

## Examining OHV user displacement at the Oregon Dunes National Recreation Area and Sand Lake: A 10-year trend study



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### ABSTRACT

The purpose of this research is to combine data from three cross-sectional surveys (2002, 2006, and 2011) to examine the possibility of two distinct OHV user displacement processes at Oregon Dunes National Recreation Area (ODNRA)/Sand Lake. We adopted a broader definition of displacement to better understand displacement of OHV visitors during periods of changing levels of management regimentation that ranged from low (Type 1 displacement) to high (Type 2 displacement). The study used a random sampling method and a total of 1773 exit interviews were completed. The data were analyzed using Analysis of Variance, Chi-Square tests, and Analysis of Moment of Structures. Results suggest a Type 2 displacement process in 2002 was followed by a Type 1 process in 2006 as a result of changing managerial and social conditions. Ultimately, these changes led to more highly satisfied visitors in 2011 that are recreating in a safer environment.

### MANAGEMENT IMPLICATIONS

Visitor displacement is not inherently bad when it is managed. As part of their current management plan, ODNRA/Sand Lake managers use the Recreation Opportunity Spectrum (a zoning tool) to define recreation opportunities for the area, and in a larger regional context, this can be used to minimize Type 1 displacement in some areas (higher levels of regimentation) and Type 2 in others (lower levels of regimentation). To be effective at ODNRA/Sand Lake, clearly stated management objectives are needed for each recreation opportunity zone.

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## 1. Introduction

In recreation research, displacement has been narrowly defined as a type of visitor behavior in which people are driven away from preferred places that are no longer considered acceptable or satisfying (Becker, 1981; Kuentzel & Herberlein, 1992; Schreyer & Knopf, 1984; Shelby, Bregenzer, & Johnson, 1988). Although the term displacement has typically been confined to visitors who

seek solitude and can no longer find it, other types of people with different needs and desires may also be displaced. Some users are sensitive to the behaviors of other users and crowding. Some users value freedom and lack of regulation more than solitude and would be displaced by the imposition of regulations. Because these people are affected differently by different courses of action (or inaction), managers need to be aware of their presence and views. Hall and Cole (2000) provide a more generic, balanced definition of displacement, "as a process in which recreationists are driven away from a preferred place due to changes in conditions resulting from management action or lack thereof" (2000, p. 113). We adopted the broader definition of displacement in our research to help managers of the Oregon Dunes National Recreation Area (ODNRA)/Sand Lake find ways to better manage Off-Highway Vehicle (OHV) use.

In 2002, the first of three studies examining OHV use patterns at ODNRA and Sand Lake was conducted. The study examined

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several variables including visitor demographics, trip characteristics, experience use history, overall trip satisfaction, quality of outdoor recreation, and perception of crowding and conflict. The study was repeated in 2006 and 2011. The purpose of this research is to combine data from the three cross-sectional surveys (2002, 2006, and 2011) to examine a possible visitor displacement process given evidence provided by OHV user displacement trends, trends in levels of sensitivity to crowding and conflict, and satisfaction trends at ODNRA/Sand Lake. The results are discussed in the context of changing social and managerial conditions such as the adoption of a 2003 alcohol ban and stricter camping rules in 2005 at ODNRA/Sand Lake.

## 2. Major management actions implemented from 2002 to 2011

After the first study was completed in 2002, the Forest Service implemented an alcohol ban on ODNRA/Sand Lake. The more restrictive management policy was adopted in May 2003 and was among the most radical management actions implemented during the study period. The alcohol ban was necessary to help reduce traumatic injuries, violent crimes, illegal behavior, resource damage at riding areas and dispersed campsites, and “drunken rowdiness” (*Alcohol ban in sand dunes of Oregon curbs trouble, 2003*). The alcohol ban includes all OHV riding areas with the exception of developed sites such as campgrounds, picnic areas, or parking lots. The penalty for violation is a \$5000 fine and/or six months imprisonment (*USDA Forest Service, 2012*). For some, the alcohol ban was seen as a way for riders to “take their business elsewhere” (*Barnard, 2003*), while others see the alcohol ban as a way to maintain a safe environment for all OHV users.

Examples of other major management actions implemented in the ODNRA during the study period (2002–2011) include confining overnight dune campers at ODNRA/Sand Lake into 133 “sand-camps” in 2005 to end the “camping free-for-alls” (*Hubbard, 2013*). In 2011, Siuslaw National Forest, which ODNRA/Sand Lake is a part of, started working with stakeholders on a proposal to close some of the illegal OHV riding trails, while other illegal riding trails will be designated as legal. Managers hope that designated riding trails will lead to better managed OHV use and protect native plant communities in the area such as lichens and mosses from extinction (*Hubbard, 2013*). The following four research questions were addressed in the context of those restrictive management policies that could contribute to user displacement.

1. What are the *relationships* between perceived crowding and conflict and quality of the recreation experience at ODNRA/Sand Lake?
2. What are the *crowding and conflict sensitivity trends* over the ten year study period (i.e., crowding–quality relationships, conflict–quality relationships, perceptions of crowding, and perceptions of conflict)?
3. What are the *displacement trends* of ODNRA/Sand Lake over the ten year study period (i.e., changes in gender, experience use history, and trip characteristics)?
4. What are the *trends in visitor satisfaction and quality outdoor recreation* over the ten year study period?

