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Management perceptions of off-highway vehicle use on National Forest system lands in Appalachia

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MANAGEMENT PERCEPTIONS OF OFF-HIGHWAY VEHICLE USE ON NATIONAL FOREST SYSTEM LANDS IN APPALACHIA

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ABSTRACT

MANAGEMENT PERCEPTIONS OF OFF-HIGHWAY VEHICLE USE ON NATIONAL FOREST SYSTEM LANDS IN APPALACHIA

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Because of recent changes in the USDA Forest Service (USFS) travel management regulations, all National Forests are required to create a travel management atlas that includes a motor vehicle use map by 2009. The purpose of this study was to determine the perceptions of OHV use, issues, and management among USFS District Rangers on National Forests in the Appalachian region, and to determine the differences in perceptions of those District Rangers based on the level of OHV recreation opportunities provided on their Districts. Having this information available will help managers make decisions about how to update their travel management plans. In October of 2006, 42 District Rangers on 14 National Forests were surveyed using a modified Dillman mail-back method. The questionnaire, modified from a 2004 study by Chavez and Knap, addressed questions related to types of OHV activity on each Ranger District, amounts and types of road and trail opportunities on the District, OHV user motivations and preferences, physical and social issues arising from OHV use on the District, management tactics used to deal with OHV-related issues on the District, and demographic information. Out of 42 possible responses, 29 usable questionnaires were returned, for a response rate of 69.1%. Data were analyzed using Mann-Whitney comparisons between independent samples and Kendall's tau-b correlation. Further analysis was performed on responses to open-ended questions. The main difference found between managers with high and low levels of OHV recreation opportunities on their Districts was the number of management tactics employed to deal with issues. There were few differences in management perceptions of OHV use across Districts, of OHV users' motivations and preferences, or the types of OHV-related impacts managers reported. District Rangers need to weigh the costs and benefits of differing levels of OHV recreation opportunities on their Districts, including resource suitability and potential for collaborative management efforts.

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INTRODUCTION

Background

In 2003, USDA Forest Service (USFS) Chief Dale Bosworth cited four "key threats" to National Forest lands: fire and fuels, invasive species, loss of open space, and unmanaged recreation, particularly unmanaged off-highway vehicle (OHV) use. While there is some controversy among the public regarding the appropriateness of OHV use on National Forest System (NFS) lands (e.g., Haefele, Shields, & Lybecker, 2005; Shields, Haefele, & Lybecker, 2005), the legislation that defines the role of the USFS requires NFS lands to be managed for multiple uses, including multiple recreational uses. Previously, federal land management agencies dealt with OHV use under Executive Orders 11644 (1972) and 11787 (1977), which ordered them to "designate lands for OHV use, monitor OHV use, and correct any adverse effects of OHV use" (U.S. General Accounting Office [GAO], 1995, p. 8). Additionally, these federal land management agencies were to create and post maps and signs showing OHV routes in the areas where they were designated, and to enforce rules and regulations governing OHV use on federal lands (GAO, 1995, pp. 10-12). Several audits of the Executive Orders' implementation indicate that compliance with these Orders has been erratic, largely due to staffing and funding shortfalls (e.g., Council on Environmental Quality [CEQ], 1979; GAO, 1995; Yankoviak, 2005).

While the USFS agrees that OHV use falls under the aegis of existing multiple-use legislation, "the magnitude and intensity of motor vehicle use have increased to the point that the intent of Executive Orders 11644 and 11989 cannot be met while still allowing unrestricted cross-country travel" (USDA Forest Service [USFS], 2005). In response to these concerns, Federal Rules 36 CFR 212, 251, 261, and 295 were amended to provide a more cohesive travel

management plan and ensure better compliance with Executive Orders 11644 and 11787 (USFS, 2005).

Where before USFS trails were tacitly considered to be open to OHV use unless they were specifically posted as closed (Brooks & Champ, 2006), the new travel management rule established that Forests would create a trails inventory that listed the specific recreational opportunities available for each trail, and create a travel management atlas that displays the "system of roads, trails, and airfields of an administrative unit" (USFS, 2005, p. 105). A separate motor vehicle use map that displays "designated roads, trails, and areas on an administrative unit" (p. 105), where "designated" means that the road, trail, or area, is designated for OHV use is also to be created (p. 104). These motor vehicle use maps are to be based on existing maps and established trails, including unauthorized, user-created trails, if it is determined that the user-created trails can appropriately be included within the designated trail system (Yankoviak, 2005). A four-year time frame has been developed, during which different Forests are expected to complete their travel management atlases by the ends of 2006, 2007, 2008, or 2009, depending on the deadline designated for that particular Forest (USFS, 2005).

In the most recent National Survey on Recreation and the Environment (NSRE), OHVs were described as:

> 1) 4-wheel drive jeeps, automobiles, or sport utility vehicles; 2) motorcycles designed for off-highway use; 3) all-terrain vehicles, better known as ATVs and other specially designed off road motor vehicles used in a wide variety of ways. Although some observers and organizations include snowmobiles in their broad definition of OHVs, they are not included as OHVs for the purposes of this report, even though the NSRE has collected data specifically addressing this widely

> popular motorized activity. Further, it is recognized that OHVs are used frequently for business, commuting, and other work-related reasons, particularly those in the 4-wheel drive category of OHV types. This report, however, focuses **only** on the recreational uses of OHVs (Cordell, Betz, Green, & Owens 2005, pp. 1-2; emphasis in original).

As with the NSRE, this study focuses only on the recreational use of OHVs. Available machines vary in size, have engine displacement between 50cc and 700cc, and weigh up to 600 pounds (Canadian Paediatric Society, 2004). Between 1993 and 2003, OHV purchases in the United States have increased 174 percent, not including used-vehicle sales through dealerships or through private sellers. Trail bikes appear to be less commonly used than four-wheeled all-terrain vehicles (Hatfield-McCoy Trails, 2006; Holmes & Englin, 2005; USFS, 2004).

The most recent data available on recreational OHV use indicate that such use continues to increase (Cordell et al., 2005; Dolesh, 2004). According to Cordell et al. (2005), the mean number of activity days for OHV use on public land increased from 23.3 in 2001 to 30.7 in 2003. While in the short term recreational OHV use appears to be on the increase, Bowker, English, and Cordell (1999) project that through 2050 such use will show only seven percent growth as measured in activity days, and negative 22 percent growth as measured by primary-purpose trips. This assessment places recreational OHV use in the "five slowest growing outdoor recreational activities" through 2050 (Bowker et al., 1999, p. 349).

Notwithstanding the long-term projections, increasing short-term demand for OHV use has created a challenge for the USFS. While demand continues to increase in general for recreational opportunities on public lands, the supply of such lands is not increasing, and, in some cases, is beginning to decrease (Bowker et al., 1999). The Multiple-Use and Sustained-

Yield Act of 1960 (MUSYA) mandates that the USFS provide "timber, forage, water, fish and game, and recreational opportunities, many of which conflict with each other, but it is also supposed to regulate public uses to preserve biological integrity and forest aesthetics" (Nie, 2003). In addition to the on-site management challenges faced by the USFS, the amount of private land that is accessible to recreationists free of charge has decreased almost 50 percent between 1979 and 1996 (USDA, 2001, as cited in Yankoviak, 2005), further exacerbating the pressure on the USFS and other public land management agencies to provide recreation opportunities.

This pressure is considerably greater on the East coast, where land acquisitions – rather than the designation of public-domain lands, as on the West coast – were the norm for developing National Forests. Although private landholders developing property adjacent to National Forests are becoming more common on the West coast (Bosworth, 2003), NFS lands on the East coast were often established in such a way that they abutted private property from the beginning (Weeks Act, 1911). While private trail systems like the Hatfield-McCoy Trails in West Virginia and the TrailPass system in Tennessee offer fee-based recreation opportunities for OHV users, the majority of OHV-related recreational opportunities are still provided by the USDI Bureau of Land Management (BLM) and the USFS (Cordell et al., 2005). According to Bowker et al. (1999), both increases in population density and "[p]rojected reductions in indexes of available supply have noticeable negative effects on the growth of land-intensive activities like hunting, hiking, off-road vehicle driving, and primitive camping" (p. 350).

While the expansion of OHV access on National Forest lands was not found to be a priority for individuals living in Region 8 or Region 9, a high level of disagreement existed as to whether the Forest Service should expand existing OHV recreation opportunities or provide them

at all (Haefele et al., 2005; Shields et al., 2005). Managers in these areas are therefore caught in the middle of competing public demands for how OHV use should be managed.

The USFS currently permits motorized use on over 300,000 miles of roads and trails combined; however, more than 60,000 miles of unauthorized or unplanned OHV trails are currently estimated to exist on National Forest lands (Dolesh, 2004; USFS, 2005; Yankoviak, 2005). While the new travel management plan is intended to reduce the amount of unauthorized OHV use, most studies that examine techniques for successful OHV management have been based on the West coast (e.g., Behan, Richards, & Lee, 2001; Chavez & Knap, 2004, 2006; Duncan & Maughan, 1978; Eckert, Wood, Blackburn, & Peterson, 1979; Gilbert, 2003), where ecosystem and climatic differences can make it difficult to extrapolate the results of those studies to successful East coast OHV recreation management.

The purpose of this study is to determine the perceptions of OHV use, issues, and management among USDA Forest Service District Rangers in National Forests in the Appalachian region, and to examine the differences in perceptions of those District Rangers based on the level of OHV recreation opportunities provided on their Districts. As managers develop travel inventories and motor vehicle use maps to include in their transportation atlases, they may consider opening or closing trails to OHV use. Managers who have information available about what other managers nearby are experiencing relative to the levels of OHV recreation opportunities they offer will be better able to make decisions about travel plans on their own Districts.

Research Questions

1. How do District Rangers on Appalachian National Forests perceive OHV use on their Districts?
    a. How do District Rangers on Appalachian National Forests perceive OHV users' motivations and preferences on their Districts?
    b. How do District Rangers on Appalachian National Forests perceive physical impacts of OHV use on their Districts?
    c. How do District Rangers on Appalachian National Forests perceive social impacts of OHV use on their Districts?
    d. What management tactics do District Rangers on Appalachian National Forests prefer to use to deal with the impacts of OHV use?
2. How does the level of OHV recreation opportunity on a Ranger District affect District Rangers' overall perceptions of OHV use on their District?
    a. What differences are there in perceptions of OHV users' motivations and preferences between District Rangers with low and high levels of OHV recreation opportunities on their Districts?
    b. What differences are there in perceptions of physical impacts of OHV use between District Rangers with low and high levels of OHV recreation opportunities on their Districts?
    c. What differences are there in perceptions of social impacts of OHV use between District Rangers with low and high levels of OHV recreation opportunities on their Districts?

d. What differences are there in preferred management tactics related to OHV use between District Rangers with low and high levels of OHV recreation opportunities on their Districts?

Hypotheses

There are few studies that address management of OHV use in general; while there are some user profiles with varying levels of detail available for states in Appalachia (Fly, Stephens, Askins, & Hodges, 2002; Hatfield-McCoy Trails, 2005), the only known study dealing specifically with management perceptions of issues and management tactics is Chavez's and Knap's 2004 study of managers in California, which was updated in May of 2006. While that study was the basis for the survey instrument in this study, there are no current studies addressing the differences between different levels of OHV recreation opportunities and the issues and tactics differing levels may or may not present or require. Similarly, because there have been so few studies related to management perceptions of other types of recreation, motorized or nonmotorized, it would be presumptuous to develop directional hypotheses. Because there are no data that support developing hypotheses in any particular direction, I have chosen to work from the null hypotheses to avoid introducing any personal biases or assumptions into this study. My hypotheses are as follows:

H_{0a}: There is no difference in overall perceptions of OHV use on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

H_{0b}: There is no difference in perceptions of OHV users' motivations and preferences on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

H_{0c}: There is no difference in perceptions of physical impacts of OHV use on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

H_{0d}: There is no difference in perceptions of social impacts of OHV use on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

H_{0e}: There is no difference in preferred management tactics related to OHV use on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

Terminology

1. **OHV:** For the purposes of this study, off-highway vehicles (OHVs) are considered to be three- and four-wheel all-terrain vehicles and off-road motorcycles used for recreational purposes.
2. **Appalachian Region:** The Appalachian Mountains extend through Southern New York, most of Pennsylvania, southeastern Ohio, all of West Virginia, eastern Kentucky, western Virginia, eastern Tennessee, western North Carolina, northeastern Mississippi, and northern Alabama, Georgia, and South Carolina (Appalachian Regional Commission [ARC], 2002; Figure 1).

Figure 1. **The Appalachian Region (ARC, 2002).**

3. **Recreation Opportunity Spectrum (ROS):** The ROS helps resource managers divide large areas into a system of recreation sub-areas based on the types of recreation experiences that are likely to be generated there. Recreation opportunity classes

(primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban) are established based on a set of criteria weighing physical, social, and managerial settings appropriate to that area (Clark & Stankey, 1979).

4. **Impacts:** Changes in the natural resource resulting from recreation use. "The biophysical characteristics of the natural resource base help determine the degree of change in the environment that results from recreation use. While even light levels of use may cause change in the environment, some resource bases are inherently more fragile than others" (Manning, 1999, p. 73).
5. **Road:** "A motor vehicle route over 50 inches wide, unless identified and managed as a trail" (USFS, 2005, p. 106).
6. **Trail:** "A route 50 inches or less in width or a route over 50 inches wide that is identified and managed as a trail" (USFS, 2005, p. 106).
7. **Unauthorized road or trail:** "A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas" (USFS, 2005, p. 107).
8. **Forest transportation atlas:** According to the updated travel rule, all NFS administrative units (National Forests, National Grasslands, and so on) are required to create a Forest transportation atlas that displays "the system of roads, trails, and airfields of an administrative unit," including a motor vehicle use map that shows the "designated roads, trails, and areas on an administrative unit or a Ranger District of the National Forest System" (USFS, 2005, p. 105).

Significance of the Study

Most studies that examine techniques for successful OHV management have been based on the West coast (e.g., Behan, Richards, & Lee, 2001; Chavez & Knap, 2004, 2006; Duncan & Maughan, 1978; Eckert et al., 1979; Gilbert, 2003), where ecosystem, social, and climatic differences between the two areas can make it difficult to extrapolate the results to successful East coast management. Because this study takes place on the East coast, it will help address an existing gap in the OHV management literature. In addition, this study will assist managers in Appalachia by helping to share information about management issues and strategies appropriate for and specific to dealing with varying levels of OHV use on National Forests in the Appalachian region.

Limitations

District Rangers were selected as the point of contact for this study due to the wide variation in job titles and responsibilities held by USFS employees; since every Forest has different recreation-related positions, it is difficult to determine who wears what "hat" in the context of OHV management (Chavez & Knap, 2004, 2006; D. Chavez, personal communication, August 29, 2006; GAO, 1995). In accordance with the methodology Chavez and Knap (2004, 2006) employed in their studies of OHV management on National Forests in California, I have opted to contact District Rangers in order to maintain consistency with regard to job responsibilities that may have an influence on perceptions of OHV use. Unlike the aforementioned study, however, this study includes District Rangers without OHV recreation opportunities on their Districts in order to determine the perceptions of OHV use and users across varying types of exposure to OHV use and users. While selecting this population does

ensure consistency, there is also the possibility that selecting it may lead to useful information from other sources being missed.

This study is limited to the Appalachian region and is not a national study. Results applicable to this region may not apply to other areas, but comparisons among regions may be useful.

Although every attempt was made to obtain the most recent information available about Districts on the Forests being surveyed, Ranger Districts on some Forests were consolidated over the duration of the study and some of the information obtained prior to the initial survey mailing was inaccurate. Because of the consolidation of some Districts, some Districts received duplicate survey instruments; the initial count of 47 Ranger Districts also was inaccurate. The final count of Ranger Districts was 42. In addition, in spite of the survey instrument instructions requesting information specific to the District in question regardless of the amount of time a District Ranger was employed there, some respondents chose to complete the survey instrument using information about Districts outside the study region. There was also a duplicated instrument received from the same Ranger District as a previously received instrument. These two instruments were therefore not usable.

Delimitations

This study focuses specifically on the perceptions of District Rangers in National Forests within the Appalachian Mountain range. To be selected for the study, the Appalachian Mountains had to be located within a National Forest's boundaries; all Forests were located either in Region 8 or Region 9. Under those criteria, the National Forests selected for this study were: Allegheny, Monongahela, Chattahoochee, Daniel Boone, Wayne, Cherokee, George Washington and Jefferson, Pisgah, Nantahela, Uwharrie, Holly Springs, Tomigbee, Talladega,

and Sumter. The only National Forest in New York State is in the Finger Lakes region and therefore outside of the Appalachian region as defined by the ARC (ARC, 2002). Every other state in the Appalachian region, however, is represented in this study.

This study was conducted in fall of 2006. It is a snapshot of conditions at that time, as well as of perceptions of District Rangers employed on National Forests in the Appalachian region at that time.

Summary of the Following Chapters

In the chapter that follows, I provide a detailed explanation of the conceptual framework through a review of the literature. This study is based on a 2004 study by Chavez and Knap, as well as the updated 2006 version of that study. In this series of studies, the authors surveyed District Rangers in California National Forests about OHV use-related issues and management tactics, based on the concerns expressed by former USFS Chief Bosworth (2003) about unmanaged recreation. In the literature review I discuss the framework developed in that study and organize the components thereof according to the Recreation Opportunity Spectrum. I examine the following topics: physical aspects of OHV recreation, including physical impacts to soils, trails, and riparian areas; as well as noise and other impacts on wildlife; social aspects of OHV recreation, including OHV recreationists and their motivations and preferences, and recreation conflict related to motorized recreation; and managerial aspects of OHV recreation including management tactics commonly used by resource managers.

In Chapter Three, I discuss the methodology employed for the study. This study was a census of all District Rangers whose National Forests contained the Appalachian Mountain range, as delineated by the ARC (2002). Data were collected using a modified Dillman (2000) method and mail-back surveys. The survey instrument was based on Chavez and Knap (2004)

and modified with input from a variety of academic experts on OHV user and USFS management professionals working in various positions and regions. Twenty-nine of 42 possible responses were received, for a final response rate of 69.1%. Due to the small sample size, nonparametric methods were used to analyze the data, including Mann-Whitney and Kendall's tau.

In Chapter Four, I discuss the results of the data analysis. Twenty-seven of 29 respondents reported OHV use on their District, and 28 of 29 reported that OHV use was a forest resource management concern. Overall, managers' perceptions of OHV users' motivations and preferences tended to match OHV users' self-reports, with some differences related to social and trail preferences. Managers reported between three and 24 OHV-related issues on their Districts, with 72.4% reporting between 11 and 18 OHV-related issues. The top three OHV-related issues across Districts were soil erosion or compaction, user-created trails, and users going cross-country. Managers employed a combination of different types of tactics across Districts. Open-ended responses pointed to issues with illegal and unauthorized behaviors causing resource damage, conflicts with adjacent property holders, funding and staffing issues, and interagency conflict and communication issues.

Between groups, managers with a high level of OHV recreation opportunities were more likely to perceive OHV users' motivations and preferences in the same way that OHV users had self-reported in previous studies. There was a small to moderate positive correlation between the ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$), and were more likely to use a greater number of management tactics than users with a low level of OHV recreation opportunities ($U = 36.00$, $p < .01$). There were no significant differences in demographic characteristics between groups.

In Chapter Five I discuss the foregoing results with respect to hypothesis testing and the research questions established in Chapter One. I discuss the management implications arising from these findings, including the need for more and more varied management tactics as the level of OHV recreation opportunity increases and the lack of decline in OHV-related illegal and unauthorized activities as OHV recreation opportunities increase. Finally, I make recommendations for future research based on these findings.

LITERATURE REVIEW

In Chapter One, I discussed the rising popularity of OHV recreation in the United States and the background of the 2005 travel management rule developed by the USFS. Because of the four-year time frame set to develop inventories of both authorized and unauthorized trails and establish a comprehensive travel management atlas that includes a motor vehicle use map, it is important for managers to have information about OHV recreation-related issues and management tactics. A series of hypotheses and research questions were set forth regarding the amount of OHV recreation opportunities a Ranger District offers and how that amount affects perceptions of OHV use and users; definitions, limitations, and delimitations were also discussed.

In this chapter, I provide a detailed explanation of the conceptual framework through a review of the literature. This study is based on the 2004 and 2006 studies by Chavez and Knap. In the 2004 study, the authors surveyed 38 District Rangers in California National Forests about OHV-use-related issues and management tactics, based on the concerns expressed by USFS Chief Bosworth (2003) about unmanaged recreation; they added responses from seven additional District Rangers in the more recent study but otherwise employed the same method. In the literature review I discuss the framework developed in that study and organize the components thereof according to the Recreation Opportunity Spectrum. I examine the following topics: physical aspects of OHV recreation, including physical impacts to soils, trails, and riparian areas; as well as noise and other impacts on wildlife; social aspects of OHV recreation, including OHV recreationists and their motivations and preferences, and recreation conflict related to motorized recreation; and managerial aspects of OHV recreation including management tactics commonly used by resource managers.

