-	7.4	7.5	-0.1	-
Canoeing/kayaking	7.2	6.7	0.4**	0.10	5.6	5.3	0.4	-

***significant at 1% level, **significant at 5% level

4. Discussion

This research examined recreationists' responses to RCW habitat management by comparing ratings of scenic beauty and attainment of recreation satisfaction by activity of recreation participation and by quality of RCW habitat. Our findings offer important implications useful for the management of public forests to attain the dual goals of recreation and wildlife habitat management. They suggest that there are important differences in perception of scenic beauty and satisfaction with recreational experience that differ depending on the nature of the recreational activity, pointing to the challenges managers face as they try to manage lands for multiple recreational uses. We also found that there were significant differences in how different user groups perceive good and poor-quality RCW habitat and how it affected satisfaction with recreational experiences. This may further complicate the challenges for land managers who need to balance maintaining specific habitat conditions with the divergent perceptions of users of these lands.

Recreation users participating in various activities rated scenic beauty and recreation satisfaction differently, providing support for our first hypothesis (H_1). Unlike the assumption in the SBE model [19], results from this study indicate that recreation users have different standards for rating both scenic beauty and recreation satisfaction. This suggests that the public's acceptance of forest management treatments is culturally derived [43,44] and that they do make judgments based on their immediate purpose in using the environment [35]. Forest managers therefore need to effectively communicate with the public regarding the ecological importance of active forest management treatments in order to make multi-objective forestry practices acceptable to a broad constituency.

Consistent with Brunson and Shelby [29], hikers and campers did not differ in terms of their perceptions of scenic beauty, but they did indicate significant differences in recreation satisfaction. Campers reported the lowest recreation satisfaction, regardless of the quality of RCW habitat. Hunters, hikers/backpackers, and OHV users were likely to attain better recreation experiences than campers from forest sites being managed for RCW. This is likely because the former recreationists enjoy open, park-like conditions perpetuated by frequent low intensity fires that remove the hardwood midstory, whereas campers prefer dense hardwood midstories that provide visual shielding from other campers. Promoting hiking/backpacking, hunting, and OHV riding opportunities in forests managed to promote RCWs (or areas requiring active management) and keeping camping sites away from these areas could result in positive outcomes. This would reduce the negative impacts of prescribed burning and some other management treatments on recreation users' attainment of expected experiences, be beneficial in minimizing conflict among land management objectives, and help managers achieve multiple objectives through forest management.

Most recreation user groups perceived higher scenic beauty and reported attainment of higher recreation satisfaction from good quality than from poor-quality RCW habitat, supporting our second hypothesis (H2). This finding indicates that forest sites maintained as good quality RCW habitat also offer quality recreation opportunities to visitors, a win-win scenario for multi-objective forestry practices. Expansion of forests that offer suitable RCW habitat is likely to not only benefit RCW populations and other dependent wildlife species (e.g., gopher tortoise), but also opens diverse

opportunities for recreation users. Results also indicate that attainment of recreation satisfaction was strongly associated with the perception of scenic beauty in both good and poor-quality habitat for at least certain activity user groups, partially supporting our third hypothesis (H3). This finding indicates that maintaining scenery is fundamental to allowing visitors to attain satisfying experiences and to improving recreation users' understanding of the ecological importance of prescribed burning and other forest management treatments. However, development of good quality RCW habitat is likely to have higher aesthetic and recreation value than low quality habitat. It will require several years and stages of active management (e.g., burning, thinning), which some recreation users may find less acceptable. Foresters will continue to confront the challenges of developing a forest site as a suitable RCW habitat while still providing satisfying recreation experiences. Development of an ecological perspective through a learning experience centered on the dynamic qualities of forest environments and the nature of both subtle and dramatic changes in the forest lifecycle [44] could encourage users to accept these treatments through a more inclusive perception of aesthetic quality. Improving recreationists' knowledge of active forest management for wildlife habitat improvement is important to achieve this goal. Most users of the FNST who pass through the 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, educational messages about prescribed burning should focus on how fire and other management treatments improve forest scenery over the long term, enhance habitat quality for wildlife, and sustain the overall health of the forest.