## 3. Literature review

### 3.1. Coping behavior

Although one relatively straightforward goal of outdoor recreation management is to provide for high quality visitor experience

opportunities (*Fletcher & Fletcher, 2003*), measuring management success based on overall satisfaction alone has been challenging. Empirical research has often found that visitor satisfaction remains high even when user densities and other conditions change (*Becker, 1981; Shelby et al., 1988; Manning, 2011*). For example, visitors sensitive to perceived crowding levels may be replaced by less sensitive visitors; therefore, satisfaction as reported in cross-sectional surveys may continue to be high (*Manning & Valliere, 2001*). Many studies on crowding and conflict suggest that coping behaviors provide a reasonable explanation for consistently high reporting of quality, and a better understanding of coping may provide managers with more useful information (*Johnson & Dawson, 2004; Manning & Valliere, 2001*). The coping mechanisms investigated include spatial and temporal displacement (altered patterns of recreation activity), product shift (redefining expectations or experiential definition), and rationalization (reducing inconsistencies between expectations and actual encounters through a cognitive process). Any coping mechanism could be used by visitors to reduce stress (*Sutherland, 1996*), but displacement and product shift are among the most commonly studied and most frequently reported mechanisms adopted by outdoor recreation visitors. For example, *Hall and Shelby (2000)* found that temporal displacement (42%) and spatial displacement (26%) were most likely used by visitors of a reservoir site to deal with crowding. *Johnson and Dawson (2004)* reported that hikers in the Adirondack Wilderness were more likely to use displacement and product shift strategies (30%), more so than rationalization (8%) when dealing with unacceptable social conditions including over-crowding. *Manning and Valliere (2001)* found that most residents living around Acadia National Park (94%) adopted a behavioral or cognitive coping mechanism, primarily displacement and product shift behaviors, to deal with crowding and conflict on carriage roads. *Hammitt and Patterson (1991)* also concluded that backpackers in Great Smoky Mountains National Park were more likely to adopt physical coping behaviors (e.g., camping out of sight of other groups, timing trip to avoid other parties, and avoiding popular trails) than social coping behaviors (e.g., avoiding talking to backpackers outside of own group). Finally, *Fleishman, Feitelson, and Salomon's (2007)* study of visitors in two Israeli Nature Reserves assessed concerns regarding visitor encounters. To measure crowding sensitivity, the visitors were asked whether the number and behavior of encounters mattered to them. They found that the most crowding sensitive visitors were more likely to be disturbed when crowding was highest, and for them, a greater investment of resources (e.g., terminating their visit earlier than planned) was needed to respond to the resulting stress. All these examples emphasize the important role of coping behaviors as a way for visitors to avoid or minimize negative experiences that result from crowding and conflict (social conditions of the environment). However, the current literature on outdoor recreation seems to lack studies that examine how visitors cope and adapt to management actions or inactions intended to meet management objectives (managerial conditions of the environment). This paper intends to help address this concern using a method similar to *Légaré and Haider (2008)*.

*Légaré and Haider (2008)* combined data from three cross-sectional surveys to explore how the Chilkoot Trail hikers were affected by restrictive management policies (i.e., user fees and daily visitor quota) by evaluating changes to the visitor composition. Based on the consistently high level of satisfaction and increasingly favorable evaluations of problems reported from 1993 to 2004, they concluded that the implemented management actions achieved intended management goals. Furthermore, they believe that “Understanding the process of [visitor] adaptation that takes place as a result of management actions or inaction, and how different sub-populations of visitors are likely to be affected will lead to a better management of the system of parks and protected areas in Canada.” (p. 175).

Our paper helps answer [Légaré and Haider's \(2008\)](#) call for more long-term monitoring studies in the literature to better understand the constantly changing conditions of outdoor recreation areas and visitor perceptions of those conditions. For example, crowding conditions at a recreation area may change over time ([Shinder & Shelby, 1995](#)). What may be considered as overcrowded at one time may be considered acceptable at a later time, so managers are beginning to look at trend studies to track change among the population ([Menard, 2002; Taris, 2000](#)). Trend studies call for data to be gathered on the same variables over a period of time to analyze ongoing patterns ([Légaré & Haider, 2008](#)). In addition, trend studies in outdoor recreation provide more than mere “snapshots” of the current situation ([Crompton & Kim, 2004](#)), so managers are able to monitor changes over time and implement management actions when the impacts are unacceptable.

### 3.2. Conceptual framework

The conceptual framework ([Fig. 1](#)) used in this paper was adapted from [Hall and Cole's \(2000\)](#) broader definition of displacement. This OHV visitor displacement model was intended to be more comprehensive; however, only the subjective evaluations of crowding and conflict were included. As [Manning \(2011\)](#) posits, although situational variables such as resource, social, and managerial settings can influence overall satisfaction, those influences are facilitated by subjective evaluations of individual visitors. Displacement concepts (illustrated as feedback loops in [Fig. 1](#)) were also added to the framework to connect the quality of outdoor recreation opportunities with visitor characteristics. The framework suggests that visitors become displaced as a result of management action or inaction intended to address crowding and conflict related issues. Although other impacts such as declining resource conditions could be included in the framework, they were not examined in this study.

#### 3.2.1. Types 1 and 2 displacement

In outdoor recreation, displacement is one of several coping behaviors that can occur in response to changing conditions at a recreation area, and it is a key concept emphasized in this paper. Displacement occurs when visitors cease using a recreation site because of sensitivity to crowding, conflict, or other impacts. [Hall and Cole \(2000\)](#) describe displacement as a process that comes in two forms: Type 1 and Type 2. Type 1 displacement occurs when the area is heavily used and impacted and has low levels of regulation. As a result of Type 1 displacement, visitors sensitive to crowding and other impacts are displaced. Type 2 displacement occurs when the area is highly regulated by way of use limits, permits or other restrictive management actions. As a result of Type 2 displacement, visitors sensitive to regulation are displaced. The two distinct displacement processes were examined in this study using evidence provided by short-term and long-term trends.