Conceptual Framework

This study was developed from a study by Chavez and Knap (2004), in which the authors surveyed District Rangers in California National Forests about OHV use-related issues and management tactics based on the concerns expressed by USFS Chief Bosworth (2003) about unmanaged recreation. According to the authors,

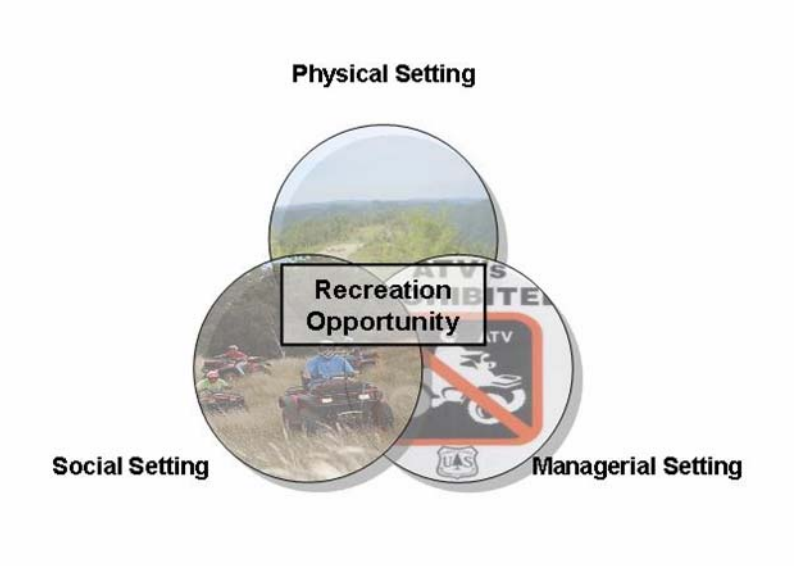
> There are several OHV management issues of concern to Chief Bosworth and others. Included in these are: unplanned roads and trails, soil erosion, water degradation, habitat destruction, the spread of invasive species, conflicts between different recreational users, and violations of sites sacred to American Indians (Chavez & Knap, 2004, p. 6).

Chavez and Knap stated the need to understand management perceptions of OHV use due to managers' unique understanding of the complex nature of the issues related to OHV use on NFS lands as well as of the management tactics that can be used to resolve or mitigate those issues (p. 7). Because the 2006 study by those authors was in essence the same study with seven more responses to their survey included in the results, it was not necessary to update methodological or theoretical aspects of this study when their follow-up study was published. In order to categorize and further clarify the myriad issues faced by resource managers dealing with OHV use and users, I have organized these issues within the physical, social, and managerial settings of the Recreation Opportunity Spectrum (ROS).

The ROS (Clark & Stankey, 1979) helps resource managers divide large areas into a system of recreation sub-areas based on the types of recreation experiences likely to be generated there. Recreation opportunity classes (primitive, semi-primitive non-motorized, semi-primitive

motorized, roaded natural, rural, and urban) are established based on a set of criteria weighing physical, social, and managerial settings appropriate to that area (Figure 2).

Figure 2. **The Recreation Opportunity Spectrum.**



The USFS defines the type of recreation experience opportunity available in a given area by designating a particular ROS class to that area. The criteria used to establish what ROS class an area falls into are: the remoteness of the area from "the sights and sounds of man" (Buist & Hoots, 1982), the overall size of the area, evidence of human modification, user density, and level of management visibility (Clark & Stankey, 1979). OHV use is prohibited in any federally designated Wilderness area (Wilderness Act, 1964), as well as in areas classified as primitive or semi-primitive non-motorized under the ROS (Clark & Stankey, 1979).

Under the new travel rule, OHV use may be permitted on roads or trails near those areas, but the decision whether such use will occur will be decided at the District (or similar) level (USFS, 2005). While such decisions are left open to managers of the areas in question, it is unlikely that a manager directly following the ROS handbook would make such a decision, as Clark and Stankey (1979) directly caution against having motorized opportunities sited next to

ROS classes that do not support such activity in order to avoid having impacts from one class "spill over" into another (p. 23).

If an area not included in one of the foregoing ROS classifications provides OHV-related recreational opportunities, the type of experience an OHV user can expect to have will be dependent upon the ROS class designation for that area (**Error! Reference source not found.**). Motorized use is permitted in four ROS classes, starting with semi-primitive motorized and continuing into the urban class designation.

Table 1

ROS Setting Opportunities

Primitive	Essentially unmodified environments. Large in size. Few encounters with and little evidence of other users. Little to no evidence of management involvement. Motorized use prohibited.
Semi-primitive non-motorized	Natural or natural-appearing environments. Moderate to large size. Few encounters with but frequent evidence of other users. Subtle management presence/involvement. Motorized use prohibited.
Semi-primitive motorized	Natural or natural-appearing environments. Moderate to large size. Low user concentration but frequent evidence of other users. Subtle management presence/involvement. Motorized use permitted.
Roaded natural	Natural-appearing environments. Moderate evidence of humans. Prevalent evidence of other users. Resource modifications evident. Motorized use permitted.
Rural	Modified natural environments. Frequent encounters with and ready evidence of humans. Facilities frequently provided for special activities, including intensified motorized use and parking.
Urban	Urbanized environments with natural-appearing background elements. Resource modifications enhance specific recreation activities. Frequent encounters with and ready evidence of humans. Highly intensified facility development focused on accommodating motor use.

Adapted from Buist & Hoots,1985, p. 85

An OHV user riding in a semi-primitive motorized area would find few other recreationists, motorized or non-motorized; be riding in a fairly large area; and see little evidence

of management or development. If the same user were to ride in an area classified as roaded natural, that user would have more encounters with other users, be riding in a smaller area than the previous area, and see more signs of management intervention. Continuing up the scale, the same rider, in a rural area, would have quite a few encounters with other users and see a considerable amount of development and other management intervention. By the time that same rider entered an area designated as urban, he or she would be riding in a densely populated, highly developed and highly managed area.

The challenge in designating ROS classes appropriate to OHV use comes not with the criteria for class designations per se, but with the differences between motorized and nonmotorized users' motivations and preferences for recreation opportunities that might occur in the same area. This topic will be addressed in greater depth below.

The major sections of this literature review will consist of:

- The conceptual framework for this study, above.
- *Physical aspects of OHV recreation,* including physical impacts to soils, trails, and riparian areas; as well as noise and other impacts on wildlife.
- *Social aspects of OHV recreation,* including OHV recreationists and their motivations and preferences, and recreation conflict related to motorized recreation.
- *Managerial aspects of OHV recreation,* including management tactics commonly used by resource managers.

Physical Aspects of OHV Recreation

Physical Impacts

Regardless of the type of use occurring on it, how a trail impacts the resources around it depends on the "location, construction, vegetation, soil conditions, level of maintenance, and 'the amount and timing of trail use' … Impact usually increases from humans to stock to motorized vehicles" (Krumpe & Lucas, 1986). Horses, for example, cause more post-rainfall sedimentation than either hikers or llamas (Deluca, Patterson, Freimund, & Cole, 1998); at the extreme of this scale, OHVs are considered to cause impacts that are "spatially extensive and temporally enduring" (Leung, 1998, p. 2; Priskin, 2003). The effects of such impacts can range from disturbances of watersheds to introduction of invasive or exotic species, as well as diminution of visitor experience quality and safety (Leung & Marion, 1996). Disturbances to and deaths of animal and reptile species have also been reported as a result of OHV use (e.g., Gilbert, 2003; Munger, Barnett, Novak, & Ames, 2003; Wisdom, Ager, Prisler, Cimon, & Johnson, 2005).

Impacts to the trail itself depend on "(1) frequency of use, (2) type and behavior of use, (3) season of use, and (4) environmental conditions" (Cole, 2004, p. 12; Nepal & Nepal, 2004). Climate, geology, topography, soil type, and vegetation also determine the level of degradation that may occur on a particular trail (Leung & Marion, 1996, p. 131-2). For example, the higher the elevation of a trail, the greater the soil loss (Burde & Renfro, 1986, as cited in Leung & Marion, 1996; CEQ, 1979; Leung & Marion, 2000); steeper slopes also contribute to greater erosivity (Leung & Marion, 1996, p. 132). In 1979, the CEQ suggested that OHV use should be avoided altogether in alpine tundra such as that found in New England, on the West coast, and in Appalachia due to the fragility of the soil in alpine tundra environments (p. 11). While some types of soil are more vulnerable to significant damage from OHV use than others, however, all soil types will experience some damage (CEQ, 1979).

"User type, use intensity, and user behavior" (Leung & Marion, 1996, p. 132; Cole, 1993) also influence the level of impact on a trail. According to the CEQ (1979):

> [OHVs]…are a multiplier of man. It takes 2 to 3 days for a walker to travel as far as motorcyclists or four-wheel drivers can in 2 to 3 hours. In addition, a motorcycle or 4x4 wheel exerts greater shear-stress upon the ground than the human foot. A typical motorcycle, driven very carefully so as to leave the smallest mark on the land, affects 1 acre of land for every 20 miles it travels. A four-wheel drive vehicle driven in a similar manner affects 1 acre in only 6 miles of travel. A person walking has to travel 40 miles to affect 1 acre of land (p. 25).

"Few OHV trails are planned trails where a full range of environmental considerations was carefully weighed before constructed. In fact, few trails are specifically constructed for OHV use" (Meyer, 2002, p. 8). Such unplanned trails frequently cross areas that are not suitable for OHV recreation at current use levels (Marion & Leung, 2004; Meyer, 2002).

Impacts caused by motorized or other uses start with trampling, which causes abrasion to vegetation and other organic matter. The abrasion, in turn, leads to reduced plant vigor and reproduction and eventually to changes in species composition and vegetation cover. Trampling also leads to soil compaction, which can increase runoff and erosion; in combination with the initial reduction in organic matter and concomitant reduction in vegetation and soil biota, these changes can further aggravate runoff and erosion in trampled areas (Hendee & Dawson, 2002, p. 416). Motorized trail use causes the same damage to vegetation and roots as any other type of use, but at a more rapid rate (CEQ, 1979; Meyer, 2002, p. 3). The higher the travel speed of a single OHV, the greater surface disruption caused by that vehicle (Webb and Wilshire, 1983). As well as damage to the soil and plant life through and over which the trail travels, such erosion

can, over time, create hazardous trail conditions for recreational users (Hendee & Dawson, 2002).

Along with soil abrasion and compaction, shearing and displacement can occur because of OHV use (CEQ, 1979; Meyer, 2002, p.3). Soane et al. (as cited by Thurston, 1998) found that agricultural vehicles exert three types of force on soil surfaces: downward compaction, rotational shearing stress, and vibrational effects; Prudente (2003) noted these same effects on soil from OHVs. The amount of effect an OHV has on the soil on which it operates depends on the steepness of the grade on which the user is riding. Motorcycles exert the greatest amount of torque during uphill travel, which is where the majority of motorcycle-generated erosion, abrasion, and compaction occurs; downhill travel, on the other hand, causes less impact than foot travel since a rolling motorcycle exerts less force than the halting gait of an individual hiking downhill (Weaver & Dale 1978, as cited by Thurston, 1998, p. 10).

As more OHVs travel through an area, the increased travel creates ruts in the trail on which the OHV users are riding. Because these ruts are created by tires, their extent and depth tends to be greater than ruts caused by foot traffic, particularly when they are generated by hard braking. OHV-created ruts also tend to cause erosive water flows to a greater degree than those caused by footsteps (Cessford, 1998). After ruts have developed in a trail, braiding – also known as multiple or parallel trails – begins to occur, since users travel beside or around problem areas in the existing trail in order to find routes more similar to the undamaged original (Hendee & Dawson, 2002; Leung & Marion, 1999; Meyer, 2002, p. 7).

As with any other trail (e.g., Hendee & Dawson, 2002), OHV trails are less prone to erosion and the issues stemming from erosion if they are built in an appropriate location and designed to accommodate the type of use they receive (Lennon et al., 1987). Marion and Leung

(2004) suggested that good motorized trail designs avoid stream crossings or provide bridges to minimize stream damage, and that trails be designed to handle greater impacts by surfacing the tread with geofabrics or crushed stone. Prudente (2003), on the other hand, suggested that anywhere that surface runoff potential was high was an inappropriate place to site an OHV trail.

While well-located and –designed trails can help mitigate or avoid immediate damage to soils and trail surfaces, the erosion created by OHVs ridden on poorly located or –designed trails can have a deleterious effect on stream dynamics as well as on soils. "Fine-grained soils with lower saturated hydraulic conductivities" generate the greatest amount of runoff (Prudente, 2003, p. 214), making motorized trails inadvisable on those types of soils. Chin, Rohrer, Marion, and Clingenpeel (2004) found that turbidity increased near OHV trails on the Ouachita National Forest, and that otherwise clear streams became "muddy and sediment laden" near OHV crossings (p. 293). The sedimentation, in turn, decreased the depth of those streams, reducing viable habitat and spawning beds for fish species "during low flow or drought conditions" (p. 295; Prudente, 2003). Stream temperatures have also been found to increase at OHV stream crossings, reducing the ability of the water to provide oxygen for aquatic species (Taylor, n.d.). Finally, OHVs leak gasoline and motor oil onto soils and into the streams their riders ford, resulting in further pollution of riparian areas (Bluewater Network, 1999; Havlick, 2002).

Intensive management tactics to deal with these types of issues work well in the frontcountry settings for which they are intended (Marion and Leung, 2004), but OHVs also increase the ability of recreationists to access more remote areas, leading to increased visitation to areas that were previously used by a small number of people (CEQ, 1979; USDI Bureau of Land Management [BLM], 2000; USFS, 2004). "This increased visitation inevitably results in intentional and inadvertent damage through collection, vandalism, surface disturbance, and other

depreciative behavior" (BLM, 2000, p. 6). In ecologically sensitive areas, a single pass by an OHV can cause immediate changes in vegetation as well as on the soil (Kutiel, Eden, & Zhevelev, 2000, p. 21). According to Hendee and Dawson (2002), the act of creating any trail increases the likelihood that exotic and invasive plant species will be introduced to an area. Trail impacts that affect a relatively small portion of an ecosystem are generally considered acceptable, but trail construction can involve alterations that can, in some area, cause significant impacts. These impacts include:

> …creation or elimination of rock faces where trails traverse rock outcrops; creation of debris slopes where boulders are pushed down slope to build the trail; creation of flat, soil-covered surfaces where trails traverse steep talus slopes; and creation of wet soil areas where trails impede normal drainages (Hendee & Dawson, 2002, p. 421).

These changes, in turn, can create suitable habitat for exotic and invasive species, which are easily and often unknowingly introduced to an area by its visitors, whether on foot or on an OHV.

Since OHVs increase their users' ability to travel greater distances, the likelihood of OHV users introducing exotic plant species in remote areas where they ride also increases (Cole, 1993; CEQ, 1979; Munger et al., 2003). These exotic plants can cause a reduction in habitat and food sources for reptiles and small mammals (CEQ, 1979; Munger et al., 2003), as well as for other plant species (Leung & Marion, 2000).

In addition to impacting soil, water, and plant and animal species, OHVs generate air pollution. The California Air Resources Board (n.d.) found that two- and four-stroke OHV engines release over 100 times as many smog-forming pollutants into the air than automobiles

(California Air Resources Board, n.d., as cited by Bluewater Network, 1999, p. 3); an OHV's carbon monoxide emissions alone are 4,000 times that of an automobile (Environmental Protection Agency, n.d., as cited by Bluewater Network, 1999, p. 12).

Noise

Noise can be considered both a physical and a social impact (Krause, 2001; Mace, Bell, & Loomis, 1999; Staples, 1997). In this section of the literature review, I will focus on the impacts of noise on wildlife; impacts of noise on humans will be addressed below.

Noise itself can be considered a subset of sound; the difference between noise and natural sound is simply that noise is a sound that is not wanted. "Sounds that are loud, unpredictable, and uncontrollable are likely to be perceived as noise" (Mace et al., 1999, p. 226). The Noise Control Act of 1972 established that "an average day-night sound level of 65dB[A]" in an area qualifies it for environmental noise protection (Staples, 1997). The average OHV, on the other hand, has a sound level of 81-111 dBA (Bluewater Network, 1999, p. 31).

While it may be tempting to think of natural sound as silence, it is rather a combination of sounds from animals, land, water, weather, and humans (Maher, Gregoire, & Chen, 2005). This combination of natural sounds (the "soundscape") in a recreation area is commonly measured at or below 20 dBA (Miller, 2002). The average human conversation, by contrast, is approximately 55 dBA (Grau, 2005). The noisiest OHV, therefore, is twice as loud as the average human conversation and more than five times as loud as sound levels usually found in a natural setting.

Noise affects different species in different ways. Noise from OHVs has been found to disturb elk herds in the Rocky Mountains and in eastern Oregon (Gilbert, 2003; Wisdom et al., 2005), increasing their movement rates and displacing them from areas where they usually forage. In the same study, however, Wisdom and colleagues found that black-tailed deer do not

respond differently to OHV riding than any other human activity in the same area. According to Hendee and Dawson (2002), it is difficult to assess the long-term effects of wildlife disturbances, but "unintentional disturbance has undoubtedly altered the distribution, population structure, and behavior of many wildlife species" (p. 414).

Social Aspects of OHV Recreation

OHV Users

Demographics

Between 1994 and 2004, the number of OHVs in the United States has tripled, with four-wheelers accounting for more than 70 percent of the OHV market (Cordell et al., 2005; Dolesh, 2004). As of 2003, there were more than eight million OHVs in the U. S. (Cordell et al., 2005). Nationally, Americans aged 16 and older who participated at least one time in recreational use of OHVs "increased from 16.8 percent in 1999-2000 to 23.8 percent in 2003-2004" (Cordell et al., 2005, p. 6). In 2003-4, participation rates in the study area ranged from 15.6 percent in Ohio to 34.5 percent in West Virginia; the mean participation rate across the study area was 21.85 percent. Table 2 shows OHV participation rates throughout the study region state by state.

Table 2.

OHV Participation in Appalachia by State

State	**Participation (percent)**
Pennsylvania	19.3
Ohio	15.6
West Virginia	34.5
Kentucky	24.2
Virginia	21.5
Tennessee	20.1
North Carolina	20.7
South Carolina	18.9
Mississippi	23.2
Alabama	22.1
Georgia	20.3

While the majority of participants in OHV recreation tend to be "under 50, male, White, and suburban," more women, Hispanics, and urban residents are beginning to participate in the activity (Cordell et al., 2005, p. 7). Much has been made of the demographic makeup of OHV users, but the only consistent difference found across several studies is that OHV users tend to be less educated than recreationists who do not ride OHVs (e.g., Cordell et al., 2005, Duncan & Maughan, 1978; Havlick, 2002; Yankoviak, 2005).

OHV users tend to be active participants in outdoor recreation in general, averaging 26.6 activity days per year riding OHVs. They are also twice as likely as other outdoor recreationists to participate in outdoor activities other than their primary activity (with the exception of backpacking) and three times more likely than other outdoor recreationists to participate in all types of hunting (Cordell et al., 2005). Fly et al. (2002) found that in addition to OHV riding, OHV users in Tennessee tended to participate in sightseeing, hunting, fishing, and camping when they took a trip where OHV riding was considered their primary activity.

Participation in OHV riding is increasing; unfortunately, so is the death toll. Between 1982 and 2001, there were 4,541 deaths in the United States attributed to OHV use; five months later that toll had increased by slightly over ten percent. Of those fatalities, 38 percent involved children under 16 years of age (Ingle, 2002). In 2006 alone, West Virginia had a record death toll of 52. According to the West Virginia University Center for Rural Emergency Medicine (2004), over 95 percent of OHV crash victims were not wearing a helmet, about 40 percent of crashes occurred on paved streets or roads, and 22 percent involved alcohol or other drugs (p. 1).

While most OHV riders feel that education programs are important (Fisher, Blahna, & Bahr, 2001), fewer than ten percent of riders learned to operated their vehicles "through a dealer, salesman, or an organized training program" (Levenson, 2003, p. 3). Almost half (44%) of

OHVs are purchased used, with 83 percent purchased in a private sale, rather than from a dealership. The majority of riders are either self-taught, or were taught by "a friend or relative" (Levenson, 2003, p. 3). Because motorized recreationists are less likely to participate in educational activities than nonconsumptive or consumptive recreationists, it has been difficult to find successful methods of promoting safety and other related programs (Thapa & Graefe, 2002).