Finally, this study offers an important methodological implication regarding visual elicitation through the use of photographs to assess forest and landscape aesthetic perceptions and preferences. Like others, we used photographs to capture various forest conditions, but unlike most previous researchers, we obtained ratings of both scenic beauty and recreation satisfaction from onsite users. This elicitation method allowed respondents to better reflect their perspective of the actual sites as they rated them in the pictures. In addition, this time-efficient approach allowed researchers to be considerate of users' immediate purposes, such as hiking and camping, as they rated forest sites shown in the pictures. Previous research has often relied on respondents to remember or imagine a recreation visit. We believe this approach offers more valid and reliable assessment related to perception and preference of forest aesthetics.

Limitations and future direction of research

We classified and compared respondents by activity of participation. While doing so, we classified respondents based on their first major activity at the time of data collection. However, activities people choose to recreate are not necessarily mutually exclusive. Users can participate in more than one equally important activity in a single visit or at a single site in a forest. When asked to report three activities in order of importance, about 10% of respondents, such as those who hiked and camped, struggled to select one activity as more important than the other. This generates the potential for some inaccuracies or poor precision in classification of respondents by activity. Future research should consider adopting more effective classification criteria to offer more robust conclusions regarding differences associated with the activity people chose to recreate and perception of scenic beauty and recreation satisfaction.

We used a single picture to represent each forest site condition considered in this study. A single photograph cannot represent the diversity of a surrounding environment seen from a specific viewpoint [45]. Thus, reliability and validity of such assessments could be improved by using panoramic photographs or forest walk simulations using 360° cameras. In addition, we used photographic images representing different times after burning across different forest sites rather than for a single site. Tracking the same sites before and after burning and other management treatments for multiple years (time lapse photos) and assessing recreation users' perceptions of scenic beauty and recreation satisfaction in a longitudinal research design will offer more robust evidence to confirm or disconfirm the findings presented in this study.

Peer-reviewed version available at Forests 2018, 9, 241; doi:10.3390/f9050241

5. Conclusions

This study confirms that forest aesthetic perception and preference depend upon an individual's immediate purpose in using an environment. In other words, the recreation activity users choose affects their evaluation of forest management treatments in terms of aesthetic and recreational quality. Future studies should consider users' purpose for visiting a site in any assessment of aesthetic preferences and visit experiences. Scenery management programs in public forest should keep the activities that a targeted site provides for users. For example, keeping camping sites away from RCW habitats or areas requiring active management will provide these users with a more positive outcome. On the other hand, such sites are appropriate for hunters, hikers/backpackers, and OHV users. Research related to wildlife habitat management has shown that forest sites developed as good quality RCW habitat also offer habitat for many other wildlife species, including gopher tortoise. This research indicates that good quality RCW habitat also offers higher scenic and recreational quality. Expansion of RCW habitat can not only support recovery of this endangered species and benefit many other wildlife species, but it can also offer quality recreation opportunities for visitors. Nonetheless, improving recreationists' ecological knowledge remains important in order to improve users' experience when they recreate in forest sites under development as RCW habitat with the requisite frequent and intensive application of treatments, particularly prescribed burning. Hunters rated higher scenic beauty and recreation satisfaction of forest sites representing various forms of active management than other activity users, suggesting that developing programs to facilitate knowledge transfer from hunters to other recreation users could be beneficial.

Supplementary Materials: The following are available online at www.mdpi.com/link, Figure S1: Photographic images used for panel selection of good and poor-quality RCW habitat in Ocala National Forest, USA.

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Author Contributions: Ramesh Paudyal, Taylor Stein, Holly Ober, and Eric Jokela developed conceptual ideas; Ramesh Paudyal designed the study, conducted data collection and analysis, and wrote the paper; Mickie Swisher contributed to the design and study instrument; Holly Ober, Mickie Swisher, and Eric Jokela edited the manuscript. Damian Adams provided overall guidance.

Conflicts of Interest: The authors declare no conflict of interest.

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