## 4. Methodology

The purpose of this trend study is to combine data from three cross-sectional surveys (2002, 2006, and 2011) to examine the possibility of OHV user displacement, crowding and conflict sensitivity trends, and satisfaction trends at ODNRA/Sand Lake.

### 4.1. Study area

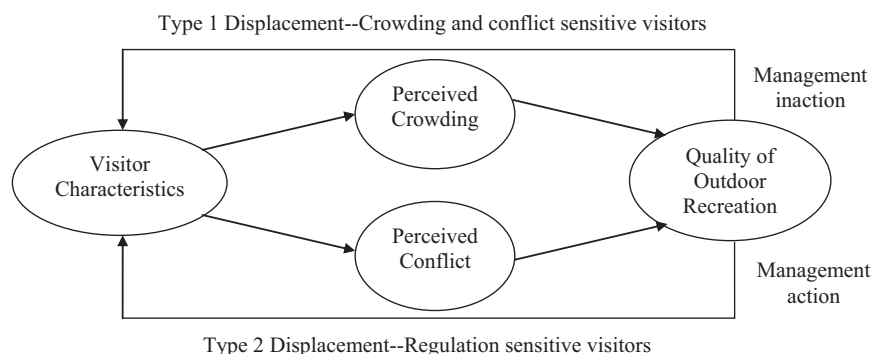
Oregon Dunes National Recreation Area (ODNRA) was established in March 1972. Located along the Oregon Coast in the Siuslaw National Forest, congress designated this 31,500 ac area for “public outdoor recreation use and enjoyment” as well as “conservation of scenic, historic, scientific, and other values contributing to public enjoyment” ([Oregon Dunes Management Plan, 1994](#), p. 8). Of the 31,500 ac designated for ODNRA, the Forest Service only manages 28,900 ac. The remaining land is mostly managed by the Oregon State Parks System. ODNRA is unique because it has one of the “largest expanses of temperate coastal sand dunes in the world,” and the close proximity of ocean, forests, and sand dunes make the area home to plant and animal species not commonly found in other areas of the world ([Oregon Dunes Management Plan, 1994](#), p. 8). ODNRA rests on approximately 40 mile of Oregon coastline beginning north in Florence and ending south in Coos Bay ([Fig. 2](#)). ODNRA averages 1.5 million visitors annually and provides a significant economic boost to communities located within the area's boundaries that once relied on fishing and wood products industries that have since declined. Sand Lake is another popular sand dunes riding area that is also managed by Siuslaw National Forest. Sand Lake covers 1076 ac and is located on Oregon's North Coast. Sand Lake's features are similar to ODNRA with closer proximity to the Pacific Ocean as well as closer proximity to the Portland, OR metro area ([USDA Forest Service, 2012](#)).

### 4.2. Instrument development

A similar on-site exit interview was developed and administered in 2002, 2006 and 2011. The surveys consisted of mostly closed-ended questions. The common variables among the three cross-sectional surveys that were examined in this study include: visitor and trip characteristics, perceptions of crowding and conflict, outdoor recreation quality, and overall visitor satisfaction. These variables and their measurement scales are provided in [Table 1](#).

### 4.3. Sampling

The exit surveys were limited to individuals who were riding OHVs on the day they were contacted and asked to participate in the study. The study used a stratified sampling method similar to



**Fig. 1.** Visitor displacement model (adapted from [Hall & Cole, 2000](#)).

the USDA Forest Service’s National Visitor Use Monitoring study. Interviews were conducted during a randomly selected six hour time period (8 am–2 pm, 10 am–4 pm, 11 am–5 pm, or 2 pm–8 pm) during the summer recreation season. The interviewers were stationed at a visible area, normally in the staging area of the OHV study site. The interviewers approached users as they were exiting the trail. A participant was randomly selected within his/her travel group and asked to participate in the study.

4.4. Data analysis

The analysis relied on Analysis of Variance and Chi-Square ( $\chi^2$ ) tests (SPSS version 20), and Analysis of Moment of Structures (AMOS) to create Structural Equation Models (SEM). As recommended by Anderson and Gerbing (1988), SEM involved a two-step modeling approach to identify an acceptable fit of the measurement model and to assess the validity of the structural model. The SEM analyses involved an evaluation of the measurement model to specify the associations between the latent factors and the observed variables. The latent factors (depicted as ovals) and observed variables (depicted as boxes) are labeled in each SEM reported in the results. Once the Confirmatory Factor Analysis (CFA) indicated an acceptable fit of the

measurement model, the structural model with the specifications of predictive relationships between the latent variables was tested.

It is valid to compare the effect sizes, such as standardized path coefficients, among the three studies for several reasons. Each SEM examined far exceeds the desired 20:1 ratio between the number of study participants and model parameters (Suh, 2006). The recommended minimum sample size needed to detect small effects (.1) and model structure using conventional power (.8) and probability levels (.05) is 150 for our study—this is three times smaller than our smallest sample. Furthermore, based on Slavin and Lake’s (2008) study of effects of sample size (categorized as < 50, 51–100, 151–250, 251–400, 401–1000, 1001–2000, and > 2000) on effect size in program evaluations, we avoid small sample bias (i.e., large and overstated effect sizes and large standard deviation of effect sizes) because we use large samples with similar size ( $N=442$  to  $N=844$ ).