Preferences

Motorized recreationists tend to favor multiple-use facilities over separate use facilities. Since OHV riders tend to be active in outdoor recreational activities other than riding (Cordell et al., 2005; Fly et al., 2002), they tend to show support for both nonmotorized and motorized activities. By contrast, recreationists who participate solely in nonmotorized activities tend not to show support for the provision of motorized recreational opportunities (Andereck, Vogt, Larkin, & Frye, 2001; Brooks & Champ, 2006).

According to Bury, Holland, & McEwen (1983, as cited by Thapa & Graefe, 2003), OHV riders' activities tend to take priority over the impacts of their machines. Several studies have shown motorized recreationists to be the most technocentric participants in outdoor recreation, preferring the development of resources over the preservation of the natural environment (e.g., Brooks & Champ, 2006; Schuett & Ostergren, 2003; Thapa & Graefe, 2003). Brooks and Champ (2006) found that OHV users in Colorado's Front Range region tended to equate protection with shortages or reductions of recreational access for OHV users. Symmonds, Hammitt, and Quisenberry (2000), however, found that motorized recreationists were more likely to agree with nonconsumptive recreationists that habitat protection was more important than development. That study included hunters and other consumptive recreationists in the same segment as OHV users, though, where the previously cited studies looked at OHV recreationists as a unique segment.

While OHV users were generally found to be less environmentally concerned and less environmentally active than other outdoor recreationists (Schuett & Ostergren, 2003), they were still found to be concerned with the conditions of the areas in which they recreate. Litter and erosion were regular concerns mentioned by OHV riders (Andereck et al., 2001; Chavez & Schuett, 2005; Fly et al., 2002), although overall they preferred less intensive management of recreation areas than nonmotorized users (Andereck et al., 2001). The age OHV users started to ride appears to have no significant effect on their levels of environmental concern (Ewert, Place, & Sibelthorp, 2005).

Benefits and Motivations

In a study of the members of the National Off-Highway Vehicle Conservation Coalition (NOHVCC), Schuett and Ostergren (2003) found that the top five reasons NOHVCC members rode OHVs were fun, family enjoyment, stress relief, physical challenge, and to be in a natural environment. Studies of riders without organizational affiliations found similar motivations for participation; among those were enjoying natural scenery, being with other people with similar interests, getting away from crowds of people, family togetherness, and being around the sights and smells of nature (CEQ, 1979; Fly et al., 2002). OHV riders tend to be more social than nonmotorized recreationists, and generally do not value solitude as a reason for recreating (CEQ, 1979).

Some recreationists use OHVs for the convenience they provide or to gain access to areas they might otherwise not be able to reach. Hunters who use OHVs "can cover distance with much less effort than hiking. They can also retrieve harvested big game with far less effort than packing it out on foot" (USFS, 2004, p. 21; Nie, 2003). Lynch and Nelson (2002) suggested that since many OHV users start riding as adults, as riders develop age-related mobility impairments

they may use OHVs "to access outdoor recreational settings they formerly used without motorized assistance" (p. 312).

It should be noted that although some recent studies examined the motivations for riding and benefits of riding perceived by OHV users, many of the studies cited here are from the late 1970s. The information in this section reflects a shortcoming in the OHV literature in general: in states where users are required to register OHVs (e.g., Fisher et al., 2001) or when they are involved with an organized club (e.g., Chavez & Schuett, 2005; Schuett & Ostergren, 2003), contact can be made with those users. Since many states do not require registration of off-highway vehicles and most OHV recreationists are not involved in organized clubs, this demographic has consistently proven difficult to contact.

Conflict

In Jacob and Schreyer's (1980) seminal work on the subject, they defined conflict as "goal interference attributed to another's behavior" (p. 369). According to their model, there are four factors that contribute to conflict: activity style, resource specificity, mode of experience, and lifestyle tolerance (p. 370). Any of these factors can be a catalyst for conflict, but most conflict situations involve some combination of the four.

Activity style is the personal meaning or meanings a recreationist assigns to their activity of choice. Not every recreationist will expect the same things from the same activity. For example, one person may go hiking with the intention of having a solitary experience, while another might hike with a large group, hoping to spend the day socializing with friends.

Resource specificity refers to the importance an individual attaches to a particular resource for a recreation experience. The more specialized a recreationist grows in their activity of choice, the more limited that recreationist's options become, as fewer recreation resources

provide the specific opportunity they seek (Bryan, 1977). In Bryan's 1977 study of anglers, for example, he found that conflict was more likely to arise when anglers of varying levels of specialization encountered each other because the less specialized anglers, who had more recreation options than the more specialized anglers due to the more general focus of their angling goals, were perceived by the more specialized anglers as interfering with their ability to accomplish what they had set out to do in the place they found most appropriate for their activity.

Mode of experience relates to the various and varying expectations recreationists have toward their perceptions of the recreation resource they choose. While the primary motivation of many outdoor recreationists is to seek quiet or solitude, for example (Manning, 1999), OHV recreationists' primary motivation for riding tends to be social in nature (CEQ, 1979; Fly et al., 2002; Schuett & Ostergren, 2003). If a recreationist has entered a selected site seeking quiet and instead encounters groups of OHV riders and the concomitant noise their machines produce, the nonmotorized recreationist may perceive conflict, as that person is unable to reach their intended goal of finding quiet and solitude.

Lifestyle tolerance is defined as "the tendency to accept or reject lifestyles different from one's own" (Jacob & Schreyer, 1980, p. 370). More recent research has placed a considerable focus on this aspect of recreation conflict, examining the normative and value-related issues related to recreationists' perceptions of in- and out-groups (e.g., Carothers, Vaske, & Donnelly, 2001; Ivy, Stewart, & Lue, 1992; Thapa & Graefe, 2004; Watson, Niccolucci, & Williams, 1994). In-groups are comprised of recreationists who participate in the same activity as the individual experiencing conflict; out-groups are comprised of recreationists participating in a different activity than that individual. While in-group-versus-out-group conflict is more common, studies have also shown that conflict can arise within in-groups, particularly between

more- and less experienced participants in an in-group's activity (Bryan, 1977; Thapa & Graefe, 2004; Vaske, Dyar, & Timmons, 2004).

A considerable amount of the literature points to conflict between mechanized and nonmechanized recreationists being related to the rate of speed at which their preferred activities takes place. That is to say, whatever recreational activity an individual chooses, nonmechanized recreationists tend to be antagonistic toward mechanized or motorized recreationists (Krumpe & Lucas, 1986). While mechanized and motorized recreationists tend to be more tolerant of other recreationists regardless of activity, nonmechanized users tend to have a low tolerance for mechanized and motorized users (Andereck et al., 2001). Examples of nonmechanized versus mechanized conflict abound: among others, there have been studies of cross-country skiers and snowmobilers (Knopp & Tyger, 1973; Vittersø, Chipeniuk, Skår, & Vistad, 2004), hikers and mountain bikers (Bradsher, 2003; Carothers, Vaske, & Donnelly, 2001; Cessford, 2004; Heer, Rusterholz, & Baur, 2003), hikers and OHV users (Behan et al., 2001; CEQ, 1979; Dolesh, 2004; Shultis, 2001), and canoeists and motorboaters (Adelman, Heberlein, & Bonnicksen, 1982; Ivy et al., 1992; Kuhn, 2004).

Noise has also been noted as a component of motorized-versus-nonmotorized recreation conflict. Mace and colleagues (1999) suggested that since noise is generally defined as "unwanted sound," and that seeking quiet is frequently ranked as a major reason for recreationists to seek outdoor opportunities, the aural component of the recreation experience needs to be taken into consideration along with the physical and aesthetic components (pp. 225-6). The authors found that annoyance with unwanted sounds decreased the perception of naturalness in National Park System landscapes. Further to that, Grau (2005) found that people recreating in outdoor areas were more sensitive to sounds in general, and that the louder the

human-generated sounds individuals were subjected to, the less acceptable they found their recreation settings.

Conflicts arising from motorized noise tend to be asymmetrical; that is, nonmotorized recreationists tend to experience goal interference from motorized recreationists more so than their motorized counterparts experience from them. Although there have been no studies directly related to OHV noise and its effects on other recreationists, the examples of other motorized-versus-nonmotorized conflict exist in the literature. Noise-related conflict has been observed between cross-country skiers and snowmobilers (Knopp & Tyger, 1973; Vittersø et al., 2004), as well as between motorboaters and canoeists (Ivy et al., 1992; Kuhn, 2004).

Managerial Aspects of OHV Recreation

Management Tactics

Resource managers have a large variety of options available to them in terms of tactics used to manage various types of recreation. Manning (1999) suggested that these tactics can be collapsed into four strategies: increasing supply, reducing use impacts, increasing the resource's durability, and limiting use (p. 239). Other research suggested that rather than examining the end results that Manning (1999) recommended, that actual management practices be taken into account. These practices, or tactics, can also be divided into four categories: direct, indirect, resource hardening, and collaborative management techniques (Chavez, 1996; Chavez & Knap, 2004, 2006; Manning, 1999).

Direct management tactics have an immediate effect on the recreationist; they tend to be proscriptive in nature. Direct tactics involve the immediate presence or action of a resource manager, and may limit what recreationists can do in a given area (Hendee & Dawson, 2002; Manning, 1999). Common management tactics include law enforcement, prohibition or

regulation, zoning, rotating use, limiting group size, and limiting length of stay (GAO, 1995; Lime, 1977, 1979, as cited by Manning, 1999). In Chavez and Knap's 2004 and 2006 studies of OHV management in California, the most commonly used direct management tactics included law enforcement closing or moving trails, prohibiting or limiting use, requiring special use permits for an activity, organizing trail maintenance events, and seasonal closures (p. 21).

Indirect management tactics, while visible to varying degrees, are considered to be less intrusive and more prescriptive than proscriptive. The emphasis of indirect management is to modify or influence user behavior by influencing "the factors on which they base their behavior" (Manning, 1999, p. 240). Indirect tactics do not necessarily involve the immediate presence or action of a resource manager; that manager employs indirect management tactics by choosing whether or not to maintain a trail (influencing whether people choose to use that trail), publicizing specific aspects of a resource area (influencing the types of people interested in visiting), educating users about the ecology of the area (influencing the users' perceptions about appropriate behavior toward the resource), or choosing whether or not to improve fish and wildlife populations in the area (influencing what types of recreationists choose to use the area), to name a few (GAO, 1995; Lime 1977, 1979, as cited by Manning, 1999, p. 242). When employing indirect tactics, California OHV managers most commonly used different types of signage; user ethics and etiquette, brochures, trail use recommendations, and trail maps (Chavez & Knap, 2004, p. 20; Chavez & Knap, 2006).

Resource hardening increases the durability of the resource by developing facilities or using natural or artificial means to stabilize or harden trails or other surfaces (Hendee & Dawson, 2002; Manning, 1999). Chavez and Knap (2004, 2006) found that California OHV managers who employed this tactic most commonly developed "staging areas with parking facilities,"

modified trails to include drain dips or artificial tread, offered designated campsites, and specified a maximum grade on trails. The authors of that study found that resource hardening was not a preferred option for resource managers in California; no tactics involving resource hardening were in the top management tactics employed to deal with OHV use.

Collaborative, also called "bridge-building," management tactics involve one or more stakeholders or stakeholder groups in decision-making about how an area is to be managed (Chavez, 1996; Brooks & Champ, 2006). Sometimes building bridges can be as simple as having a conversation with an individual recreating at a particular site; other times, it may take the form of a lengthy process involving a diverse array of citizens and interest groups with varying priorities and agendas in a series of meetings to develop a plan that accommodates the wants and needs of those individuals and groups to the greatest extent possible (Brooks & Champ, 2006). Clearly, such tactics occupy a complex place in any resource management occupation:

> …resource professionals … need to account for both scientific and experiential knowledge; recognize that people have preferred forms of information exchange and delivery systems; understand that various sources of information are viewed as more credible than others; and realize the degree of risk (uncertainty) associated with knowledge about a problem is highly relevant to citizens (Shindler & Cramer, 1999, p. 32).

District Rangers in California frequently made personal contacts with users or user groups who rode OHVs on their Districts; they also encouraged volunteer patrols, adopt-a-trail programs, meetings with local OHV clubs, using local groups and volunteers to maintain their trails, partnerships, and meetings with state-level OHV organizations (Chavez & Knap, 2004, p. 23; Chavez & Knap, 2006). According to Lennon et al. (1987), organized OHV users want to

work directly with management, and encourage resource managers to work directly with the OHV community:

> Staying in tune to the ORV user is important to good management. Users are essential in laying out trail and road networks to meet the desired experiences. Organized users are very interested in the prevention of resource damage because they, for the most part, readily understand the implication of good management and responsible riding upon the availability of future opportunities (p. 14).

The managers interviewed in the Chavez and Knap (2004, 2006) study found collaborative management techniques to be most successful, given situations where users and managers were both willing to work together (p. 24).

Nie (2003) commented that a "pattern often repeats itself in natural resource policymaking: vague or contradictory legislative directives are followed by incompatible budgetary mandates…. many of the most important forest management decisions have been made through the Congressional budgetary process" (pp. 318-9). This appears to be the case for managers dealing with OHV use under MUSYA and prior to the new travel rule. Budgetary constraints often prevented managers in the California study from using more collaborative management tactics and techniques, particularly shortfalls in "funding, personnel, and training" (Chavez & Knap, p. 3); studies in other areas have indicated managers outside of California face similar constraints (Brooks & Champ, 2006; Shindler, Brunson, & Stankey, 2002). In many cases, managers rely on funding from state agencies to support OHV programs at their sites; the level of nonfederal support for these programs therefore affects managers' abilities to implement any of the types of management tactics described above (GAO, 1995). The same GAO study of OHV management on the West coast found that managers were increasingly turning to

partnerships with local tribes, OHV clubs, and businesses to try to address the shortfalls in funding and labor.

When to employ each of these types of management tactics depends on the behavior the manager is trying to change or curtail. Unlawful behavior clearly requires the involvement of law enforcement; ignorant or uninformed behavior, on the other hand, might be better served by education (Tynon & Chavez, 2006). The opportunity to use collaborative management tactics with success can only occur if trust exists or has been built between the resource manager and the recreationists who use that resource (e.g., Brooks & Champ, 2006; Shindler, Brunson, & Stankey, 2002). Budgetary limitations and fear of litigation from other stakeholders (D. Palmer, personal communication, October 24, 2006) make it difficult for managers to move forward with any type of major decisionmaking or planning processes that might have an effect – positive or negative – on recreation opportunities. In a management environment this complex, if managers have more information at their disposal regarding what does and does not work when dealing with numerous and varied issues and stakeholders, they are more likely to find successful and creative ways to resolve management issues that arise by applying appropriate management tactics (Brooks & Champ, 2006).

Conclusion

Managing OHV use on NFS lands is fraught with complexity. Without appropriate trail siting and design, OHV use can cause extensive resource damage. Among the physical impacts OHV use can cause are soil damage, erosion, riparian damage, introduction of invasive species, and disruption to or death of wildlife. Although OHV users are, with the exception of level of education, similar demographically to nonmotorized recreationists and tend to participate in nonmotorized activities themselves, the speed and noise of OHV activity can lead to conflict

with other users. While resource managers have a variety of direct, indirect, site-hardening, and bridge-building tactics available, funding, training, and staffing limitations often constrain managers from working with OHV users in ways they would prefer (Chavez & Knap, 2004, 2006).

In the following chapter, I discuss the methodology employed for the study. This study was a census of all District Rangers whose National Forests contained the Appalachian Mountain range, as delineated by the ARC (2002). Data were collected using a modified Dillman (2000) method and mail-back surveys. The survey instrument was based on Chavez and Knap (2004, 2006) and modified with input from a variety of academic experts on OHV user and USFS management professionals working in various positions and regions. Twenty-nine of 42 possible responses were received, for a final response rate of 69.1%. Due to the small sample size, nonparametric methods were used to analyze the data, including Mann-Whitney and Kendall's tau.

In Chapter Four, I discuss the results of the data analysis. Twenty-seven of 29 respondents reported OHV use on their District, and 28 of 29 reported that OHV use was a forest resource management concern. Overall, managers' perceptions of OHV users' motivations and preferences tended to match OHV users' self-reports, with some differences related to social and trail preferences. Managers reported between three and 24 OHV-related issues on their Districts, with 72.4% reporting between 11 and 18 OHV-related issues. The top three OHV-related issues across Districts were soil erosion or compaction, user-created trails, and users going cross-country. Managers employed a combination of different types of tactics across Districts. Open-ended responses pointed to issues with illegal behavior causing resource damage, conflict with

adjacent property holders, funding and staffing issues, and interagency conflict and communication issues.

Between groups, managers with a high level of OHV recreation opportunities were more likely to perceive OHV users' motivations and preferences in the same way that OHV users had self-reported in previous studies. There was a small to moderate positive correlation between the ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$), and were more likely to use a greater number of management tactics than users with a low level of OHV recreation opportunities ($U = 36.00$, $p < .01$). There were no significant differences in demographic characteristics between groups.

In Chapter Five I discuss the foregoing results with respect to hypothesis testing and the research questions established in Chapter One. I discuss the management implications arising from these findings, including the need for more and more varied management tactics as the level of OHV recreation opportunity increases and the lack of decline in OHV-related illegal and unauthorized activities as OHV recreation opportunities increase. Finally, I make recommendations for future research based on these findings.

METHOD

In Chapter One, I discussed the rising popularity of OHV recreation in the United States and the background of the 2005 travel management rule developed by the USFS. Because of the four-year time frame set to develop inventories of both authorized and unauthorized trails and establish a comprehensive travel management atlas that includes a motor vehicle use map, it is important for managers to have information about OHV recreation-related issues and management tactics. A series of hypotheses and research questions were set forth regarding the amount of OHV recreation opportunities a Ranger District offers and how that amount affects perceptions of OHV use and users; definitions, limitations, and delimitations were also discussed.

In Chapter Two, I provided a detailed explanation of the conceptual framework through a review of the literature. This study is based on 2004 and 2006 studies by Chavez and Knap, in which the authors surveyed District Rangers in California National Forests about OHV-use-related issues and management tactics, based on the concerns expressed by USFS Chief Bosworth (2003) about unmanaged recreation. In the literature review I discussed the framework developed in the 2004 study and used in the 2006 follow-up study and organize the components thereof according to the Recreation Opportunity Spectrum. I examined the following topics: physical aspects of OHV recreation, including physical impacts to soils, trails, and riparian areas; as well as noise and other impacts on wildlife; social aspects of OHV recreation, including OHV recreationists and their motivations and preferences, and recreation conflict related to motorized recreation; and managerial aspects of OHV recreation including management tactics commonly used by resource managers.

In Chapter Three, I discuss the methodology employed for the study. This study was a census of all District Rangers whose National Forests contained the Appalachian Mountain range, as delineated by the ARC (2002). Data were collected using a modified Dillman (2000) method and mail-back surveys. The survey instrument was based on Chavez and Knap (2004) and modified with input from a variety of academic experts on OHV user and USFS management professionals working in various positions and regions. Twenty-nine of 42 possible responses were received, for a final response rate of 69.1%. Due to the small sample size, nonparametric methods were used to analyze the data, including Mann-Whitney and Kendall's tau.

In Chapter Four, I presented the results of the data analysis and hypothesis testing. Twenty-seven of 29 respondents reported OHV use on their District, and 28 of 29 reported that OHV use was a forest resource management concern. Overall, managers' perceptions of OHV users' motivations and preferences tended to match OHV users' self-reports, with some differences related to social and trail preferences. Managers reported between three and 24 OHV-related issues on their Districts, with 72.4% reporting between 11 and 18 OHV-related issues. The top three OHV-related issues across Districts were soil erosion or compaction, user-created trails, and users going cross-country. Managers employed a combination of different types of tactics across Districts. Further analysis of open-ended responses pointed to issues with illegal behavior causing resource damage, conflict with adjacent property holders, funding and staffing issues, and interagency conflict and communication issues.

Between groups, managers with a high level of OHV recreation opportunities were more likely to perceive OHV users' motivations and preferences in the same way that OHV users had self-reported in previous studies. There was a small to moderate positive correlation between

the ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$), and were more likely to use a greater number of management tactics than users with a low level of OHV recreation opportunities ($U = 36.00$, $p < .01$). There were no significant differences in demographic characteristics between groups.

In Chapter Five I discuss the foregoing results with respect to the research questions established in Chapter One. I discuss the management implications arising from these findings, including the need for more and more varied management tactics as the level of OHV recreation opportunity increases and the lack of decline in OHV-related illegal and unauthorized activities as OHV recreation opportunities increase. Finally, I make recommendations for future research based on these findings.

Sampling Procedure

This study is a census of National Forests within the Appalachian Mountain range. The Appalachians extend through southern New York, most of Pennsylvania, southeastern Ohio, all of West Virginia, eastern Kentucky, western Virginia, eastern Tennessee, western North Carolina, northeastern Mississippi, and northern Alabama, Georgia, and South Carolina (ARC, 2002; Figure 3).

Figure 3. **The Appalachian Region (ARC, 2002).**

To be selected for the study, the Appalachian Mountains had to be located within the National Forest's boundaries; all Forests were located either in USFS Region 8 or Region 9. Under those criteria, the National Forests selected for this study were: Allegheny, Monongahela, Chattahoochee, Daniel Boone, Wayne, Cherokee, George Washington and Jefferson, Pisgah, Nantahela, Uwharrie, Holly Springs, Tomigbee, Talladega, and Sumter. The only National Forest in New York State is in the Finger Lakes region and therefore outside of the ARC definition of the Appalachian region. Every other state in the Appalachian Range is represented in this study.

District Rangers were selected as the point of contact due to the wide variation in job titles and responsibilities held by USFS employees; since every Forest has different recreation-related positions, it is difficult to determine who wears what "hat" in the context of OHV management (Chavez & Knap, 2004, 2006; GAO, 1995; D. Chavez, personal communication, August 29, 2006). In accordance with the methodology Chavez and Knap (2004, 2006) employed in their study of OHV management in California National Forests, I opted to contact

42 District Rangers in order to maintain consistency with regard to job responsibilities and similarities in perceptions. Unlike the aforementioned study, however, this study includes District Rangers without OHV recreation opportunities on their Districts in order to determine the perceptions of OHV use and users across varying types of exposure to OHV use and users.

Data Collection

Data were collected by postal mail using a modified Dillman (2000) method. On the day the prenotification letter[1] was mailed, an email was sent from the National OHV Program Director at the USFS to managers in Regions 8 and 9. A week later, the survey instrument was mailed, accompanied by a cover letter containing instructions for completing the survey and a postage-paid return envelope. After 90 days, a second, follow-up, letter requesting their participation was sent to nonrespondents along with a second copy of the survey instrument, instructions, and a postage-paid return envelope.

Instrumentation

The survey instrument was based on an instrument developed by Chavez and Knap (2004) to assess issues related to OHV use and management tactics employed by managers on National Forests in California. Because of the length of the original survey instrument and difficulty with data collection in that study (D. Chavez, personal communication, August 29, 2006), the instrument was modified based on input from experts on OHV recreation, USFS District Rangers, and USFS recreation managers. Further modifications were made in order to include managers who did not offer OHV recreation opportunities on their Districts, as well as a section on OHV user motivations and preferences. Pretesting was administered at West Virginia

[1] Recent research has indicated that response rate may be better using prenotification letters rather than prenotification postcards, making a letter a more cost-effective option relative to response rate (Hembroff, Rusz, Rafferty, McGee & Ehrlich, 2005).

University and in USFS Region 6. Feedback from those sources prompted further modifications to the instrument. Following pretesting and final updates to the instrument and prenotification letter, the final instrument was approved by the West Virginia University Institutional Review Board. The prenotification letter is included in Appendix I and the survey instrument is included in Appendix II.

The final instrument is divided into sections addressing:

- Types of OHV activity on the District, including questions about
  - the presence of OHV-related activity on the District
  - fees and permits on the District
  - perceptions of encounters with OHV users on the District
  - volunteerism among OHV users on the District
  - requests for OHV use in areas not permitting OHV use
  - requests for permits or commercial events on the District
  - presence of OHV-related vendors on or near the District
  - amount of open and closed roads and trails, including Wilderness
  - acreage on District, including Wilderness
  - OHV-related planning on the Forest and District levels
  - management issues during the past year, including issues related to safety and unmanaged recreation
- OHV user motivations and preferences, including
  - social preferences
  - activity participation preferences
  - motivations for riding OHVs
  - management preferences
- Physical and social issues arising from OHV use on the District, including
  - impacts to soil, riparian areas, vegetation, and wildlife
  - interpersonal issues
  - unmanaged recreation
  - crowding
- Management tactics used to deal with OHV-related issues on the District, including:
  - direct tactics
  - indirect tactics
  - resource hardening tactics
  - collaborative management tactics
- Demographic information

Treatment of Data

The data were analyzed in SPSS 15.0, using nonparametric methods including Mann-Whitney comparisons between independent samples and Kendall's tau-b correlation analyses. Mann-Whitney was selected as it is the most powerful non-parametric version of the t-test. The dependent variable is the level of OHV recreation opportunity provided on a Ranger District. Districts were defined as having a high level of OHV opportunities if they had a ratio of open to closed trails above the median ratio of 12.16 percent; Districts whose ratio of open to closed trails fell below the median were defined as having a low level of OHV opportunities. The independent variables are:

- Perceptions of OHV-related activity and interest,
- Perceptions of OHV users' benefits and motivations,
- Perceptions of physical impacts of OHV use,
- Perceptions of social impacts of OHV use, and
- Perceptions of managerial issues related to OHV use.

Some Districts did not report the trail mileage on their District; that information was gathered from Forest- and District-specific internet sites, when possible. Because few respondents reported the amount of roads over 50 inches wide that were open or closed to OHV use and because these data were not available from other sources, roads were not considered in the analysis.

Summary

In this chapter I discussed the methodology employed in this study. Due to ecological and social similarities specific to the Appalachian region, a census of District Rangers on National Forests in the Appalachian Mountain range was taken. Using a modified Dillman (2000) method, mail-back surveys were sent to 42 Ranger Districts on 14 National Forests. The survey instrument was developed based on Chavez and Knap (2004), and modified with input from

experts and professionals. Data were analyzed using nonparametric methods including Mann-Whitney comparisons between groups and Kendall's tau-b correlation analyses.

In the following chapter, I discuss the results of the data analysis. Twenty-seven of 29 respondents reported OHV use on their District, and 28 of 29 reported that OHV use was a forest resource management concern. Overall, managers' perceptions of OHV users' motivations and preferences tended to match OHV users' self-reports, with some differences related to social and trail preferences. Managers reported between three and 24 OHV-related issues on their Districts, with 72.4% reporting between 11 and 18 OHV-related issues. The top three OHV-related issues across Districts were soil erosion or compaction, user-created trails, and users going cross-country. Managers employed a combination of different types of tactics across Districts. Open-ended responses pointed to issues with illegal behavior causing resource damage, conflict with adjacent property holders, funding and staffing issues, and interagency conflict and communication issues.

Between groups, managers with a high level of OHV recreation opportunities were more likely to perceive OHV users' motivations and preferences in the same way that OHV users had self-reported in previous studies. There was a small to moderate positive correlation between the ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$), and were more likely to use a greater number of management tactics than users with a low level of OHV recreation opportunities ($U = 36.00$, $p < .01$). There were no significant differences in demographic characteristics between groups.

In Chapter Five I discuss the foregoing results with respect to hypothesis testing and the research questions established in Chapter One. I discuss the management implications arising from these findings, including the need for more and more varied management tactics as the

level of OHV recreation opportunity increases and the lack of decline in OHV-related illegal and unauthorized activities as OHV recreation opportunities increase. Finally, I make recommendations for future research based on these findings.

RESULTS

In Chapter One, I discussed the rising popularity of OHV recreation in the United States and the background of the 2005 travel management rule developed by the USFS. Because of the four-year time frame set to develop inventories of both authorized and unauthorized trails and establish a comprehensive travel management atlas that includes a motor vehicle use map, it is important for managers to have information about OHV recreation-related issues and management tactics. A series of hypotheses and research questions were set forth regarding the amount of OHV recreation opportunities a Ranger District offers and how that amount affects perceptions of OHV use and users; definitions, limitations, and delimitations were also discussed.

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In this chapter, I discuss the results of the data analysis. Twenty-seven of 29 respondents reported OHV use on their District, and 28 of 29 reported that OHV use was a forest resource management concern. Overall, managers' perceptions of OHV users' motivations and preferences tended to match OHV users' self-reports, with some differences related to social and trail preferences. Managers reported between three and 24 OHV-related issues on their Districts, with 72.4% reporting between 11 and 18 OHV-related issues. The top three OHV-related issues across Districts were soil erosion or compaction, user-created trails, and users going cross-country. Managers employed a combination of different types of tactics across Districts. Open-ended responses pointed to issues with illegal behavior causing resource damage, conflict with adjacent property holders, funding and staffing issues, and interagency conflict and communication issues.

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Survey Participation and Response Rates

Forty-seven instruments were mailed to the most current list of Ranger Districts available. One instrument was returned as no such address; four other Districts were reported to be consolidated with other Districts by respondents. The final total for the census, minus those five Districts, was 42. Of the 42 possible responses, 31 surveys were returned. One instrument was returned with a note stating that the survey had been completed with information about a District that was not in USFS Region 8 or 9; it was not used in the analysis, as the instrument was completed using information about a USFS Region that was outside the study area. A second instrument was a duplicate and was also not used. There were therefore 29 usable instruments out of 42 possible responses, for a response rate of 69.1 percent.

Demographics

The mean age of respondents was 49.8 years. Of the 27 respondents who reported their gender, 19 were male and 8 were female. Respondents had been in their current position for an

average of 8.2 years, and had, on average, been working for the USFS for 22.4 years. On average, respondents had had 17.3 years of education. Mann-Whitney tests between the two groups indicated that there were no significant differences in any of these characteristics between District Rangers with low levels of OHV recreation opportunities on their Districts and OHV users with high levels of OHV recreation opportunities on their Districts ($p > .05$ in all cases).

Activity and Interest

Summary of Responses

The first questions on the survey instrument asked respondents if they had OHV activity on their Forest and if they had OHV activity on their District, legal or not. Respondents were then asked if they charged fees or required permits for OHV users to ride on their Districts, and if so, how much they charged for those fees or permits. All respondents (N = 29) reported OHV activity on their Forest, and 27 (93.1%) reported OHV activity on their District. Of those 27 respondents, 51.9 percent charged fees to ride and 26.1 percent required permits to ride. While respondents who charged for fees or permits all responded with a daily charge, six (22.2%) also included an annual fee. Daily charges for fees or permits ranged from free to $10.00, with a mean price of $4.86 among sites that had a daily fee. Annual charges for fees or permits ranged from $25.00 to $50.00, with a mean charge of $32.50 for sites that offered an annual rate.

The next questions on the survey instruments dealt with the nature of personal contacts respondents had with OHV users in the past year, either through face-to face contact or through telephone calls, email, or letters. Twenty-five District Rangers (86.2%) reported having personal contact with OHV users on their Districts. Only one respondent (3.4%) rated their personal contact with those users as completely negative; 6.9 percent reported their contact as mostly negative; 24.1 percent rated that contact as neither positive nor negative; and 55.2 percent rated

their personal contacts with OHV users as mostly positive. No respondent rated their personal contact as completely positive. On a scale of 1-5 (1 = completely negative, 5 = completely positive), respondents scored their personal contact with OHV users as 3.46. Following the questions about the nature of their personal contacts with OHV users, respondents were asked if OHV users had volunteered to monitor or maintain trails on their District in the past year. In the past year, 41.4 percent of respondents (n = 25) had OHV users volunteer to monitor trails, 51.0 percent (n = 25) had OHV users volunteer to maintain trails. Ten respondents (34.5%) reported that in the past year OHV users had not volunteered to monitor or maintain trails (totals equal more than 100% due to multiple selections).

Respondents were then asked if, in the past year, they had had requests to ride OHVs on closed roads or trails that excluded motorized vehicles, and, if so, the number of requests they had received. The majority of respondents (72.4%) had received requests to ride OHVs on closed roads or trails that exclude motorized vehicles. The number of requests ranged between one and 40, with the median number of requests being 6. The respondent who reported 40 requests to ride OHVs on those trails made a note in the margin of the instrument that those requests had mostly come from individuals wanting access for oil and gas exploration or from recreational groups wanting to do maintenance on trails used in winter.

Respondents were also asked if, in the past year, they had received requests to ride OHVs in federally designated Wilderness and how many requests they had received. Only two respondents (6.9%) had received requests to ride in federally designated Wilderness in the past year; each received two requests. One respondent noted in the margins of the instrument that the requests to ride in Wilderness on that District had come from a search-and-rescue group during rescue operations. In addition, respondents were asked if they had received requests in the past

year for races, poker runs, or rallies and how many of those types of requests they had received; and whether, in the past year, they had encountered commercially advertised or sponsored OHV tours coming to their Districts without permits. Eleven respondents (37.9%) had received requests for races, poker runs, or rallies on their District in the past year; the number of requests ranged from one to 15, with 20.7 percent of respondents receiving a single request and a median number of requests of 5. Five respondents (17.2%) had encountered commercially advertised or sponsored OHV tours coming to their Districts without permits in the past year.

Following those questions, respondents were asked if they had concessionaires or nearby businesses that rented OHVs for use on their Districts, as well as the number of concessionaires or businesses on their Districts and within 50 miles. Five respondents (17.2%) had concessionaires or nearby businesses that rented OHVs for use on their District. Of those five respondents, all of them reported having a single concessionaire or nearby business renting OHVs for use on their District; two also reported having one concessionaire or business renting OHVs within 50 miles of the District.

Respondents were then asked questions about the types and mileages of roads and trails open and closed to non-highway legal OHV use on their Districts. These types included paved road over 50 inches open and closed to OHV use, unpaved road over 50 inches open and closed to OHV use, trails under 50 inches open and closed to OHV use, and trails specially designed for OHV use. Only one respondent reported having paved road open to non-highway legal OHV use on their District. Respondents (n = 19) reported having between one and 100 miles of paved road on the District that was closed to non-highway legal OHV use. Six respondents reported that they had unpaved road open to OHV use on their Districts; the mean mileage of unpaved road open to non-highway legal OHV use was 7 miles, with a range of one-half mile to 15 miles.

In their responses to questions about the types and mileage of trails open and closed to OHV use, 17 respondents reported having trails open to non-highway legal OHV use, 10 reported no trails open to non-highway legal OHV use, and two did not respond. Mean open trail length was 13.94 miles, with a range of between two and 72 miles of OHV trail opportunities. The mean mileage of trails closed to non-highway legal OHV use for all respondents, regardless of amount of open trail, was 119 miles. The mean ratio of miles of trail open to OHV use versus miles of trail closed to OHV use across respondents was 18.28 percent; the median ratio was 12.16 percent.

Along with road and trail types open and closed to OHV use, respondents were asked about the number of acres in their District overall; the amount of acreage, if any, of federally designated Wilderness in their District; and the number of miles of trail in Wilderness on their District. The mean area of the respondents' Districts was 177,637.27 acres. Twenty-one respondents (72.4%) reported having federally designated Wilderness on their Districts; mean Wilderness area was 16,830 acres. Eleven Districts with Wilderness areas on their Districts reported having no trails in their District's Wilderness area; mean trail mileage in Wilderness was 21.78 miles.

Respondents were asked if their Forest Plan included provisions for OHV trails or opportunities and if any of those opportunities were on their Districts. They were also asked the most recent year their Forest Plan had been updated. Twenty-six respondents (89.7%) indicated that their Forest Plan included provisions for OHV trails or opportunities; 18 of those 26 respondents (62.1%) had OHV trails or opportunities on their Districts. Respondents (n = 24) reported that their Forest Plans had most recently been updated between 1987 and 2006, with the majority of updates (50%) taking place in 2004. Respondents were also asked if there were OHV

trails or opportunities on non-Forest Service property abutting their District. Thirteen respondents (44.8%) reported that there were OHV trails or opportunities on non-Forest Service property abutting their District.

When asked if they considered control of OHV use to be a forest resource management concern, 28 of 29 respondents (96.6%) responded "yes." In the following question, respondents were asked if they considered the management of OHV use to be one of the top four issues on their District. Twenty-one (72.4%) considered the management of OHV use to be a top-four issue. Respondents were then asked if they had observed evidence or received reports of OHV use on closed roads and on trails that exclude motorized vehicles. A majority had observed evidence of OHV use on closed roads (89.7%) and on trails that exclude motorized vehicles (89.7%); 96.6 percent had received reports of OHV use on closed roads and 93.1 percent had received reports of OHV use on trails that exclude motorized vehicles.

Respondents were asked if they had completed surveys to show OHV use patterns, to document impacts, or to assess visitor feelings on OHV use. They were also asked if they had spoken to USFS employees on other Districts who had completed similar surveys either on their Forests or on other Forests. In the past year, nine District Rangers had completed surveys to show use patterns (6.9%; n = 25), document impacts (10.3%; n = 25), or assess visitor feelings on OHV use (10.3%; n = 25). Five (17.2%; n = 25) had spoken to USFS employees on other Districts who had completed similar surveys; three (10.3%; n = 25) had spoken to USFS employees on other Forests who had completed similar surveys.

When asked if they had seen evidence of resource damage from OHV use in the past year, 93.1% of respondents replied in the affirmative. Four (13.8%; n = 25) had personally observed OHV accidents resulting in personal injury; 75.9 percent of respondents (n = 28) had

received reports of such accidents. Slightly over one-third of respondents (34.5%; n = 26) had observed safety problems related to OHV use in the past year, and 79.3 percent (n = 28) had received reports of the same. Four (13.8%; n = 25) had observed incidents of user conflict related to OHV use, and 19 (65.5%; n = 27) had received reports of OHV-related user conflict. Twenty-one of 28 respondents (75%) reported that they had areas on their District that were suitable for OHV use.

Differences Between Groups

Data were analyzed using a combination of Mann-Whitney and Kendall's tau statistics. Managers with high levels of OHV opportunities available on their Districts, defined as managers with a ratio of open to closed trail above the overall median ratio of 12.16 percent, were more likely to charge fees to ride on their Districts ($U = 37.500$, $p < .05$), but there was no significant difference between the two groups with regard to requiring permits for OHV riders.

There was a moderate positive correlation between the level of OHV recreation opportunity a District provided and the rating a respondent gave their contact with OHV users ($\tau_{23} = .363$, $p < .05$); that is to say, as the amount of available OHV opportunity on a District increased, so did the level of positivity a respondent had toward the OHV users he or she had encountered. There was also a moderate positive correlation between the amount of available OHV opportunity a District offered and the likelihood of a respondent to report that OHV riders volunteered to monitor trails on that District ($\tau_{22} = .394$, $p < .05$) or maintain trails on that District ($\tau_{22} = .580$, $p < .01$). Respondents with a high level of OHV opportunities on their Districts were more likely to report that OHV riders had volunteered to maintain trails on their District in the past year ($U = 29.50$, $p < .05$). Respondents with a low level of OHV recreation

opportunities on their Districts were more likely to for riders on that District not to volunteer for either ($U = 17.00$, $p < .01$).

There was also a moderate positive correlation between the level of OHV recreation opportunity offered on a District and the respondent reporting OHV use being a "Top 4" issue ($\tau_{25} = .408$; $p < .05$). There was also a moderate positive correlation between the level of OHV recreation opportunity offered on a District and the respondent reporting that in the past year he or she had received reports of OHV accidents on the District ($\tau_{25} = .408$, $p < .05$).

Motivations and Preferences of OHV Users

Summary of Responses

The majority of respondents agreed with the following statements about OHV user motivations and recreation preferences (Table 3): that OHV users were less interested in management than non-OHV users (57.1%; n = 21), that OHV users preferred riding with family and friends (100%; n = 28), that OHV users were concerned about litter in areas they use (51.9%; n = 27), that OHV users ride to be in a natural environment (66.7%; n = 27), and that frequent users of an area are more likely to volunteer to help maintain OHV areas and trails (55.2%; n = 24). The majority of respondents were also in agreement that OHV users tended to be more tolerant of other user groups than vice-versa (78.3%; n = 23), that OHV users preferred to ride with clubs (65%; n = 20), that hunters who use OHVs enjoy using them because they can cover distances with less effort than hiking (100%; n = 26), that OHV users support nonmotorized recreational activities (66.7%; n = 18), that OHV users ride for stress relief (84.6%; n = 13).

Respondents also tended to agree that OHV users want support facilities near the trails they ride (81.8%; n = 22), that OHV users bring economic growth to the communities

surrounding the areas where they ride (76%; n = 25), that OHV users who use an area once or twice a year are more likely to support user fees to help manage that area (70%; n = 20), and that OHV users do not participate in other outdoor recreational activities (91.3%; n = 23). Additionally, the majority of respondents agreed that OHV users prefer to ride close to home (84%; n = 25), that people use OHVs as transportation to reach primary activities such as hunting or fishing (64%; n = 25), that OHV users ride to seek physical challenges (80.8%; n = 26), and that people with mobility impairments use OHVs to access areas they could not otherwise reach (84.6%; n = 26). Finally, the majority of respondents agreed that OHV users prefer to ride on trails that provide opportunities to view scenery (85.7%; n = 21), that hunters who use OHVs do so because they can retrieve harvested big game with less effort than packing it out on foot (96%; n = 25); and that OHV users ride to escape from civilization (73.7%; n = 19).