5. Results

The data collected in all three study years was merged into a single dataset ( $N=1773$ ) and includes 442 respondents in 2002 (24.9% response rate), 487 respondents in 2006 (27.5% response rate), and 844 respondents in 2011 (47.6% response rate). The increased number of respondents in 2011 does not reflect an increase in the visitor population, rather more interviewers were available at more locations during the study.

Before estimating the models the data for all the exogenous variables were checked for missing cases and normality. Mean substitution was used because the data contained only few missing cases (less than 6.5% per variable). Mean substitution works best with a small number of missing cases (Schumacker & Lomax, 2010). Kurtosis and skewness indexes showed that the observed variables in the model did not violate the normality assumption. Absolute skewness ranged from .8 to 1.8 and kurtosis from .1 to 5. None of the observed variables had an absolute skewness index close to 3.0, which is considered extreme (Chou & Bentler, 1995) or an absolute kurtosis index close to 10, considered as problematic (Kline, 2005). Also, visual observation of normal distribution curves showed no violation of the normality assumption.

5.1. RQ1: What are the relationships among variables in an overall model predicting quality of outdoor recreation?

Prior to testing the structural relationships of the displacement model, factor analysis was performed on the entire data set to



Fig. 2. Location of ODNRA and Sand Lake.

Table 1  
Common variables included in the three cross-sectional surveys.

Visitor and trip characteristics	Perceived crowding and conflict items	Quality of outdoor recreation items	Satisfaction item
Number of years visited	How crowded did you feel on ODNRA/Sand Lake during your visit? (Overall Crowding)	I thoroughly enjoyed my trip (Quality 1)	Overall experience at ODNRA/Sand Lake (Overall Satisfaction)
Number of visits per year			
First time visitors	I avoided my favorite parts of ODNRA/Sand Lake because of too many people (Crowding 1)	I thought the recreation area and its surroundings were in good physical condition (Quality 2)	
Gender			
Length of stay			
Travel distance	The number of OHVs at the recreation area reduced my enjoyment (Crowding 2) I stayed off the dunes during parts of the day because there were too many OHVs in the area (Crowding 3) The behavior of other people at the recreation area lowered the quality of my experience (Conflict 1)	My trip was well worth the money I spent to take it (Quality 3) I was disappointed with some aspects of my trip (Quality 4, reverse coded)	

Note: Overall crowding was measured on a 9-point scale (1 = “not at all crowded” to 9 = “extremely crowded”) and the remaining crowding and conflict items were measured on a 5-point scale (1 = “strongly disagree” to 5 = “strongly agree”). Overall satisfaction was measured on a 10-point scale (1 = “worst possible experience” to 10 = “best possible experience”).

**Table 2**  
Summary of exploratory factor analysis results for crowding and quality of outdoor recreation using varimax rotation ( $N=1645$ ).

Factors	Mean	Factor loadings	Eigen value	% Variance explained	Reliability coefficient
<b>1. Perceived crowding</b>			2.68	28.48	.72
I stayed off the dunes during parts of the day because there were too many OHVs in the area	1.96	.789			
I avoided my favorite parts of Oregon Dunes/Sand Lake because there were too many people	2.10	.784			
The number of OHVs at the recreation area reduced my enjoyment	2.04	.764			
<b>2. Quality of outdoor recreation</b>			1.18	26.74	.61
I thoroughly enjoyed my trip	4.51	.790			
My trip was well worth the money I spent to take it	4.38	.778			
I was disappointed with some aspects of my trip (reverse coded)	3.80	.548			
I thought the recreation area and its surroundings were in good physical condition	4.08	.514			

Note: Perceived crowding and quality were measured on a 5-point scale (1 = "strongly disagree" to 5 = "strongly agree").

establish underlying relationships among the variables (Table 2). The factor loadings for all the variables were above .5 and Cronbach's alpha for crowding (.72) and quality of outdoor recreation (.61) confirm internal consistency and convergent validity for the two constructs (Table 2). According to Hair, Anderson, Tatham, and Black (1998) reliability values of .7 and higher indicate good reliability while values between .6 and .7 are acceptable. Discriminant validity was evaluated by examining the correlation matrix for all the observed variables. Correlation coefficients were generally higher between variables under the same construct than they were between variables under different constructs. Discriminant validity requires that measures of a construct relate more highly to each other and less so to measures of other constructs (Lehmann, 1988). The critical ratios for both scales were also examined and are in the range of what is normally deemed as acceptable (Vaske, 2008).

#### 5.1.1. Testing the measurement model

Using the entire data set, the constructs including perceived crowding (three items measured on a 5-point scale), perceived conflict (one item measured on a 5-point scale), and quality of outdoor recreation (four items measured on a 5-point scale) were examined using SEM (Fig. 3). The overall crowding item (measured on a 9-point scale) and overall satisfaction item (measured on a 10-point scale) were not included in this SEM analysis. The measurement model was run first and the fit tests show the overall measurement model was a good fit: CFI (.960), TLI (.924), NFI (.949), RMSEA (.044).

#### 5.1.2. Testing the structural relationships of the model

The fit of the overall structural model was assessed using  $\chi^2$ ,  $\chi^2/df$  (or CMIN, CMIN/DF in AMOS), NFI, CFI, and RMSEA. In SEM, a non-significant  $\chi^2$  indicates no statistical differences between the observed variables (i.e. survey statements) and the latent concepts (e.g., crowding), implying the model fits the data. According to Kline (1998), a CMIN/DF ratio between 2:1 and 5:1 and RMSEA below .08 is considered as an adequate fit, and both CFI and NFI should be equal to or greater than .90 to accept the model (Garson, 2011). The overall structural model's  $\chi^2$  was significant ( $\chi^2=253.549$ ,  $p < .001$ ) and the remaining model assessment statistics including CMIN (253.549), CMIN/DF ratio (7.923), CFI (.918), NFI (.908), RMSEA (.063) and  $R^2$  (.38) indicate that the data provided a good fit to the model (Fig. 3). Taken together, the variables explained 38% of the variance in the model. As expected, significant negative relationships of perceived crowding ( $\beta = -.496$ ,  $p < .05$ ) and conflict ( $\beta = -.202$ ,  $p < .05$ ) with quality of outdoor recreation were identified. The negative coefficients indicate that as perceived crowding and conflict increase, quality of outdoor recreation decreases.

#### 5.2. RQ2: What are the crowding and conflict sensitivity trends over the ten year study period?

A SEM was examined for each study year (2002, 2006, and 2011) to more specifically identify crowding and conflict sensitivity trends (Fig. 4). Since the standardized solution was used to estimate the path coefficients ( $\beta$ ), the estimates can be interpreted as an increase/decrease or change of standard deviation of a dependent variable (quality) resulting from 1 SD increase/decrease of an independent variable (perceived crowding or conflict) (Hayduk, 1987). Levels of crowding and conflict sensitivity are inferred from these estimates. For example, a coefficient of 1 means quality moves in tandem with perceived crowding or conflict (high sensitivity). A coefficient close to 0 implies little movement in quality regardless of the levels of perceived or conflict (low sensitivity). As shown in Fig. 4, the standard estimate between quality and perceived crowding in the 2002 model of  $-.669$  indicates that a 1 SD increase in perceived crowding is expected to result in a decrease of .669 SD in quality. Likewise, a 1 SD increase in perceived conflict in the same model is expected to result in a decrease of .152 SD in quality. The larger path coefficient indicates that the 2002 sample of visitors is more sensitive to perceived crowding levels.

The 2002 ( $R^2=.47$ ) and 2011 ( $R^2=.36$ ) models (Fig. 4) explained more variance than the 2006 ( $R^2=.08$ ) model. As expected, significant negative relationships were found between the two predictor variables of crowding and conflict and quality in each of the three study years. Crowding had its strongest negative relationship with quality in 2002 ( $\beta = -.669$ ,  $p < .05$ ). The strength of the crowding-quality relationship significantly ( $z=8.52$ ,  $p < .001$ ) decreased in 2006 ( $\beta = -.168$ ,  $p < .05$ ), but returned as a significantly ( $z=10.85$ ,  $p < .001$ ) stronger relationship in 2011 ( $\beta = -.485$ ,  $p < .05$ ). Conflict had its weakest relationship with quality in 2002 ( $\beta = -.152$ ,  $p < .05$ ), then gradually ( $z=2.36$ ,  $p=.018$ ) increased in 2006 ( $\beta = -.226$ ,  $p < .05$ ) and more significantly ( $z=5.61$ ,  $p < .001$ ) in 2011 ( $\beta = -.374$ ,  $p < .05$ ) indicating an overall increasing trend.

#### 5.2.1. Perceptions of crowding

We would expect that crowding sensitive visitors would prefer areas that are perceived less crowded, as appears to be the case in 2002. Although the 2002 visitors were more crowding sensitive, they were less likely to be displaced by crowding given the lower levels of perceived crowding that were reported in the same year. That is, overall perceived crowding (measured on a 9-point scale) was rated lower ( $M=2.93$ ,  $SD=2.22$ ,  $p < .001$ ) by respondents in 2002 than in 2006 (Table 3). Perceived crowding levels significantly ( $p < .001$ ) increased ( $M=4.11$ ,  $SD=2.20$ ) in 2006 and then returned to more moderate levels ( $M=2.47$ ,  $SD=1.62$ ) in 2011. Similar significant trends were observed for the other perceived crowding items that were measured on a 5-point scale (i.e., 'I

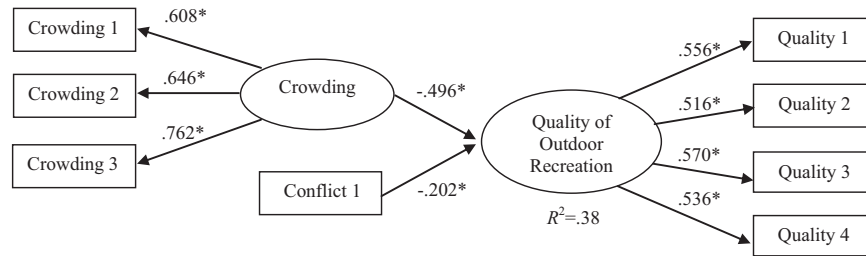


Fig. 3. Overall SEM model. \*Significant at  $p < .05$ .

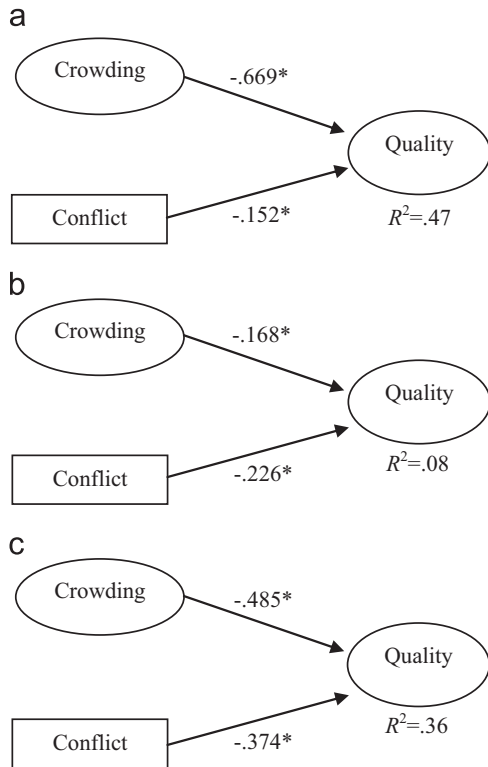


Fig. 4. SEM by study year. \*Significant at  $p < .05$ . (a) 2002 Study, (b) 2006 Study and (c) 2011 Study.

avoided my favorite parts of ODNRA/Sand Lake because there were too many people', 'I stayed off the dunes during parts of the day because there were too many OHVs in the area', and 'the number of OHVs at the recreation area reduced my enjoyment').