Table 3

Respondent Perceptions of OHV Users' Motivations and Preferences

	Mean Score (1=strongly disagree; 4=strongly agree)					
Statement	**Overall**	**N**	**High Use**	**n**	**Low Use**	**n**
OHV users prefer to ride with family and friends.	3.38	27	3.25	14	3.50	13
Hunters who use OHVs enjoy using them because they can cover greater distances with less effort than hiking.	3.18	26	3.33	13	3.00	13
Hunters who use OHVs do so because they can retrieve harvested big game with less effort than packing it out on foot.	2.96	26	3.50	13	2.42	13
People with mobility impairments use OHVs to access areas they could not otherwise reach.	2.66	27	3.00	14	2.33	13
OHV users prefer to ride close to home.	2.62	27	3.17	14	2.67	13
OHV users ride to seek physical challenges.	2.59	27	3.08	14	2.17	13
OHV recreationists bring economic growth to the communities surrounding the areas where they ride.	2.55	27	2.92	14	2.17	13
OHV users ride to be in a natural environment.	2.48	27	2.50	14	2.75	13
OHV users do not participate in other outdoor recreational activities.	2.45	27	2.83	14	2.00	13
People use OHVs as transportation to reach primary activities such as hunting or fishing.	2.39	26	2.83	13	2.25	13
OHV users tend to be more tolerant of other user groups than vice-versa.	2.38	27	2.75	14	2.08	13
OHV users who use an area frequently are more likely to volunteer to help maintain OHV areas and trails.	2.31	27	2.75	14	2.08	13
OHV users want support facilities near the trails they ride.	2.31	27	3.17	14	2.08	13
OHV users are concerned about litter in the areas they use.	2.21	27	2.58	14	2.00	13

Table 3

Respondent Perceptions of OHV Users' Motivations and Preferences

Statement	Mean Score (1=strongly disagree; 4=strongly agree) Overall	N	High Use	n	Low Use	n
OHV users are concerned about their image as responsible recreationists.	2.07	27	2.42	14	1.75	13
OHV users prefer to ride on trails that provide opportunities to view scenery.	2.07	27	2.75	14	1.75	13
OHV users are concerned about erosion on the trails they use.	1.93	27	2.25	14	1.75	13
OHV users who use an area once or twice a year are more likely to support user fees to help manage that area.	1.93	27	2.50	14	1.58	13
OHV users prefer less intensive management of the areas they use than nonmotorized users of those areas.	1.82	26	2.75	14	1.17	12
OHV users prefer to ride with clubs.	1.79	27	2.75	14	1.25	13
OHV users ride to escape from civilization.	1.79	27	2.42	14	1.50	13
OHV users support nonmotorized recreational activities.	1.69	27	2.33	14	1.00	13
OHV users prefer single-activity trails.	1.62	27	2.08	14	1.42	13
OHV users ride for stress relief.	1.32	26	1.83	13	1.25	13
OHV users like to participate in races.	1.14	27	1.67	14	.92	13
OHV users prefer multiple-activity trails with combined motorized and non-motorized uses.	1.14	27	1.42	14	1.33	13

The majority of respondents disagreed with the following 27 statements about OHV users' motivations and preferences: 73.1 percent (n = 26) disagreed that OHV users were concerned about erosion on the trails they use; 80.0 percent (n = 25) disagreed that OHV users prefer single-activity trails; 57.1 percent (n = 14) disagreed that OHV users like to participate in races; 94.4 percent (n = 18) disagreed that OHV users preferred multiple-activity trails with combined motorized and non-motorized uses; and 57.7 percent (n = 26) disagreed that OHV users were concerned about their image as responsible recreationists.

Differences Between Groups

Mann-Whitney tests were performed to see if there were differences between management perceptions of OHV users' motivations and preferences between respondents with high and low levels of OHV recreation opportunities on their Districts, where high levels were those above the median ratio of open to closed trails (12.16%) and low levels were those below

the median. Although most statements about OHV users' motivations and preferences were not significantly different ($p > .05$) between respondents with low and high levels of OHV opportunities, there were statements with which respondents with a high level of OHV recreation opportunity on their District had a greater tendency, on average, to agree (Table 4). Group means are reported in Table 3.

Table 4

Differences in Perceptions of OHV User Motivations and Preferences Based on Level of OHV Recreation Opportunities Provided

Statement	Mann-Whitney U
OHV users prefer less intensive management of the areas they use than nonmotorized users of those areas.	29.500**
OHV users prefer to ride with family and friends.	91.000
OHV users are concerned about litter in areas they use.	55.000
OHV users ride to be in a natural environment.	81.000
OHV users who use an area frequently are more likely to volunteer to help maintain OHV areas and trails	61.000
OHV users are concerned about erosion on the trails they use.	74.500
OHV users prefer single-activity trails.	52.000
OHV users tend to be more tolerant of other user groups than vice-versa.	61.500
OHV users prefer to ride with clubs	39.500*
Hunters who use OHVs enjoy using them because they can cover distances with less effort than hiking.	74.000
OHV users like to participate in races.	68.500
OHV users support nonmotorized recreational activities.	36.500**
OHV users ride for stress relief.	70.000
OHV users want support facilities near the trails they ride.	48.000*
OHV recreationists bring economic growth to the communities surrounding the areas where they ride.	62.500
OHV users who use an area once or twice a year are more likely to support user fees to help manage that area.	67.000
OHV users do not participate in other outdoor activities.	71.500
OHV users prefer to ride in areas close to their homes.	83.000
OHV users prefer multiple-activity trails with combined motorized and nonmotorized uses.	90.000
OHV users are concerned about their image as responsible recreationists.	48.500*
People use OHVs as transportation to reach primary activities such as hunting or fishing.	42.500*
OHV users ride to seek physical challenges.	47.000*
People with mobility impairments use OHVs to access areas they could not otherwise reach.	51.000
OHV users prefer to ride on trails that provide opportunities to view scenery.	59.500
Hunters who use OHVs do so because they can retrieve harvested big game with less effort than packing it out on foot.	51.000
OHV users ride to escape from civilization.	63.500

*Significant at p<.05
** Significant at p<.01

Issues Related to OHV Use

Summary of Responses

When asked to select OHV-related issues they had either observed or received reports of on their Districts, the following issues, in decreasing frequency, were reported (Table 5). All respondents reported soil erosion or compaction as an issue; respondents also unanimously reported user-created trails were an issue. All but one respondent (96.6%) reported OHV users going cross-country as an issue; 82.8 percent of respondents reported vegetation damage, litter or trash at trail access points, and litter or trash on roads or trails. OHV users going too fast was reported as an issue by 79.3 percent of respondents; 75.9 percent of respondents also reported lack of safety wear as an issue.

Conflict with hikers or backpackers, alcohol or drug use, and excessive noise were reported as issues by 69.0 percent of respondents; 62.1 percent were aware of inexperienced drivers in difficult terrain. Conflicts with people on horseback on trails as well as between hunters using OHVs and hunters not using OHVs were reported by 48.3 percent of respondents. The next frequent issue reported by District Rangers was crowding: 41.4 percent of respondents reported that crowding at trail access points was an issue. An equal percentage of respondents (37.9%) reported dangerous routes and graffiti or other vandalism as issues. Destruction or defacing of historic resources was reported by 34.5 percent of respondents; 31.0 percent were aware of issues of conflicts with mountain bikers and of harassment of wildlife. For 27.6 percent of respondents crowding on roads or trails was an issue; 20.7 percent reported lack of spark arrestors on OHVs as an issue. Dangerous drop-offs and mines were an issue for 17.2 percent of

respondents, 13.8 percent reported injury to or death or individual members of a wildlife species, and 6.9 percent reported reduction in size of habitat.

Table 5

Frequencies of Reports of Physical and Social Issues

Issue	Respondents Reporting Issue			Type of Issue
	Overall (N=29)	**High Use** (n=15)	**Low Use** (n=14)	
Soil erosion or compaction	29	15	14	Physical
User-created trails	29	15	14	Social/physical
OHV users going off established roads or trails (cross-country)	28	15	14	Social/physical
Litter or trash at trail access points	24	14	10	Physical
Vegetation damage	24	14	10	Physical
Litter or trash on roads or trails	24	13	11	Physical
OHV users going too fast	23	12	11	Social
Lack of safety wear	22	15	7	Social
Alcohol or drug use	20	9	11	Social
Conflict with hikers or backpackers	20	10	10	Social
Excessive noise	19	11	8	Physical/social
Inexperienced drivers in difficult terrain	18	13	5	Social
Conflicts with people on horseback on trails	14	7	7	Social
Conflicts between hunters using OHVs and hunters not using OHVs	14	8	6	Social
Crowding at trail access points	12	9	3	Social
Dangerous routes	11	6	5	Social
Graffiti or other vandalism	11	7	4	Physical
Destruction or defacing of historic resources	10	7	3	Physical
Harassment of wildlife	9	5	4	Physical
Conflicts with mountain bikers on trails	9	7	2	Social
Crowding on roads or trails	8	6	2	Social
Lack of spark arrestors on OHVs	6	4	2	Social
Dangerous drop-offs, mines, etc.	5	3	2	Physical
Injury to or death of individual members of a wildlife species	4	3	1	Physical
Reduction in size of habitat	2	2	0	Physical

Respondents each reported between three and 24 OHV-related issues, with the majority (72.4%) reporting between 11 and 18 issues. Other issues reported by respondents included illegal use of OHVs, unspecified resource damage, the cost of trail maintenance, litter or trash in unspecified locations, unspecified user conflict, and conflicts with adjacent property owners. Respondents were asked to list what they considered to be the top three issues related to OHV use on their District. The frequency of each top-three response was tabulated, and the total scores were weighted. Issues that respondents ranked as number one were scored three points, number-

two issues received a score of two points, and number-three issues were scored one point. The final weighted list of top-three issues generated the following overall top issues list (Table 6).

Table 6

Top Issues as Reported by Respondents

Issue	Weighted Score
Soil erosion or compaction	44
User-created trails	41
OHV users going off established roads or trails (cross-country)	25
Vegetation damage	9
Litter or trash, location not specified	8
Illegal use	5
Resource damage, type not specified	5
Conflict with hikers or backpackers on trails	4
Crowding on roads or trails	3
Prohibitive cost of trail maintenance	3
Litter or trash on roads or trails	3
Conflicts with adjacent property holders	2
OHV users going too fast	2
User conflict, activities not specified	2
Harassment of wildlife	1
Conflicts with equestrians on roads or trails	1
Conflicts between hunters using OHVs and hunters not using OHVs	1

Differences Between Groups

Mann-Whitney tests comparing responses from respondents with high and low levels of OHV recreation opportunities on their Districts, that is, respondents with ratios of open to closed trails above and below the median ratio of 12.16 percent respectively, indicated that there were significant differences in reporting the following issues and impacts: lack of safety wear (U = 42.00, $p < .05$), and inexperienced drivers in difficult terrain ($U = 34.50$, $p < .01$). There were no significant differences between the total numbers of physical or social impacts between groups, nor in the types of issues respondents were likely to report as a top-three issue. There was a small to moderate positive correlation between the ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$). That is, Districts with a greater ratio of open to closed trails tend to report more issues. See Table 5 for the exact numbers of responses to each question for each group.

Management Tactics

Summary of Responses

Respondents were asked what management tactics they used to manage their top three OHV-related issues on their Districts (Table 7). The most commonly used management tactics were law enforcement (96.6%), bulletin boards (75.9%), closing or limiting use (75.9%), posters or signs (72.4%), and personal contacts (65.5%). More than half of respondents used maps (62.1%), drain dips (58.6%), brochures (55.2%), user ethics or etiquette (51.7%), trail descriptions (51.7%), and seasonal closures (51.7%) to manage their top three OHV-related issues.

Between one-third and one-half of respondents reported that they managed their top three OHV-related issues with trail use recommendations (48.3%), staging areas with parking facilities (41.4%), maintaining trails with local groups and volunteers (41.4%), organized events to do trail maintenance (37.9%), relocating or redesignating trials (37.9%), artificial tread (34.5%), or OHV club meetings (34.5%).

Fewer than a third of respondents managed their top three OHV-related issues by specifying a maximum grade (31.0%); local newspaper articles (27.6%); volunteer patrols (27.6%); meetings with state OHV groups (27.6%), separating trails (24.1%), public service announcements (20.7%); designated campsites (20.7%); public meetings (20.7%); Adopt-a-Trail programs (20.7%); private sector or industry involvement (20.7%); non-issuance of guide, outfitter, or event permits (13.8%); or partnerships with OHV shops (13.8%). Additionally, fewer than a third of respondents employed the following management tactics to deal with their top three OHV-related issues: water bars (13.8%), separate user groups (13.8%), lengthening trails to disperse riders (10.3%), opening more trails (6.9%), specifying a minimum grade

(3.4%), or holding workshops (3.4%). No respondents managed their top three OHV-related issues by having OHV users ride in dispersed patterns or by alternating access times between different user groups.

Table 7

Frequency of Use of Management Tactics

	Respondents Using Tactic		
Management Tactic	**Overall** (N=29)	**High Use** (n=15)	**Low Use** (n=14)
Law enforcement	28	14	14
Bulletin boards	22	14	8
Close or limit use	22	12	10
Posters or signs	21	14	7
Personal contacts	19	13	6
Maps	18	13	5
Drain dips	17	13	4
Brochures	16	12	4
User ethics/etiquette	15	10	5
Trail descriptions	15	10	5
Seasonal closures	15	12	3
Trail use recommendations	14	11	3
Staging areas with parking facilities	12	9	3
Maintain trail with local groups and volunteers	12	9	3
Organized events to do trail maintenance	11	8	3
Relocate/redesignate trails	11	9	2
Artificial tread (e.g., geofabric with sand and gravel, concrete blocks)	10	8	2
Local OHV club meetings	10	7	3
Specify maximum grade	9	7	2
Local newspaper articles	8	6	2
Meetings with state OHV groups	8	7	1
Volunteer patrols	8	6	2
Separate trails	7	4	3
Public service announcements	6	5	1
Designated campsites	6	5	1
Public meetings	6	4	2
Adopt-a-Trail programs	6	5	1
Private sector/industry involvement (e.g., partnerships)	6	4	2
Provisions for special use permits	5	4	1
Non-issuance of outfitter, guide, or event permits	4	2	2
Partnerships with OHV shops	4	3	1
Water bars	4	2	2
Separate user groups	4	2	2
Lengthen trails to disperse riders	3	2	1
Open more trails	2	2	0
Specify minimum grade	1	1	0
Workshops	1	1	0
Users ride in dispersed patterns	0	0	0
Alternate access times between different user groups	0	0	0

Differences Between Groups

Mann-Whitney tests comparing responses from respondents with high and low levels of OHV recreation opportunities on their Districts, where respondents with high levels of use were those with ratios of open to closed trails above the median ratio of 12.16 percent and those with low levels of use were those with ratios of open to closed trails below the median, indicated that there were significant differences in the use of several management tactics to manage the top-three issues reported by District Rangers. District Rangers with high levels of OHV recreational opportunities on their Districts were more likely to report using drain dips ($U = 34.50$, $p < .01$), seasonal closures ($U = 34.00$, $p < .01$), and personal contacts ($U = 48.50$, $p < .05$). They were also more likely to report relocating or redesignating trails ($U = 46.50$, $p < .05$), using posters or signs ($U = 42.00$, p<.05), providing maps ($U = 41.50$, $p < .05$) and brochures ($U = 41.00$, $p < .05$), and making trail use recommendations ($U = 40.50$, $p < .05$). Respondents with a high level of OHV recreation opportunities were more likely to use a greater number of management tactics than users with a low level of OHV recreation opportunities ($U = 36.00$, $p < .01$), perhaps due to the larger number of issues they face (Table 8).

Table 8

Differences in Uses of Management Tactics

Tactic	Mann-Whitney *U*
Posters or signs	42.00*
Brochures	41.00*
User ethics and etiquette	61.00
Maps	41.50*
Public service announcements	65.50
Local newspaper articles	66.00
Bulletin boards	55.50
Trail descriptions	61.00
Trail use recommendations	40.50*
Close or limit use	82.50
Non-issuance of outfitter, guide, or event permits	90.00
Organized events to do trail maintenance	60.00
Relocate or designate OHV trails	46.50*
Seasonal closures	34.00**
Provisions for special use permits	72.00
Law enforcement	84.50

Table 8

Differences in Uses of Management Tactics

Tactic	Mann-Whitney *U*
Users ride in dispersed patterns	91.00
Separate trails	86.00
Separate user groups	90.00
Alternate access times between different user groups	91.00
Specify a maximum grade on trails	59.50
Specify a minimum grade on trails	84.50
Drain dips (reversal of grade)	34.50**
Flexible water bars	90.00
Artificial tread (e.g., geofabric with sand and gravel, concrete blocks)	53.00
Lengthen trails to disperse riders	85.00
Staging areas with parking facilities	53.50
Designated campsites	65.50
Personal contacts	48.50*
Local OHV club meetings	66.50
Meetings with state OHV groups	52.50
Adopt-a-trail programs	65.50
Public meetings	79.00
Volunteer patrols	66.00
Partnerships with OHV shops	78.50
Workshops	84.50
Private sector/industry involvement (e.g., partnerships)	79.00
Maintain trail with local groups and volunteers	53.50
Open more trails	78.00
Total number of tactics used	36.00**

**Significant at p < .05*
***Significant at p < .01*

Responses to Open-ended Questions

Summary

There were a total of 108 handwritten responses to all questions, including five unsolicited responses to closed-ended questions. Of the 103 responses to open-ended questions, 27 of the 28 respondents who agreed that OHV use was a forest resource management concern gave reasons why; the one respondent who disagreed with that statement did not state why not. All respondents who agreed that OHV use was a forest resource management concern had seen evidence of resource damage from OHV use; 25 provided descriptions of the damage they had seen, including the causes of that damage. All responses to open-ended questions are provided in

Appendix IV; the following selected responses represent the range of responses across the level of trail opportunities available in the study area.

Respondents were asked to explain why they did or did not have areas on their District that were suitable for OHV use; 24 respondents provided explanations about suitability. Seven of the respondents had stated that they did not have areas suitable for OHV use on their District; the remaining 17 stated that they did have suitable areas for OHV use on their District. All of those respondents had reported that there were opportunities for OHV recreation on their District. Eleven respondents listed additional OHV-related issues in the Issues section of the instrument, and five listed additional management tactics in the Tactics section. Nine respondents included additional commentary in the question requesting additional comments or concerns related to OHV use on their Districts.

The number of responses were split almost equally between respondents with high levels of OHV recreation opportunities (50.5%) and low levels of OHV recreation opportunities (49.5%) on their Districts. These responses were similar in content between groups and across categories. When those responses were analyzed for content, it was found that they fell into the physical, social, and managerial ROS settings that were also the framework for the closed-ended portions of the survey instrument; that is, there were no unexpected categories that occurred outside of the ROS framework. Examples of comments are provided for each ROS setting.

Physical Impacts

Respondents reported the following physical impacts related to OHV use on their Districts: erosion and other soil damage; unauthorized trails; riparian damage; vegetation damage; and impacts on wildlife. Examples of these comments include:

Erosion and other soil damage

Soil erosion resulting from OHV use off trails or designated areas (Respondent 15, low level of OHV recreation opportunities).

The heavy use on designated trails needs constant maintenance to avoid soil erosion. The illegal riding in the forest creates more soil erosion than we can repair with existing funds (Respondent 46, high level of OHV recreation opportunities).

Unauthorized trails

Probably 90% of the OHV use on the district is illegal. It is a major problem w/user developed trails everywhere. There is also significant illegal OHV use in the wilderness (Respondent 13, low level of OHV recreation opportunities; emphasis in original).

Illegal riding w/trail closed; riding off trail, on closed roads, and rider use made trails (Respondent 18, high level of OHV recreation opportunities).

Riparian damage

One area of district suffered serious riparian damage from years of use (Respondent 14, low level of OHV recreation opportunities).

Wetlands & ponds being used for mudding, streams & stream banks being degraded (Respondent 27, high level of OHV recreation opportunities).

Vegetation damage

Illegal, user created trails that damage vegetation and cross small streams (Respondent 11, low level of OHV recreation opportunities).

Native vegetation damage, seeded logging roads torn up (Respondent 5, high level of OHV recreation opportunities).

Impacts on wildlife

> Unauthorized use/illegal use is a massive problem & is growing causing erosion & negative impacts to plant/wildlife species (Respondent 34, low level of OHV recreation opportunities).
>
> Impacts on water quality and aquatic T&E [threatened and endangered] species (Respondent 16, high level of OHV recreation opportunities).

It is interesting to note that many of the open-ended responses related to physical impacts could also be categorized in the "social issues" category, as the majority of the impacts respondents described occurred as a result of specific user behavior (illegal or unauthorized use).