### 5.2.2. Perceptions of conflict

A single conflict item (the behavior of other people at the recreation area lowered the quality of my experience) was examined (Table 3). Although the 2011 visitors were more conflict sensitive, they were less likely to be displaced by conflict given the lower levels of perceived conflict that was reported in the same year ( $M = 1.79$ ,  $SD = .89$ ,  $p < .001$ ). Perceived conflict was moderate and significantly ( $p < .05$ ) higher in 2002 ( $M = 2.16$ ,  $SD = .97$ ) and 2006 ( $M = 2.31$ ,  $SD = .97$ ); however, the 2006 visitors were more conflict sensitive than the 2002 visitors. Given the higher levels of conflict sensitivity and the highest levels of perceived conflict, a Type 1 process provides a possible explanation for displaced visitors in 2006.

### 5.3. RQ3: What are the displacement trends of ODNRA/Sand Lake over the ten year study period?

Visitor and trip characteristics were compared across the three study periods to better understand displacement trends. The

variables examined include gender, repeat visitation, number of years visited, length of stay, travel distance, and group size.

Pearson's  $\chi^2$  was used to examine changes in gender and repeat visitation by study year. *Gender*—The gender ratio of ODNRA/Sand Lake visitors significantly changed during the 10 year study period. The percent of females was less ( $\chi^2 = 30.20$ ,  $df = 1$ ,  $p < .001$ ) in 2002 (17.7%) than in 2006 (34.3%). However, the percent of females in 2006 did not significantly change ( $\chi^2 = 1.02$ ,  $df = 1$ ,  $p = .312$ ) in 2011 (31.6%). *Repeat Visitors*—The ratio of repeat visitors and first time visitors also significantly changed during the study period. Repeat visitors dropped from 92.6% in 2002 to 86.0% in 2006 ( $\chi^2 = 10.22$ ,  $df = 1$ ,  $p = .001$ ). A larger percentage (90.2%) of repeat visitors returned in 2011 ( $\chi^2 = 5.06$ ,  $df = 1$ ,  $p = .024$ ).

Analysis of Variance was used to examine changes in other visitor and trip characteristics (Table 4). *Years visited*—The total number of years a respondent visited ODNRA/Sand Lake were calculated by subtracting the year of study from the year the respondent first visited the ODNRA/Sand Lake. From 2002 to 2011, the average years visited significantly ( $p < .001$ ) increased from 11.85 years in 2002, to 13.19 years in 2006, and 15.45 years in 2011. *Number of visits per year*—The average number of annual visits changed significantly ( $p < .001$ ) from 17.01 times per year in 2002 to 8.31 times per year in 2006, and returned to higher levels ( $M = 10.62$ ) in 2011. *Length of stay*—The average number of days spent at ODNRA/Sand Lake significantly ( $p < .001$ ) changed from 2.84 days in 2002 to 4.00 days in 2006 and 3.54 days in 2011. *Travel distance*—Although most respondents' primary residence is in the Coos Bay, OR area, the average number of miles traveled to ODNRA/Sand Lake significantly ( $p < .05$ ) increased from 184.68 mile in 2002, to 226.71 mile in 2006 and 262.29 mile in 2011. *Group size*—The average number of people in a travel group at ODNRA/Sand Lake was 7.29 people in 2002, and it remained roughly the same in 2006 ( $M = 6.93$ ) and in 2011 ( $M = 6.33$ ).

### 5.4. RQ4: What are the trends in visitor satisfaction and quality outdoor recreation over the 10-year study period?

A single overall satisfaction item and four quality items were examined by study year to assess whether the experience of OHV visitors improved over the 10-year study period (Table 5). Overall satisfaction (measured on a 10-point scale) significantly differed by study year ( $p < .001$ ) and was greatest in 2011 ( $M = 8.75$ ,  $SD = 1.53$ ) and lowest in 2006 ( $M = 8.37$ ,  $SD = 1.31$ ) and 2002 ( $M = 8.29$ ,  $SD = 1.53$ ). The other quality items (measured on a 5-point scale) had similar and significant trends, wherein, quality of outdoor recreation was again rated highest in 2011 ( $M = 4.07$  to  $M = 4.57$ ). These results suggest that satisfaction and quality of recreation opportunities did improve over the ten year study period.