Social Issues

The social issues respondents reported included issues with adjacent property holders, uncontrolled use, illegal activities, and user conflict. Examples of these comments include:

Issues with adjacent property holders

> Primary source of illegal OHVs is from adjacent pvt. land owned by people who have OHVs and ride off of their land on to NF. This creates hundreds of origins of OHVs. Rural neighborhood (interface) create user developed trails on the adjacent NF (Respondent 13, low level of OHV recreation opportunities).
>
> Unmanaged OHV use has resulted in widespread resource damage on National Forest System lands and in some cases on adjoining private lands (Respondent 16, high level of OHV recreation opportunities).

Uncontrolled use

> Lots of use out of the back yard of neighbors. In some cases use has developed networks of unauthorized roads (Respondent 26, low level of OHV recreation opportunities).

> Unauthorized use continues to be a problem the further you are from the authorized trail system (Respondent 36, high level of OHV recreation opportunities).

Illegal activities

> Arson by OHV operators. Illegal drug manufacturing by accessing growing areas on OHVs (Respondent 14, low level of OHV recreation opportunities).
>
> Resource damage. Other associated illegal activity (poaching etc) (Respondent 8, high level of OHV recreation opportunities).

User conflict

> Conflicts among OHV groups – family groups vs. guys drinking beer & riding (Respondent 26, low level of OHV recreation opportunities).
>
> Some users have a blatant disregard for rules, and a few have created additional problems by confronting law enforcement, adjacent property owners, and other users (Respondent 27, high level of OHV recreation opportunities).

Most of these responses, regardless of the subcategory listed above, fall under a greater, overall, category of law enforcement issues and illegal behavior as the catalyst for the social issues the respondents described, as well as for the physical impacts in the previous section.

Managerial Issues and Management Tactics

When they were asked to list additional management tactics for their top three OHV-related issues, four respondents listed additional tactics and one cited staffing and budget issues as a limitation to implementing additional tactics. Three respondents listed a single additional tactic, and one respondent listed four. The additional tactics, listed here in their entirety, were as follows:

> Special adaptations and devices to make roads & trails inaccessible to OHVs (Respondent 23, low level of OHV recreation opportunities).
>
> Close and obliterate illegal trails. User notes on the back of trail permits. User notes posted in Spanish. Make attractive displays on bulletin boards to draw in riders/readers (Respondent 46, high level of OHV recreation opportunities).
>
> Apply for Fed Highway grants (TEA-21) to get money to maintain our designated OHV trail (Respondent 13, low level of OHV recreation opportunities).
>
> Internet web sites (Respondent 16, high level of OHV recreation opportunities).

Although it was not specifically solicited in the survey instrument, some managers included information about challenges and constraints they experienced managing OHV recreation on their Districts. The managerial issues respondents reported in the open-ended responses were related to funding and staffing issues, site design issues, and interagency issues. Examples of these responses include:

Funding and staffing

> We could really use funding geared to more law enforcement on this subject, and for installing better closure devices on roads & trails (Respondent 23, low level of OHV recreation opportunities).
>
> It consumes a great deal of my time & that of my staff. We get a lot of complaints about illegal OHV use (Respondent 24, high level of OHV recreation opportunities).

Site design

> Trailers and the vehicle turning the trailer don't fit into our typical campsite, their vehicle & trailer are too long. OHV users repair their OHVs in campgrounds and spill oil and other mechanical fluids. OHV users tend to camp in large groups

which discourages other campers from using the same areas (Respondent 11, low level of OHV recreation opportunities).

Not enough trails to disperse riders (Respondent 46, high level of OHV recreation opportunities).

Interagency issues

County has randomly and w/o consultation with FS designated some county roads as OHV routes. This causes spillover use on NF lands. Also lots of unmanaged use throughout district (Respondent 14, low level of OHV recreation opportunities).

I would like to see the state open more of their lands to OHV use, need private property owners to get more involved by developing camping/trails on private land (Respondent 37, high level of OHV recreation opportunities).

Responses in this category were generally confined to specifically managerial issues; several of the managerial issues, however, also encompassed physical and social issues, as with Respondent 11 above.

Outlier Responses

All but two responses from managers were consistent across physical, social, and managerial settings as well as between groups with high and low levels of OHV recreation activities. Two responses, however, differed in tone and content from the others. The first response was from a District Ranger with a high level of OHV opportunities who discussed the quality of volunteerism on that District:

We have an excellent working relationship with our local OHV club. They provide the bulk of the trail & trailhead maintenance. Without their help the

> facility would either have to be closed or change so much it would probably deter use. (Respondent 36, high level of OHV opportunities; emphasis in original)

The second response that differed substantively from the other open-ended responses was from a District Ranger with a high level of OHV opportunities who discussed social issues within the greater framework of local cultural issues. While the content of the portion of the response excerpted below was not different in terms of its mentioning the existence of such issues, the context of the response provided an insight into the cultural basis of OHV-related issues on that particular Ranger District:

> "I have a birth right to ride anywhere I want, when I want." ATV's are used in some communities as a form of local transportation. (Respondent 16, high level of OHV opportunities)

Hypothesis Testing

There are few studies that address management of OHV or other types of in general; while there are some OHV user profiles with varying levels of detail available for states in the Appalachian Range (Fly et al., 2002; Hatfield-McCoy Trails, 2005), the only known studies dealing specifically with management perceptions of issues and management tactics are Chavez's and Knap's 2004 and 2006 studies of managers in California, as well as a similar study of mountain biking-related issues and management tactics by Chavez (1996), on which the Chavez and Knap OHV management studies were based (Chavez & Knap, 2004).

While Chavez's and Knap's 2004 study was the basis for the survey instrument in this study, there are no current studies addressing the differences between different levels of OHV recreation opportunities and the issues and tactics those differing levels of opportunities may or may not present or require. There are no known studies addressing the differences of perceptions

of motivations and preferences of recreational site users of any type between resource managers and the users themselves. Similarly, because there have been so few studies related to management perceptions of other types of recreation, directional hypotheses were not developed for this study. To avoid introducing personal biases or assumptions into this study, I chose to test the following null hypotheses.

H_{0a}: There is no difference in perceptions of OHV use on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

This question was tested for each of the 43 items examined in questions 1 through 25 of the questionnaire. The null hypothesis was retained for 40 items and rejected for three. District Rangers whose Districts provided high levels of OHV recreation opportunities reported more volunteerism from OHV users ($U = 29.50$, $p < .05$). They also tended to require fees for OHV use more frequently than Districts with low levels of OHV use ($U = 37.50$, $p < .05$). District Rangers whose Districts provided low levels of OHV recreation opportunities were more likely to report that OHV users did not volunteer to monitor or maintain trails on their Districts ($U = 17.00$, $p < .01$). Since some of the District Rangers reporting low levels of OHV recreation opportunities on their Districts had no trails open to OHV use, it follows that levels of OHV users' volunteerism would also be low compared to Districts with high levels of OHV opportunities. While decisions to charge recreation fees on a District are not activity-specific, maintenance costs for motorized trails tend to be higher than for non-motorized trails (Meyer, 2002), which may increase the likelihood for the implementation of a fee structure in order to deal with the personnel increases and other costs involved in maintaining OHV trails.

There was a moderate positive correlation between the level of OHV recreation opportunity a District provided and the rating a respondent gave their contact with OHV users

($\tau_{23} = .363$, $p < .05$); that is to say, as the amount of available OHV opportunity on a District increased, so did the level of positivity a respondent had toward the OHV users he or she had encountered. There was also a moderate positive correlation between the amount of available OHV opportunity a District offered and the likelihood of a respondent to report that OHV users volunteered to monitor trails on that District ($\tau_{22} = .394$, $p < .05$) or to maintain trails on that District ($\tau_{22} = .580$, $p < .01$). These correlations may account for the increasing level of positivity of District Rangers toward their encounters with OHV users on their Districts as the level of OHV recreational opportunity increased.

H_{0b}: There is no difference in perceptions of OHV users' motivations and preferences on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

This question was tested for each of the 26 items examined in questions 26 through 51 of the questionnaire. The null hypothesis was retained for 19 of 27 cases. District Rangers with high levels of OHV recreation opportunities were more likely to agree with seven statements about OHV users' motivations and preferences. These responses coincided with OHV users' self-reports about their recreational motivations and preferences. Since District Rangers with high levels of OHV recreation on their Districts were more likely to describe personal encounters with OHV users as positive ($\tau_{23} = .363$, $p < .05$) and because they have likely worked directly with the OHV users who volunteer on their Districts, it is possible that their levels of agreement with these statements are based on their personal interactions with those users and the personal impressions those users have made on the District Rangers with whom they have interacted. Since District Rangers with high levels of OHV recreation opportunities were more likely to agree that OHV users prefer to ride with clubs (Chavez & Schuett, 2005; Schuett & Ostergren,

2003), it is also possible that they have had more direct encounters with OHV club members riding on their Districts than District Rangers with low levels of OHV recreation opportunities.

H_{0c}: There is no difference in perceptions of physical impacts of OHV use on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

The null hypothesis was retained for all cases. While there was a small to moderate positive correlation between the ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$), there were no significant differences in the physical impacts reported between these two groups, either individually or overall, nor were there significant differences between groups in the top-three impacts reported by respondents. It is important to note, however, that respondents in this study were not asked about the amounts of OHV-related impacts on their Districts, but about observations and reports of impacts on their Districts. Further research is necessary to determine if there are differences in the degree and extent of physical impacts relative to the level of OHV recreation opportunities a Ranger District offers.

H_{0d}: There is no difference in perceptions of social impacts of OHV use on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

Out of the 12 social impacts selected or listed by respondents, two were found to be significantly different between groups; the null hypothesis was retained for the other 10. District Rangers with high levels of OHV recreation opportunities were more likely to report the following two social impacts on their Districts: lack of safety wear ($U = 42.00$, $p < .05$), and inexperienced drivers in difficult terrain ($U = 34.50$, $p < .01$). There were no other significant differences between groups, and no significant difference found between the total number of social impacts reported between groups. The fact that District Rangers with high levels of OHV

activity on their Districts were more likely to report lack of safety wear and inexperienced drivers in difficult terrain as social issues may be a function of the numbers of OHV users who recreate on their Districts. Further research is necessary to determine if this is the case.

H_{0e}: There is no difference in preferred management tactics related to OHV use on Appalachian National Forests between District Rangers with low and high levels of OHV recreation opportunities on their Districts.

Overall, respondents selected 37 of the 39 listed management tactics to deal with the top-three OHV-related issues on their Districts. Of those 37 issues, the null hypothesis was retained for 27 individual cases and rejected for 10. District Rangers with high levels of OHV recreational opportunities on their Districts were more likely to use a variety of indirect management tactics (Chavez & Knap 2004, 2006; Manning, 1999), including using posters or signs ($U = 42.00$, $p < .05$), providing maps ($U = 41.50$, $p < .05$) and brochures ($U = 41.00$, $p < .05$), and making trail use recommendations($U = 40.50$, $p < .05$). They were also more likely to harden the resource (Chavez & Knap, 2004, 2006; Manning, 1999) using drain dips ($U = 34.50$, $p < .01$) and manage directly (Chavez & Knap, 2004, 2006; Manning, 1999) through seasonal closures ($U = 34.00$, $p < .01$) and relocating or redesignating trails ($U = 46.50$, $p < .05$). If District Rangers had high levels of OHV recreation opportunities on their Districts, they were also more likely to build bridges with OHV recreationists (Chavez, 1996; Chavez & Knap 2004, 2006) by making personal contacts ($U = 48.50$, $p < .05$).

Respondents with a high level of OHV recreation opportunities were more likely to use a greater number of management tactics than users with a low level of OHV recreation opportunities ($U = 36.00$, $p < .01$). This hypothesis was the only one tested where a statistically significant difference between groups was found for all items examined.

Summary

In this chapter I discussed the results of the analysis. Twenty-nine of 42 possible responses were received, for a final response rate of 69.1%. Twenty-seven of 29 respondents reported OHV use on their District, and 28 of 29 reported that OHV use was a forest resource management concern. Overall, managers' perceptions of OHV users' motivations and preferences tended to match OHV users' self-reports, with some differences related to social and trail preferences. Managers reported between three and 24 OHV-related issues on their Districts, with 72.4% reporting between 11 and 18 OHV-related issues. The top three OHV-related issues across Districts were soil erosion or compaction, user-created trails, and users going cross-country. Managers employed a combination of different types of tactics across Districts. Open-ended responses pointed to issues with illegal behavior causing resource damage, conflict with adjacent property holders, funding and staffing issues, and interagency conflict and communication issues.

Between groups, managers with a high level of OHV recreation opportunities were more likely to perceive OHV users' motivations and preferences in the same way that OHV users had self-reported in previous studies. There was a small to moderate positive correlation between the ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$), and were more likely to use a greater number of management tactics than users with a low level of OHV recreation opportunities ($U = 36.00$, $p < .01$). There were no significant differences in demographic characteristics between groups.

In the following chapter I discuss the foregoing results with respect to the research questions established in Chapter One. I discuss the management implications arising from these findings, including the need for more and more varied management tactics as the level of OHV recreation opportunity increases and the lack of decline in OHV-related illegal and unauthorized

activities as OHV recreation opportunities increase. Finally, I make recommendations for future research based on these findings.

DISCUSSION

In Chapter One, I discussed the rising popularity of OHV recreation in the United States and the background of the 2005 travel management rule developed by the USFS. Because of the four-year time frame set to develop inventories of both authorized and unauthorized trails and establish a comprehensive travel management atlas that includes a motor vehicle use map, it is important for managers to have information about OHV recreation-related issues and management tactics. A series of hypotheses and research questions were set forth regarding the amount of OHV recreation opportunities a Ranger District offers and how that amount affects perceptions of OHV use and users; definitions, limitations, and delimitations were also discussed.

In Chapter Two, I provided a detailed explanation of the conceptual framework through a review of the literature. This study is based on 2004 and 2006 studies by Chavez and Knap, in which the authors surveyed District Rangers on National Forests in California about OHV-use-related issues and management tactics, based on the concerns expressed by USFS Chief Bosworth (2003) about unmanaged recreation. In the literature review I discussed the framework developed in the 2004 study and used in the 2006 follow-up study. I organized the components thereof according to the Recreation Opportunity Spectrum. I examined the following topics: physical aspects of OHV recreation, including physical impacts to soils, trails, and riparian areas; as well as noise and other impacts on wildlife; social aspects of OHV recreation, including OHV recreationists and their motivations and preferences, and recreation conflict related to motorized recreation; and managerial aspects of OHV recreation including management tactics commonly used by resource managers.

In Chapter Three, I discussed the methodology employed for the study. This study was a census of all District Rangers whose National Forests contained the Appalachian Mountain range, as delineated by the ARC (2002). Data were collected using a modified Dillman (2000) method and mail-back surveys. The survey instrument was based on Chavez and Knap (2004) and modified with input from a variety of academic experts on OHV user and USFS management professionals working in various positions and regions. Twenty-nine of 42 possible responses were received, for a final response rate of 69.1%. Due to the small sample size, nonparametric methods were used to analyze the data, including Mann-Whitney and Kendall's tau.

In Chapter Four, I discussed the results of the data analysis. Twenty-seven of 29 respondents reported OHV use on their District, and 28 of 29 reported that OHV use was a forest resource management concern. Overall, managers' perceptions of OHV users' motivations and preferences tended to match OHV users' self-reports, with some differences related to social and trail preferences. Managers reported between three and 24 OHV-related issues on their Districts, with 72.4% reporting between 11 and 18 OHV-related issues. The top three OHV-related issues across Districts were soil erosion or compaction, user-created trails, and users going cross-country. Managers employed a combination of different types of tactics across Districts. Open-ended responses pointed to issues with illegal behavior causing resource damage, conflict with adjacent property holders, funding and staffing issues, and interagency conflict and communication issues.

Between groups, managers with a high level of OHV recreation opportunities were more likely to perceive OHV users' motivations and preferences in the same way that OHV users had self-reported in previous studies. There was a small to moderate positive correlation between the

ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$), and were more likely to use a greater number of management tactics than users with a low level of OHV recreation opportunities ($U = 36.00$, $p < .01$). There were no significant differences in demographic characteristics between groups.

In this chapter I discuss the foregoing results with respect to hypothesis testing and the research questions established in Chapter One. I discuss the management implications arising from these findings, including the need for more and more varied management tactics as the level of OHV recreation opportunity increases and the lack of decline in OHV-related illegal and unauthorized activities as OHV recreation opportunities increase. Finally, I make recommendations for future research based on these findings.

Research Questions

1. How do District Rangers on Appalachian National Forests perceive OHV use on their Districts?

Of the 29 respondents to this survey, 93.0 percent had some sort of OHV activity on their District. Most respondents had received requests to ride in areas that were off-limits to OHVs, like closed roads or trails, or federally designated Wilderness. Eleven (37.9%) respondents had received requests for races, poker runs, or rallies. The majority of respondents did not have vendors renting OHVs to ride on their District, either on the District itself or within fifty miles of their District.

Almost half of respondents (44.8%) had adjacent, non-NFS property to their District where OHV opportunities were provided. Twenty-six of twenty-nine (89.7%) had Forest Plans that provided OHV recreational opportunities, versus all but one manager in the California study. The earlier study included only managers of areas with OHV recreation opportunities, whereas this study includes managers of areas both with and without OHV recreation opportunities. In

Appalachia, 62.1 percent of respondents had provisions for opportunities on their District in that Forest Plan.

Twenty-eight of 29 (96.6%) thought control of OHV use was a forest resource management concern, as compared to 92 percent of District Rangers in California in 2004 and 91 percent in 2006. Twenty-one of 29 (72.4%), reported that uncontrolled OHV use was a Top 4 issue on their District, in keeping with former USFS Chief Bosworth's 2003 assertion that uncontrolled recreation is one of the four major threats against the health of America's National Forests. Respondents reported OHV use occurring on roads or trails closed to non-highway legal OHV use — 89.7 percent of respondents had directly observed occurrences of this activity; 96.6 percent had received reports of OHV activity on closed roads, and 93.1 percent had received reports of the same activity on closed trails. This level of reporting is nearly identical to the California studies, where 97 percent had observed or received reports of OHV activity on closed roads or trails that exclude motorized vehicles in 2004 and 91 percent had observed the same behavior in 2006 (Chavez & Knap, 2004, 2006). Additionally, 93.1 percent of respondents in Appalachia had seen evidence of OHV-related resource damage on their Districts. Safety issues, accidents, and user conflict were reported by a majority of respondents, either from personal observations or from reports received from others.

Even so, most respondents reported that they had areas suitable for OHV use (75%), although in open-ended responses, many described "suitable areas" in terms like, "there are already established trails" as opposed to providing descriptions of resource suitability or capability for OHV opportunities. Ten respondents gave reasons why their area was suitable in terms of the resource, eight stated that they already had trails, and six gave reasons why areas were not suitable; five of the six respondents who did so did not offer OHV recreational

opportunities on their Districts. Most of the respondents who described the suitability of an area in their District for OHV use in resource-related terms described "sacrifice areas" or areas that were less prone to erosion problems; most of the respondents whose Districts did not provide OHV recreation opportunities either had nowhere to put trails, inappropriate soils, or a forest plan that did not permit OHV use.

Where 47 percent of the managers surveyed in the 2004 Chavez and Knap study and 49 percent in the 2006 study had completed surveys about OHV use in the past year, few District Rangers in this study stated that they had performed similar surveys; it is possible, then, that few District Rangers had contacted District Rangers on either their Forest or other Forests as a function of few surveys being performed overall. The fact that few surveys were being performed on these Districts points to the paucity of available OHV-related literature in general, and may indicate that information is not being shared as well as it could be. Clearly if no data are being collected, there remains little to reference.

2. How do District Rangers on Appalachian National Forests perceive OHV users' motivations and preferences on their Districts?

Twenty-five of 29 respondents indicated that they had personal contact with OHV users on their district and over half of those 25 described their encounters with OHV users as mostly positive. About a third of respondents (34.5%) had not had OHV users volunteer to monitor or maintain trails in the past year; the majority had had OHV users either volunteer to monitor (41.4%) or maintain trails (51%). A respondent with high levels of OHV recreation opportunities made it clear that volunteers were the reason for that riding area's success: "We have an excellent working relationship with our local OHV club. They provide the bulk of the trail & trailhead maintenance. Without their help the facility would either have to be closed or change so much it would probably deter use" (Respondent 36; emphasis in original).

For the most part, respondents described their perceptions of the motivations and preferences of OHV users in keeping with the literature examining the motivations and preferences of those recreationists (e.g., Andereck et al., 2001; Fly et al., 2002; Chavez & Schuett, 2005; Schuett & Ostergren, 2003). There were several responses, however, that differed from the self-descriptions provided by OHV users across studies. District Rangers in this survey tended to agree with the statement that OHV users do not participate in other recreational activities; at the same time, however, they tended to agree with the statement that people used OHVs as transportation to reach primary activities like hunting or fishing and that hunters used OHVs to cover more ground than they could on foot and to retrieve harvested game with greater ease than they could on foot.