## 6. Discussion

### 6.1. Limitations

Like Légaré and Haider's (2008) study, our results showed it is possible to find meaningful trends when combining data from

**Table 3**  
Perceived crowding and conflict by study year (ANOVA).

Variable	2002 (a) M	2006 (b) M	2011 (c) M	F	Scheffe post hoc
How crowded did you feel on ODNRA/Sand Lake during your visit? (overall crowding item)	2.93	4.11	2.47	104.86*	a < b > c
I avoided my favorite parts of ODNRA/Sand Lake because there were too many people (crowding item)	2.05	2.32	1.99	15.06*	a < b > c
I stayed off the dunes during parts of the day because there were too many OHVs in the area (crowding item)	1.96	2.31	1.73	55.09*	a < b > c
The number of OHVs at the recreation area reduced my enjoyment (crowding item)	2.03	2.19	1.94	10.68*	a < b > c
The behavior of other people at the recreation area lowered the quality of my experience (conflict item)	2.16	2.31	1.79	50.00*	a > c, b > c

Note: Overall crowding was measured on a 9-point scale (1 = “not at all crowded” to 9 = “extremely crowded”) and the remaining crowding and conflict items were measured on a 5-point scale (1 = “strongly disagree” to 5 = “strongly agree”).

\*  $p < .001$ .

**Table 4**  
Trip characteristics by study year.

Variable	2002 (a) M	2006 (b) M	2011 (c) M	F	Scheffe post hoc
Years visited	11.85	13.19	15.45	12.93**	a < c, b < c
Number of visits per year	17.01	8.31	10.62	9.68**	a > b, c
Length of stay	2.84	4.00	3.54	15.98**	a < b > c
Travel distance	184.68	226.71	262.29	5.46*	a < c
Group size	7.29	6.93	6.33	1.14	ns

\*  $p < .05$ .

\*\*  $p < .001$ .

similar cross-sectional surveys, but with some limitations. Unlike some longitudinal studies, the repeated cross-sectional studies allowed us to estimate change in visitor responses at the aggregate or population level, but unfortunately, this method does not allow us to examine the effect of specific locations on crowding and conflict perceptions and sensitivity. Crowding does vary by location (Tarrant, 1999), and we would assume conflict does as well, but this later issue was not examined in this study. In addition, it is possible that crowding and conflict sensitivity is influenced by visitors' ability to adopt intrasite displacement (seeking a less crowded site within the area), product shift (redefining expectations or experiential definition), rationalization (reducing inconsistencies between expectations and actual encounters through a cognitive process), or other less resource demanding coping mechanisms that were not examined in the study. Nonetheless, our study suggests that intersite displacement (visitors seeking less crowded sites at entirely new areas) is possibly a mechanism used by visitors who experienced undesirable crowding and conflict disturbances and changes in management, and the statistical comparison among the three data sets showed trends that were often consistent with the conceptual framework (see Fig. 1). We refer to crowding and conflict disturbances as undesirable given the negative relationship that perceived crowding and conflict have with quality of visitor experiences (see Fig. 3). Finally, the exploratory nature of the data does not allow confirmation of cause (management actions or inactions) and effect (intersite displacement) relationships. Factors other than regulatory changes could cause the changes observed in the visitor composition. Changing gas prices and economic conditions confound this effect and could influence trip characteristics such as travel distance, length of stay, and number of visits per year. And since the ODNRA was established in 1972, we might still expect the number of years visited to increase as a long term trend. Many of these limitations plague all trend studies (Légaré & Haider, 2008).

## 6.2. Synthesis of study findings

The significant OHV user crowding and conflict sensitivity trends, displacement trends, and satisfaction trends at ODNRA/Sand Lake are summarized in Table 6. An image of a triangle pointing up indicates that the percentage/means between study years increased significantly, an image of a triangle pointing down indicates that the percentage/mean decreased, and a rectangle is presented if the results between two years did not differ significantly. For SEM results, up and down triangles are based on significant changes of *B* values and represent stronger or weaker relationships.

### 6.2.1. Short-term trends (2002–2006)

The most notable change between 2002 and 2006 was our ability to predict quality of outdoor recreation in the SEM models. The 2002 model explained 47% of the variance and that declined to 8% in the 2006 model. This drastic drop in model fit was probably caused by a major regulatory change designed to address drinking and other social issues. The direct management tactics implemented during this time period include the 2003 alcohol ban and stricter sand camping rules in 2005—these were discussed earlier in the paper. A significant and expected increase in conflict sensitivity among the 2006 visitors (evident by a strengthening relationship between conflict and quality of outdoor recreation) was identified. This pattern may help explain the replacement of some 2002 visitor groups including males, repeat visitors, frequent visitors, and visitors with shorter periods of stay with a more conflict sensitive 2006 population. Hall and Cole (2000) referred to this type of displacement as Type 2. It occurs when an area is more highly regulated, a change that was introduced between 2002 and 2006 at ODNRA/Sand Lake. And, although the 2002 visitors were more crowding sensitive, they were less likely displaced by the Type 1 displacement process (caused by crowding and conflict related problems) given the lower levels of perceived crowding and conflict that were reported in 2002.

### 6.2.2. Short term trends (2006–2011)

Perceptions of crowding and conflict (especially crowding) were significantly higher in 2011, and as the visitor population generally became more sensitive to social impacts (in fact, this was the case in 3 of 4 short term crowding and conflict sensitivity trends since 2002), we expect visitors to invest more resources (e.g., displacement) into coping with crowding and conflict as was experienced in 2006 (Fleishman et al., 2007). Specifically, these higher levels of perceived crowding and conflict may help explain the displacement of some 2006 visitors, especially females, first time visitors, less frequent visitors, visitors with longer stay periods, and visitors with shorter travel distances. Hall and Cole

**Table 5**  
Overall satisfaction and quality outdoor recreation items by study year (ANOVA).

Variable	2002 (a)	2006 (b)	2011 (c)	F	Scheffe post hoc
	M	M	M		
Overall satisfaction	8.29	8.37	8.75	17.36**	a < c, b < c
I thoroughly enjoyed my trip	4.49	4.42	4.57	8.14**	b < c
I thought the recreation area and its surroundings were in good physical condition	3.97	3.86	4.28	47.97**	a < c, b < c
My trip was well worth the money I spent to take it	4.38	4.30	4.42	4.24*	b < c
I was disappointed with some aspects of my trip (reverse coded)	3.63	3.55	4.07	50.51**	a < c, b < c

Note: Overall satisfaction was measured on a 10-point scale (1 = “worst possible experience” to 10 = “best possible experience”) and quality items were measured on a 5-point scale (1 = “strongly disagree” to 5 = “strongly agree”).