This apparent contradiction raises several questions that are worthy of examination. Do District Rangers or other resource managers differentiate between "OHV users" and "hunters who use OHVs"? In other words, if a recreationist uses an OHV as a mode of transportation or in the context of a secondary activity, are they perceived as "not an OHV user?" From a management perspective, can a recreationist only participate in one activity at a time? As researchers, we may need to reexamine if what we think we are asking actually corresponds with managers' interpretations of our questions. Further examination of what makes an activity primary, secondary, or considered a recreation activity at all from the perspective of resource managers may also be warranted.

The greater difference in number of responses, however, came with respondents' disagreements with statements taken from the literature about OHV users' motivations and preferences. While managers' disagreement to particular statements was similar to that of OHV users from previous studies, specifically with the statements that OHV users prefer to ride with

clubs, prefer single-activity trails and prefer to participate in races; many of the statements District Rangers disagreed with conflicted with the self-descriptions of OHV users in the literature. Respondents disagreed that OHV users who rode in an area only once or twice a year were more likely to support user fees than users who rode in the same area more frequently (Fly et al., 2004), that OHV users preferred less intensive management than nonmotorized users of the same areas (Andereck et al., 2001), OHV users rode to escape from civilization (CEQ, 1979; Fly et al., 2002) and that OHV users support nonmotorized recreational activities (Andereck et al., 2001; Cordell et al., 2005; Fly et al., 2002). They also disagreed that OHV users ride for stress relief, and that OHV users preferred combined-use trails with both motorized and non-motorized activities.

Again, there are some noticeable contrasts and contradictions in responses to this section of the survey instrument. Overall, District Rangers disagreed with both the statements "OHV users prefer single-activity trails" and "OHV users prefer to ride on multiple-activity trails with combined motorized and nonmotorized activities." These statements were questions 32 and 44, respectively, on the survey instrument. If respondents have the perception that OHV users do not prefer either type of trail, what kinds of trails do respondents think OHV users prefer? Relative to the issues of unauthorized and illegal use District Rangers are reporting on their Districts, it may be that respondents are reacting to the issues of user-created trails and OHV riders going off established trails to ride, both of which were reported by 28 of 29 respondents and were, with weighted scores, ranked as a top-three issue across Districts.

Other statements of disagreement worth noting are respondents' disagreements to OHV user self-reports that they support nonmotorized activities (Andereck et al., 2001; Cordell et al., 2005; Fly et al., 2002), that they ride to escape civilization (CEQ, 1979; Fly et al., 2002), and

that they ride for stress relief (CEQ, 1979; Fly et al., 2002, Schuett & Ostergren, 2003). The first contradiction points back to the statements about hunters using OHVs to access more remote areas and to retrieve harvested big game more easily (USFS, 2004; Nie, 2003), as well as the statement that people use OHVs as transportation to reach primary activities, to all of which the respondents agreed. The second points to the managers' disagreement with what OHV users state as their motivations for riding OHVs across studies (e.g., Andereck et al., 2001; CEQ, 1979; Cordell et al., 2005; Fly et al., 2002; Schuett & Ostergren, 2003). These issues will be discussed further in the Future Research section, below.

3. How do District Rangers on Appalachian National Forests perceive physical impacts of OHV use on their Districts?

District Rangers on Appalachian National Forests reported a variety of OHV-related physical impacts on their Districts, but those impacts were reported with differing frequencies than managers in the California studies. Some impacts in that study were described differently or collapsed into a single response category; those responses are not compared between studies. All respondents in the Appalachian region reported soil erosion or compaction as a physical impact, whereas 58 percent of respondents in the 2004 and 73 percent of respondents in the 2006 California studies reported the same issue. Leung (1998) described the impacts caused by OHVs as "spatially extensive and temporally enduring" (p. 2), and respondents corroborated this finding in their responses to open-ended questions. For example, Respondent 46 (high level of OHV use) described the erosion issues related both to use on and off designated trails, as well as the budget constraints faced in dealing with erosion: "The heavy use on designated trails needs constant maintenance to avoid soil erosion. The illegal riding in the forest creates more soil erosion than we can repair with existing funds."

Twenty-four of 29 (82.8%) reported litter or trash at trail access points and on roads or trails compared to 50 percent of managers in California in 2004 and 49 percent in 2006. Vegetation damage was also reported by 82.8 percent of respondents in this study, whereas it was reported by 40 percent of respondents in California in 2004 and 38 percent in 2006. Further research is necessary to determine whether these issues are arising from differing user behaviors in the two study areas, whether resource suitability for OHV use is simply lower in Appalachia than in California, or whether the impacts are resulting from a complex combination of human- and resource-related issues.

Chavez and Knap (2004, 2006) categorized users going off established roads or trails as a social issue which brought about physical impacts and did not include user-created trails as a management issue in their survey, but respondents in this study consistently reported in open-ended responses that user-created trails and the impacts from off-trail riding were directly connected. Other authors have studied off-trail riding and user-created trails as physical impacts (e.g., CEQ, 1979; Leung & Marion, 1999, Marion & Leung, 2004, Meyer, 2002); because off-trail riding as an impact occurs both in the literature and in the context of the on-the-ground situation reported by District Rangers in Appalachia, riders going off established roads or trails is included in both this section of the discussion and the section of the discussion related to social issues. Twenty-eight of 29 respondents (96.6%) on Appalachian National Forests reported that user-created trails and users going cross-country were resource management issues, and in the open-ended responses these unauthorized uses were frequently mentioned as contributors to soil erosion, riparian damage, and other resource-related issues.

As might be expected, the top-three issues, when weighted, were the same as the three most reported issues above. A notable difference once the scores are weighted according to

respondents' priorities, though, is the distance in scores between the number-three issue (OHVs going off established roads or trails, 25 points) and the number-four issue (Vegetation damage, 9 points). Responses to open-ended questions about OHV-related resource impacts tended to focus on erosion and other soil damage; unauthorized trails; riparian damage; vegetation damage; and impacts on wildlife, in keeping with the literature on OHV-related impacts (e.g., Cessford, 1998; Leung & Marion, 1999, Marion & Leung, 2004, Meyer, 2002; Munger et al., 2003; Prudente, 2003).

4. How do District Rangers on Appalachian National Forests perceive social impacts of OHV use on their Districts?

Of the 27 respondents who explained why they thought OHV use was a forest resource management concern, 24 used words relating to illegal activity related to or facilitated by OHV use. Those 24 included words like "illegal," "unauthorized," or "unmanaged," or referred to activities like poaching or other, unspecified, "illegal activities." By contrast, over half of managers surveyed (55.2%) rated their personal contacts with OHV users as "mostly positive." As discussed previously, 96.6 percent of respondents reported that OHV riders going off established roads or trails was an issue on National Forests in Appalachia, versus 76 percent in California in 2004 and 73 percent in 2006. Where 60 percent of managers in California in 2004 and 58 percent in 2006 reported that OHVs going too fast was a problem on the areas they managed, 79.3 percent of managers in Appalachia reported the same problem. Slightly more than three quarters (75.9%) of respondents in Appalachia reported that lack of safety wear was an issue versus 55 percent in California in 2004 and 51 percent in 2006. Conflict with hikers or backpackers was reported with considerably greater frequency by Appalachian managers (61.0% versus 21% of Californian managers in 2004 and 18% in 2006), as was inexperienced drivers in difficult terrain (62.1% versus 34% of managers in California in 2004 and 29% in 2006).

Management perceptions of these problems in Appalachia appear to be more negative than they are in California; whether this is a difference in user behavior resulting in more reports or a difference in District Rangers' personal perceptions requires further study.

Along with the comparisons to Chavez and Knap with regard to similarities and differences between those studies, the social impacts that District Rangers observed tended to relate to illegal or unauthorized activities of varying degrees. While Brooks and Champ (2006) address this issue as part of their examination of unmanaged recreation on the Front Range in Colorado, studies of issues related to unmanaged recreation are few. Like the literature on OHV use on National Forests, the literature on crime and law enforcement on National Forests is also currently limited in scope and does not directly address activity-specific law enforcement issues. Further study may be warranted.

5. What management tactics do District Rangers on Appalachian National Forests prefer to use to deal with the impacts of OHV use?

Overall, the majority of District Rangers reported using a combination of direct, indirect, resource hardening, and collaborative approaches to dealing with the impacts of OHV use (Chavez, 1996; Chavez & Knap, 2004, 2006; Manning, 1999). The most common management tactic reported was a direct tactic (Chavez, 1996; Manning, 1999): law enforcement (96.6%, versus 77% of California managers in 2004 and 81% in 2006). Direct management tactics have an immediate effect on the recreationist; they tend to be proscriptive in nature. Direct tactics involve the immediate presence or action of a resource manager, and may limit what recreationists can do in a given area (Chavez, 1996; Manning, 1999). Other direct tactics employed by the majority of respondents were closing or limiting use (75.1%, versus 31% of California managers in 2004 and 30% in 2006) and seasonal closures (51.7%, versus 13% of California managers in both 2004 and 2006). In Chavez's and Knap's 2004 and 2006 studies of

OHV management on National Forests in California, the most commonly used direct management tactics included closing or moving trails, prohibiting or limiting use, requiring special use permits for an activity, organizing trail maintenance events, and seasonal closures. The majority of District Rangers in Appalachia, on the other hand, used fewer direct tactics than District Rangers in California, but used them with greater frequency.

The majority of tactics employed by District Rangers to manage OHV-related impacts were indirect. Indirect management tactics are used in situations where managers are hoping to influence recreationist behavior without the presence or immediate action of a resource manager (GAO, 1995; Lime 1977, 1979, as cited by Manning, 1999, p. 242). When employing indirect tactics, District Rangers in California most commonly used different types of signage; user ethics and etiquette, brochures, trail use recommendations, and trail maps (Chavez & Knap, 2004, 2006). The majority of District Rangers in Appalachia reported employing the same tactics. The majority of tactics District Rangers in this study used to manage OHV use trended toward information for and education of their District's user base. Further study is necessary to determine if these tactics are working to reduce the physical and social issues that respondents reported.

Like District Rangers in California, District Rangers in Appalachia did not tend to stabilize or harden their trails by developing facilities or manipulating trail or other surfaces through natural or artificial means (Chavez, 1996; Manning, 1999). The most commonly used resource hardening tactics reported by California District Rangers were staging areas with parking facilities, drain dips, artificial tread, designated campsites, and maximum specified grade (Chavez & Knap, 2004, 2006); none of these options, however, was considered a top management tactic for those District Rangers. Respondents in Appalachia were even less apt to

select resource hardening management tactics: the single resource hardening tactic employed by the majority of respondents was drain dips (58.6%).

District Rangers in California found that collaborative or bridge-building management tactics (Chavez, 1996; Manning, 1999) were the most successful when working with OHV users, under the condition that the OHV users were willing to reciprocate and work with the District Rangers (Chavez & Knap, 2004, 2006). Among the collaborative tactics District Rangers in California reported using regularly in both the 2004 and 2006 studies were making personal contacts with users or user groups who rode OHVs on their Districts, encouraging volunteer patrols, adopt-a-trail programs, meetings with local OHV clubs, using local groups and volunteers to maintain their trails, partnerships, and meetings with state-level OHV organizations. In contrast with the number of collaborative management tactics employed by District Rangers in California, a single collaborative management tactic was employed by the majority of respondents in Appalachia: personal contacts (65.5%, compared to 84% of California District Rangers in 2004 and 85% in 2006).

In some cases, however, Appalachian respondents reported conflicts or confrontations between law enforcement and OHV riders; this issue was not mentioned by respondents in the California study. Respondent 16 (high level of OHV recreation opportunities) reported that one of the difficulties in dealing with some OHV users on that District was encountering riders with an attitude of "I have a birth right to ride anywhere I want, when I want." Other respondents described confrontations between OHV users and law enforcement. The overall pattern of illegal and unauthorized OHV use described throughout this region points to the possibility of difficulties implementing a large-scale collaborative management process. On the other hand, since over half of respondents reported that their encounters with OHV users on their Districts

were mostly positive, it may be that this method of contact will, in the short term, be the most successful collaborative management tactic for District Rangers in Appalachia can use.

It is instructive to note that, with the exception of law enforcement, the most frequently employed management tactics among respondents to this survey were also associated with the lowest costs, including bulletin boards, closing or limiting trail use, and posters or signs. Managers in California often reported being unable to use collaborative management tactics because of budgetary constraints (Chavez & Knap, 2004, 2006); Brooks & Champ (2006) reported similar concerns on the Front Range of Colorado and the GAO (1995) reported the same issue on the West coast in general. Similarly, District Rangers in Appalachia reported that they did not have adequate staffing or funding to manage OHV recreation opportunities. For example, a respondent whose District provided a high level of OHV opportunities described the reason that District did not have areas suitable for OHV recreation as follows: "'Suitable' means we can properly manage OHV use. We do not have the funding and personnel to properly manage an OHV area of any size" (Respondent 11, high level of OHV recreation opportunities). While District Rangers in Appalachia were not asked directly about funding sources, several did mention funding issues in open-ended comments. Further study is necessary to determine if, like District Rangers on the West coast (GAO, 1995), managers in this area are turning to nonfederal funding sources to support their sites' OHV programs or if such funding is available in the Appalachian region.

6. How does the level of OHV recreation opportunity on a Ranger District affect District Rangers' perceptions of OHV use on their District?

There were few significant differences in overall perceptions of OHV use between District Rangers with high levels of OHV opportunities and District Rangers with low levels of OHV opportunities on their Districts. District Rangers with greater amounts of OHV recreation

opportunities were more likely to rate their contacts with OHV users as positive ($\tau_{23} = .363$, $p < .05$); District Rangers with high levels of OHV recreation opportunities were more likely to report volunteerism among OHV recreationists increased as OHV recreation opportunities also increased, particularly reports of OHV users volunteering to maintain trails ($U = 29.50$, $p < .05$). District Rangers with low levels of OHV recreation opportunities were less likely to have had OHV users volunteer on their Districts ($U = 17.00$, $p < .01$) and equally as likely to use law enforcement as a management tactic, which may affect the nature of their personal encounters with OHV users.

Although District Rangers with higher levels of OHV opportunities on their Districts were more likely to rate their encounters with OHV users as "mostly positive," they were also more likely to report that OHV use – particularly unmanaged OHV use – was one of the top four issues on their District, in keeping with the Four Threats described by former USFS Chief Bosworth (2003). District Rangers with higher levels of OHV recreation opportunities on their Districts were also more likely to report either witnessing or receiving reports of OHV accidents on their Districts.

7. What differences are there in perceptions of OHV users' motivations and preferences between District Rangers with low and high levels of OHV recreation opportunities on their Districts?

While District Rangers' overall perceptions of OHV users' motivations and preferences tended to differ from those users' self-reports as described in other studies, District Rangers with high levels of OHV recreation opportunities on their Districts agreed with more user self-reports than their counterparts with low levels of OHV recreation opportunities. In this study, respondents with high levels of OHV recreation opportunity were more likely to agree that OHV users prefer less intensive management of the areas they use than nonmotorized users of those

areas, and that OHV users support nonmotorized recreational opportunities. They also were more likely to agree that OHV users prefer to ride with clubs (Chavez & Schuett, 2005; Schuett & Ostergren, 2003). This statement is not in conflict with the statement that OHV users prefer to ride with family and friends (CEQ, 1979; Chavez & Schuett, 2005; Schuett & Ostergren, 2003); OHV users self-reported both of these preferences in separate studies (Fly et al., 2002).

District Rangers with high levels of OHV recreation opportunities were also more likely to agree that OHV users wanted support facilities near the trails they ride (Andereck et al., 2001), and that people use OHVs as transportation to reach primary activities such as hunting or fishing (Nie, 2003; USFS, 2004). In agreement with OHV recreationists in several studies (e.g., Fly et al., 2002; Schuett & Ostergren, 2003), District Rangers with high levels of OHV recreation opportunities were more likely to agree that OHV users ride to seek physical challenges.

Since District Rangers with high levels of OHV recreation opportunities on their Districts were more likely to report that OHV users had volunteered to monitor or maintain trails on their Districts in the past year, it follows that, as they did, those District Rangers would be more likely to agree with the statement that OHV users were concerned about their image as responsible recreationists (Brooks & Champ, 2006; Schuett & Ostergren, 2003). Although they had a more positive view of OHV users as a whole and were more likely to report that OHV users volunteered on their Districts, District Rangers with high levels of OHV opportunities on their Districts were also more likely to report unsafe behaviors by those OHV users. OHV users riding without safety wear was an issue on Districts with high levels of OHV opportunities, as were inexperienced drivers in difficult terrain. As there are no other studies available where management perceptions of OHV users motivations and preferences are made, nor are there comparisons between groups of managers regarding perceptions of these motivations and

preferences, further research is necessary to determine if this is the case in other regions and nationwide.

8. What differences are there in perceptions of physical impacts of OHV use between District Rangers with low and high levels of OHV recreation opportunities on their districts?

While the level of OHV opportunity available on a District did not point to a particular physical impact being more prevalent on one of the two types of Districts, there was a small to moderate positive correlation between the ratio of open to closed trail on a District and the number of issues respondents reported as occurring on their District ($\tau_{26} = .327$, $p < .05$). That is, as the ratio of open to closed trails increased, so did the number of issues respondents reported occurring on their Districts. Respondents in this study, however, were not asked about the amounts of OHV-related impacts on their Districts, but about observations and reports of impacts on their Districts. Chavez and Knap (2004, 2006) did not examine differences in impacts between groups, nor are there other known comparative studies about management perceptions of impacts in the general literature. Further research is necessary to determine if there are differences in the degree and extent of physical impacts relative to the level of OHV recreation opportunities a Ranger District offers.

9. What differences are there in perceptions of social impacts of OHV use between District Rangers with low and high levels of OHV recreation opportunities on their districts?

Regardless of the level of OHV recreation on their Districts, District Rangers tended to report similar social issues. District Rangers with high levels of OHV opportunities on their Districts, however, were more likely to report safety-related issues. Particularly, they were more likely to report that OHV users riding without safety wear was an issue on their District, as were inexperienced drivers in difficult terrain. These differences may be related to state or county

regulations regarding mandatory safety wear, the numbers of OHV recreationists participating on the Districts, the visibility of the trails, the level of law enforcement presence, or other OHV users in those areas reporting noncompliant OHV users on the trails. Further research is also necessary to determine why there are differing frequencies of reports of safety issues relative to the level of OHV recreation opportunity provided on a Ranger District in other study areas and nationwide.

10. What differences are there in preferred management tactics related to OHV use between District Rangers with low and high levels of OHV recreation opportunities on their districts?

Although there was no significant difference between groups with regard to what the top three issues on their Districts were, District Rangers with low levels of OHV recreation opportunities on their Districts tended, on the whole, to use fewer management tactics than their counterparts with high levels of OHV recreation opportunities to deal with top-three issues. As the amount of OHV recreation a District Ranger reported increased, the number of tactics that District Ranger used to deal with the top-three issues on their District also tended to increase ($U = 36.00$, $p < .01$). District Rangers with high levels of recreation opportunities on their Districts were more likely to employ two direct management tactics: seasonal closures ($U = 34.00$, $p < .01$) and relocating or redesignating trails ($U = 46.50$, $p < .05$).

Respondents with high levels of OHV recreation opportunities also tended to use more indirect and site hardening tactics than respondents with low levels of OHV recreation opportunities. District Rangers with high levels of OHV use were more likely to use indirect management tactics like posters or signs ($U = 42.00$, $p < .05$), maps ($U = 41.50$, $p < .05$), trail use recommendations ($U = 40.50$, $p < .05$), and brochures ($U = 41.00$, $p < .05$). They were also more likely to harden their OHV recreation areas with drain dips ($U = 34.50$, $p < .01$). Finally, these

District Rangers were also more likely to use collaborative management tactics like personal contacts ($U = 48.50$, $p < .05$) than District Rangers with low levels of OHV recreation opportunities.

There are several possibilities as to why this may be the case. As discussed above, District Rangers were asked to report the types of issues they had observed or received reports of in the past year, but they were not asked the extent of such impacts; it may be possible that District Rangers with high levels of OHV recreation opportunities are experiencing the same physical and social issues as District Rangers with low levels of OHV recreation opportunities, but with greater frequency or to a greater extent. This variation may also be funding-related, since these District Rangers were more likely to charge fees to ride on their Districts, meaning that they would have more funds at their disposal for printing, signs, and so forth. Even so, the management tactics District Rangers with high levels of OHV recreation opportunities tended to use were often relatively inexpensive to implement, in keeping with ongoing reports of funding shortfalls constraining management choices (Brooks & Champ, 2006; Chavez & Knap, 2004, 2006; GAO, 1995; Nie, 2003).