\*  $p < .05$ .

\*\*  $p < .001$ .

**Table 6**  
Synthesis of significant study findings.

	Short term trends			Long term trends
	2002	2006	2011	2002 to 2011
<b>Sensitivity trends</b>				
Strength of crowding–quality relationship	$\beta = -.669$	▼	▲	▼
Strength of conflict–quality relationship	$\beta = -.152$	▲	▲	▲
Perceptions of overall crowding	$M = 2.93$	▲	▼	▼
Perceptions of conflict	$M = 2.16$	■	▼	▼
<b>Displacement trends</b>				
Females	17.7%	▲	■	▲
First time visitors	7.4%	▲	▼	▲
Number of years visited	$M = 11.85$	■	▲	▲
Number of visits per year	$M = 17.01$	▼	▲	▼
Length of stay	$M = 2.84$	▲	▼	▲
Travel distance	$M = 184.68$	■	▲	▲
<b>Satisfaction trends</b>				
Overall satisfaction	$M = 8.29$	■	▲	▲
Thoroughly enjoyed trip	$M = 4.49$	■	▲	▲
Recreation area and its surroundings in good physical condition	$M = 3.97$	■	▲	▲
Trip worth the money spent to take it	$M = 4.38$	■	▲	▲
Disappointed some aspects of trip (reverse coded)	$M = 3.63$	■	▲	▲

(2000) referred to this phenomenon of displacement as Type 1, which occurs when the area is heavily used, impacted, and no major management regulations have been implemented. The 2011 visitors were more satisfied with their visits perhaps due to lower levels of perceived crowding and conflict. Additional research is needed to examine the impact of the newly designated riding trails proposed in 2011. Given previous trends, we would expect more balanced proportions of females/males and first time/repeat visitors if crowding and conflict problems are carefully monitored and managed.

### 6.2.3. Long-term trends (2002–2011)

All of the long-term sensitivity, displacement and satisfaction trends examined between 2002 and 2011 and reported in Table 6 were significant. The 2011 visitor population appears to be sensitive to both crowding and conflict. Given the lower levels of perceived crowding and conflict that were reported in 2011, we were not surprised that overall satisfaction and quality of recreation also significantly increased. A different mix of visitors in 2011 included a higher percent of female visitors that traveled greater distances. In comparison, the percent of females (51.5%) of the Coos Bay population remained constant in both the 2000 and 2010 census. Future research is needed to better understand the unique needs of the female visitors since they are a growing proportion of the customer population. More recently, the percent of first time

visitors has started to decline slightly as well as the number of visits made per year (perhaps due to the greater travel distance that was reported). Interestingly, the predictability of quality recreation returned to moderate levels in our 2011 model giving managers even more reason to continue to monitor changing conditions. Finally, it seems that given the new mix of crowding and conflict sensitive visitors that use the area, managers may consider to become more assertive when implementing direct management tactics that address unacceptable crowding and conflict conditions.

## 7. Conclusions

As Hall and Cole (2000) suggest, displacement, when examined more broadly, is not inherently negative that always should be avoided. It was a constant and inevitable process at ODNRA/Sand Lake where crowding and conflict can be an issue at times and where restrictive management has been implemented. It is possible that a Type 2 displacement process in 2002 was followed by a Type 1 process in 2006 as a result of changing social and managerial conditions. Ultimately, these changes led to more highly satisfied visitors who are arguably recreating in a safer environment. The designated riding trails proposed in 2011 may further



satisfy the current OHV users that seem to be more sensitive to crowding and conflict.

As part of their current management plan, ODNRA/Sand Lake managers use the Recreation Opportunity Spectrum to zone different recreation opportunities for the area, apparently for the purpose to minimize Type 1 displacement in some areas (with higher levels of regimentation) and Type 2 in others (with lower levels of regimentation). Hall and Cole (2000) recommended this style of management for wilderness areas, and to be effective at ODNRA/Sand Lake, clearly stated management objectives for the highly concentrated use areas such as campgrounds, picnic areas and parking areas are needed. When writing these objectives, managers must make a subjective judgment about the conditions they want to provide in each zone or subzone and which clientele they will favor. Given current trends, managers may want to focus on the needs of their current visitors. The 2011 visitors are more highly sensitive to crowding and conflict and likely benefited from restrictive management policies that have been implemented and continue to be enforced. Finally, by assessing a combination of both visitor sensitivity and perceived levels of crowding and conflict over time, managers will be able to operationally define and monitor social disturbances that may negatively impact visitor goal attainment (Fleishman, Feitelson, & Salomon, 2007).

This study fills a void in the literature by examining how visitors cope and adapt to management actions or inactions (managerial conditions of the environment) and compliments much of the research on visitor displacement that results from changing social conditions. However, the other dimension of the recreation setting is protection and sustainability of the natural resources which needs additional research, especially at the ODNRA. Given the unique, diverse, and sensitive ecosystems of the area, recreation ecology as a branch of recreation science, can make a good addition to the science that is conducted at the ODNRA.

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