This speculation, however, does not provide a possible explanation as to why District Rangers with higher levels of OHV recreation on their Districts were more likely to use personal contacts as a tactic to manage their top-three issues than District Rangers with lower levels of OHV recreation opportunities on their Districts. There may, however, be more opportunities for District Rangers with higher levels of OHV recreation opportunities on their Districts to make personal contacts with the OHV users on their Districts. Since District Rangers with high levels of OHV recreation opportunities were more likely to report that OHV users volunteered on their

Districts, the opportunities to build relationships with those OHV users who volunteered would also likely be greater.

When Chavez and Knap (2004, 2006) examined the different tactics managers used to deal with OHV use, they did not examine differences between groups. There are no other known studies about management of OHV-specific issues in the literature; further research is necessary to determine why managers in this region used different management tactics depending on the level of OHV recreation opportunities they offered, as well as whether managers in other regions approach issues similarly depending on the levels of OHV recreation opportunities they provide.

Management Implications

District Rangers with high levels of OHV recreation opportunities tended to have more positive direct encounters with OHV users and a greater amount of volunteerism among OHV users, but they also tended to have a greater number of physical and social impacts related to OHV use on their Districts. Along with the increased number of impacts reported by the District Rangers with high levels of OHV use, those District Rangers reported that they used more varied types of management tactics than the tactics employed by District Rangers with lower levels of OHV recreational opportunities. Possibly in an attempt to counter the increased costs related to the number of management tactics employed, District Rangers with higher levels of OHV recreation opportunities were more likely to charge fees for OHV recreation on their Districts.

The issues reported by managers in the Appalachian region were similar in type and scope to the issues reported by managers in California (Chavez & Knap 2004, 2006), but tended to be more focused on issues with soils, riparian areas, and impacts related to illegal, unauthorized, or unmanaged activities. While many of the issues and the tactics used to manage them bear similarities between locations, the differences in frequency of occurrence and of types

of tactics employed to deal with them indicate that the types of issues and tactics may only be similar nominally. Studies conducted in regions outside the area in which a management decision is being made therefore may not be representative of potential issues within the decision area.

As management on National Forests near the deadlines to develop their new travel inventories and motor vehicle use maps as required under the amended 36 CFR 212, 251, 261, and 295, District Rangers considering increasing the amount of OHV recreational opportunities on their Districts will need to weigh the costs and benefits of doing so. Unauthorized and illegal use do not seem to decrease or diminish with the amount of trails open on a District, so adding opportunities for OHV users to ride may not necessarily decrease the number of user-created trails or areas in which riders leave the designated trail system. Overall, then, adding more OHV trail opportunities may increase the costs of management, including personnel and trail management costs; may necessitate the implementation of a fee system; and may also necessitate using more varied management tactics to deal with the impacts associated with OHV use. On the more positive side of the issue, managers who choose to add more OHV trail opportunities to their Districts may experience an increase in volunteerism by OHV users and an increase in positive encounters with those users, and possibly more opportunities for collaboration as well.

Increasing the amount of OHV-related recreational opportunities, however, should not be predicated upon whether a manager thinks more trail budget money might become available or whether it is possible that OHV users might be more likely to do volunteer work. Choosing to add or open more OHV trails should have a basis in the suitability of the resource for such trails, and the capability both of the resource and the District to be able to support and maintain those trails. Under circumstances where these conditions cannot be met, providing additional trail opportunities might have more drawbacks than benefits.

Recommendations for Future Research

There are considerable gaps in the OHV recreation literature and a wellspring of study opportunities for interested researchers. Because this study, like those of Chavez and Knap (2004, 2006), was limited regionally, a nationwide study would provide more general information about management perceptions and tactics; further region-specific studies, however, would also be helpful to provide information about local, more regionalized issues. Further study is also necessary with regard to how recreationists – both OHV users and non-OHV users – perceive the same issues that have been addressed here with District Rangers. This issue was raised by Brooks and Champ (2006) in a study of unmanaged recreation in the Front Range of the Rocky Mountains, where they found that users and managers differed both in their definitions of the problems and the solutions related to unmanaged recreation. Also, further research of this sort directed toward different user groups' motivations and preferences may also help determine if scales that have been used when examining recreationists' perceptions of motivations and preferences are appropriate when addressing the same issues with resource managers, as their interpretations of recreation are seen through a different "filter" than that of the recreationists themselves.

The seeming contradictions in responses between OHV users' self-reports about motivations and preferences and District Rangers' perceptions of the same may point to a variety of issues, including whether OHV users are portraying themselves to management (or researchers) in a way that accurately reflects their underlying motivations for participating in OHV recreation, whether managers are observing behaviors and ascribing potentially inaccurate motivations to those behaviors, or whether managers perceive secondary recreational activities as outside the scope of "recreation activities." Another consideration, outside that of the interpretations of the participants, is the possibility that scales that have been considered valid

and reliable for recreationists may need to be reworked when researchers examine recreation from a manager's perspective, as their interpretations of those terms in a work-related context may differ from the interpretations of recreationists.

On an ontological level, these contradictions may be reflective of differing realities between OHV riders and District Rangers: where OHV recreationists may perceive riding their motorcycles, three-wheelers, or four-wheelers through a National Forest as a way to escape civilization and relieve stress, District Rangers may perceive resource-damaging machines operated by people who are causing work and expense for the District through their chosen activity. Neither of these groups' interpretations is necessarily wrong or inaccurate; the groups are simply viewing the same activity through a different lens. In this case, there is no reason to assume a misunderstanding of motivation or a differing interpretation of when OHV riding is a recreational activity and when a means of transportation: the differing responses in this case simply reflect differing, equally valid views of the same resource and activity. Rather than trying to reconcile these seemingly conflicting views through survey research, it might be more useful to take a phenomenological approach to the underlying meanings, following, for example, the work of Brooks and Champ (2006).

Differences in perception may also translate to different norms; clearly, the behavior displayed by OHV users in Appalachia differs from what managers expect of them, in spite of the fact that the literature indicates that OHV users are concerned about their image as responsible recreationists (Brooks & Champ, 2006; Chavez & Schuett, 2005; Schuett & Ostergren, 2003). It is possible that OHV users in Appalachia have behavioral norms that may not be able to be reconciled with the set of norms established in the literature based on traditional recreation activities. While normative differences have been explored between traditional and

newer types of winter recreation like skiing and snowboarding (Vaske et al., 2000), further exploration of other nontraditional activities is needed. The prioritization of activity over resource preservation (Bury, Holland, & McEwen, 1983, as cited by Thapa & Graefe, 2003), for example, differs greatly from the reversed priorities of nonmechanized recreationists (Andereck et al., 2001; Thapa & Graefe, 2003). The idea of recreational norms may need further exploration within the culture of the OHV user; other newer forms of recreation (Brooks & Champ, 2006; Ewert & Shultis, 1999; Ewert, Attarian, Hollenhorst, Russell, & Voight, 2006) may also need to be examined to see if their recreational norms are driven by different meanings than the normative meanings attached to traditional recreational activities.

Since OHV users tend to be more technocentric and to place their activity of choice above the impacts that their machines cause (Brooks & Champ, 2006; Bury, Holland, & McEwen 1983, as cited by Thapa & Graefe, 2003; Schuett & Ostergren, 2003; Thapa & Graefe, 2003), educating OHV users about low-impact riding and ways to avoid erosion may require different approaches to interpretation and face-to-face communication than with less technocentric "traditional" users. This difficulty is compounded by OHV riders' perceptions that efforts to protect resources are equivalent to reducing the amount of area in which they have to ride (Brooks and Champ, 2006; Chavez & Schuett, 2005). Further studies are warranted that address methods of personal and nonpersonal interpretive communication approaches, as well as trust-building interpersonal communication methods, to nontraditional recreationists. Such studies may provide managers with alternative communication techniques that educate those users and help them engage in responsible recreation practices in a way to which they can relate, as well as to engage them more closely in the management process as stakeholders. Finding successful educational communication methods is particularly important when considered with

Thapa's and Graefe's 2002 finding that OHV users are less likely to participate in educational activities than other recreationists.

Conclusion

The purpose of this study was to determine the perceptions of OHV use, issues, and management among USDA Forest Service District Rangers in National Forests in the Appalachian region, and to determine the differences in perceptions of those District Rangers based on the level of OHV recreation opportunities provided on their Districts in order to share different management issues and tactics based on level of recreational opportunities. The main difference found between managers with high and low levels of OHV recreation opportunities on their Districts was the number of management tactics employed to deal with issues. There were few differences in management perceptions of OHV use across Districts or of OHV users' motivations and preferences or the types of OHV-related impacts managers reported.

Particularly in the context of current events, managing OHV-related recreation in Appalachia is a challenge without any easy solutions. While the top issues of soil damage and user-created trails are common regardless of the levels of opportunities currently provided, decisions about what management tactics to employ will continue to be constrained by budget and staffing shortfalls. As management on National Forests near the deadlines to develop their new travel inventories and motor vehicle use maps as required under the amended 36 CFR 212, 251, 261, and 295, District Rangers considering increasing the amount of OHV recreational opportunities on their Districts will need to weigh the costs and benefits of doing so, including whether the resource is suitable for OHV recreation. Unauthorized and illegal use do not seem to decrease or diminish with the amount of trails open on a District, so adding opportunities for OHV users to ride may not necessarily decrease the amount of user-created trails or areas in

which riders leave the designated trail system. Overall, then, adding more OHV trail opportunities may increase the costs of management, including personnel and trail management costs; may necessitate the implementation of a fee system; and may also necessitate using more varied management tactics to deal with the impacts associated with OHV use. On the more positive side of the issue, managers who choose to add more OHV trail opportunities to their Districts may experience an increase in volunteerism by OHV users and an increase in positive encounters with those users. As those positive encounters increase, perhaps opportunities for large-scale collaboration efforts that include OHV users may become possible.

Increasing the amount of OHV-related recreational opportunities, however, should not be predicated upon whether a manager thinks more trail budget money might become available or whether it is possible that OHV users might be more likely to do volunteer work. Choosing to add or open more OHV trails should have a basis in the suitability of the resource for such trails, and the capability both of the resource and the District to be able to support and maintain those trails. Under circumstances where these conditions cannot be met, providing additional trail opportunities might have more drawbacks than benefits.

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APPENDIX I: PRENOTIFICATION LETTER

October 25, 2006

Thank you for assisting us in our research about off-highway vehicle use on National Forests. This research is being conducted in partial fulfillment of the requirements for a Master of Science degree in Recreation, Parks, and Tourism Resources at West Virginia University, under the supervision of Dr. Chad Pierskalla. Some of the results may also be presented at academic conferences and in academic journal submissions.

The purpose of this study is to learn more about management perceptions of off-highway vehicle use and management on National Forests. Your input will help with information sharing about management issues and strategies for dealing with OHV use on National Forests. Your responses are critical to the success of this project.

Completing this questionnaire should take about 20 minutes. Your participation in this study is voluntary, and you are free to withdraw your consent to participate at any time. All of your responses will remain confidential, and no responses will be individually identified.

Please select answers based upon your own perceptions and experiences while working in your current position. Whether or not you have OHV use on your District and/or Forest, please respond to all sections of the questionnaire. If you are responsible for more than one District, please fill out a separate survey for as many Districts as your time permits. Please do not answer for more than one District in a single question booklet. You do not have to answer any question you do not wish to answer, and your job status will not be affected if you choose not to participate in the study at any point in the process. When you have completed the question booklet, please return it in the enclosed, postage-paid envelope. The survey has an identification number to eliminate duplicate mailings. Please do not write your name on the survey itself.

If you have any questions or would like to see a copy of the completed study, please feel free to contact me or my supervisor at the following address:

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Thank you again for your time and assistance with this project. Your input is important to us!

Regards,

Kate Thompson
Graduate Research Assistant
West Virginia University

APPENDIX II: MAIL-BACK QUESTIONNAIRE

Off-Highway Vehicle Use

On USDA Forest Service Lands

West Virginia University

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Thank you again for your time and assistance with this project. Your input is important to us!

Regards,

Kate Thompson
Graduate Research Assistant
West Virginia University

I. Activity and interest. For the purposes of this study, off-highway vehicles (OHVs) are considered to be motorcycles designed for off-road use and three- and four-wheeled all terrain vehicles (ATVs). Please tell us about the levels of OHV activity and interest in OHV use on your District. "OHV activity" in this section includes both managed and unmanaged OHV activity.

1. Do you have OHV activity <u>on your Forest?</u>	Yes	☐
	No	☐
2. Do you have OHV activity <u>on your District?</u>	Yes	☐
	No	☐
If yes, do you charge fees or require permits to ride on your District? Check all that apply.	Fees	☐
	No fees	☐
	Permits	☐
	No permits	☐
If you charge fees or require permits, how much does the fee or permit cost?	$ _____	
3. In the past year, have you had personal contact (face-to-face meetings, phone calls, emails, or letters) with OHV users on your District?	Yes	☐
	No	☐
If yes, how would you characterize your personal contact with those users?	Completely positive	☐
	Mostly positive	☐
	Neither positive nor negative	☐
	Mostly negative	☐
	Completely negative	☐
4. In the past year, have you had OHV users volunteer to monitor or maintain trails on your District? Check all that apply.	Monitor trails	☐
	Maintain trails	☐
	Not applicable	☐
5. In the past year, have you received any requests to use OHVs on closed roads or trails that exclude motorized vehicles?	Yes	☐
	No	☐
If yes, approximately how many requests have you received? _____ requests		

6. In the past year, have you received any requests to use OHVs within federally designated Wilderness? Yes ☐ No ☐

If yes, approximately how many requests have you received? _____ requests

7. In the past year, have you received any requests for races, poker runs, or rallies? Yes ☐ No ☐

If yes, how many requests have you received? _____ requests

8. In the past year, have you encountered commercially advertised or sponsored OHV tours coming to your District without permits? Yes ☐ No ☐

9. Do you have concessionaires or nearby businesses that rent OHVs for use <u>on your District?</u> Yes ☐ No ☐

If yes, approximately how many are there on the District? _____ on District

If yes, how many are within 50 miles of your District? _____within 50 miles

10. How many miles of the following types of roads/trails do you have on USDA Forest Service land <u>on your District?</u>

Paved road over 50" wide open to non-highway legal OHV use _____

Paved road over 50" wide closed to non-highway legal OHV use _____

Unpaved road over 50" wide open to non-highway legal OHV use _____

Unpaved road over 50" wide closed to non-highway legal OHV use _____

Trails 50" wide or less open to non-highway legal OHV use _____

Trails 50" wide or less closed to non-highway legal OHV use _____

Specially constructed OHV trails on National Forest land _____

11. Do you have federally designated Wilderness in your District? Yes ☐ No ☐

If yes, how many acres of Wilderness? _____ acres

If yes, how many miles of trail within Wilderness? _____ miles of trail

12. How many acres of land are on your District overall?

_____ acres

13. Does your Forest Plan have provisions for OHV trails or opportunities?	Yes	☐
	No	☐
If yes, are any of those trails or opportunities <u>on your District?</u>	Yes	☐
	No	☐

14. What year was your Forest Plan most recently updated? _____

15. Are there OHV trails or opportunities on non-Forest Service property abutting <u>your District?</u>	Yes	☐
	No	☐

II. Management issues during the last year. Please let us know whether you have experienced any of the following issues in the last year as they relate to OHV use <u>on your District.</u> "OHV use" in this section includes both managed and unmanaged OHV use. For the purposes of this study, off-highway vehicles (OHVs) are considered to be motorcycles designed for off-road use, and three- and four-wheeled all terrain vehicles (ATVs).

16. Do you consider control of OHV use a forest resource management concern?	Yes	☐
	No	☐

Why or why not?

_____

_____

_____

17. Is the management of OHV use currently one of the top four issues on your District?	Yes	☐
	No	☐

18. In the past year, have you observed or received reports of OHV use on closed roads or trails that exclude motorized vehicles? Check all that apply.	I have observed or seen evidence of OHV use on closed roads	☐
	I have observed or seen evidence of OHV use on trails that exclude motorized vehicles	☐
	I have received reports of OHV use on closed roads	☐
	I have received reports of OHV use on trails that exclude motorized vehicles	☐

19. In the past year, have you completed any surveys to show use patterns, document impacts, or to assess visitor feelings on OHV use? Check all that apply.	Use patterns	☐
	Document impacts	☐
	Visitor feelings on OHV use	☐
20. In the past year, have you spoken with USFS employees from other Districts or Forests who have completed any of the above types of surveys? Check all that apply.	Yes, other Districts	☐
	Yes, other Forests	☐
	No	☐
21. In the past year, have you seen any evidence of resource damage from OHV use?	Yes	☐
	No	☐

If yes, please describe:

_____

_____

_____

22. In the past year, have you observed or received any reports of OHV accidents (personal injury)? Check all that apply.	Observed	☐
	Received reports	☐
23. In the past year, have you observed or received any reports of safety problems related to OHV use (e.g., OHV users riding too fast)? Check all that apply.	Observed	☐
	Received reports	☐
24. In the past year, have you observed or received any reports of user conflicts (e.g., hikers who do not wish to share trails with OHV users)? Check all that apply.	Observed	☐
	Received reports	☐
25. Does your District have areas suitable for OHV use?	Yes	☐
	No	☐

Why or why not?

_____

_____

_____

III. Motivations and preferences of OHV users. Based on your experiences with OHV users on <u>your District</u>, please indicate your level of agreement with the following statements (1 = Strongly Disagree, 4 = Strongly Agree). Please circle your response.

		STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE	DON'T KNOW
26.	OHV users prefer less intensive management of the areas they use than nonmotorized users of those areas.	**1**	**2**	**3**	**4**	**0**
27.	OHV users prefer to ride with family and friends.	**1**	**2**	**3**	**4**	**0**
28.	OHV users are concerned about litter in areas they use.	**1**	**2**	**3**	**4**	**0**
29.	OHV users ride to be in a natural environment.	**1**	**2**	**3**	**4**	**0**
30.	OHV users who use an area frequently are more likely to volunteer to help maintain OHV areas and trails.	**1**	**2**	**3**	**4**	**0**
31.	OHV users are concerned about erosion on the trails they use.	**1**	**2**	**3**	**4**	**0**
32.	OHV users prefer single-activity trails.	**1**	**2**	**3**	**4**	**0**
33.	OHV users tend to be more tolerant of other user groups than vice-versa.	**1**	**2**	**3**	**4**	**0**
34.	OHV users prefer to ride with clubs.	**1**	**2**	**3**	**4**	**0**
35.	Hunters who use OHVs enjoy using them because they can cover distances with less effort than hiking.	**1**	**2**	**3**	**4**	**0**
36.	OHV users like to participate in races.	**1**	**2**	**3**	**4**	**0**
37.	OHV users support nonmotorized recreational activities.	**1**	**2**	**3**	**4**	**0**
38.	OHV users ride for stress relief.	**1**	**2**	**3**	**4**	**0**
39.	OHV users want support facilities near the trails they ride.	**1**	**2**	**3**	**4**	**0**
40.	OHV recreationists bring economic growth to the communities surrounding the areas where they ride.	**1**	**2**	**3**	**4**	**0**
41.	OHV users who use an area once or twice a year are more likely to support user fees to help manage that area.	**1**	**2**	**3**	**4**	**0**
42.	OHV users do not participate in other outdoor recreational activities.	**1**	**2**	**3**	**4**	**0**
43.	OHV users prefer to ride in areas close to their homes.	**1**	**2**	**3**	**4**	**0**
44.	OHV users prefer multiple-activity trails with combined motorized and nonmotorized uses.	**1**	**2**	**3**	**4**	**0**
45.	OHV users are concerned about their image as responsible recreationists.	**1**	**2**	**3**	**4**	**0**
46.	People use OHVs as transportation to reach primary activities such as hunting or fishing.	**1**	**2**	**3**	**4**	**0**
47.	OHV users ride to seek physical challenges.	**1**	**2**	**3**	**4**	**0**
48.	People with mobility impairments use OHVs to access areas they could not otherwise reach.	**1**	**2**	**3**	**4**	**0**
49.	OHV users prefer to ride on trails that provide opportunities to view scenery.	**1**	**2**	**3**	**4**	**0**
50.	Hunters who use OHVs do so because they can retrieve harvested big game with less effort than packing it out on foot.	**1**	**2**	**3**	**4**	**0**
51.	OHV users ride to escape from civilization.	**1**	**2**	**3**	**4**	**0**

IV. Issues related to OHV use. Whether or not you currently have roads or trails designated for OHV use on your District, please complete the following section. What OHV-related issues are you aware of (i.e. seen or received reports of) on your District? Check all that apply.

	ISSUE	
52.	Destruction/defacing of historic resources	☐
53.	Conflicts with hikers or backpackers on trails	☐
54.	Soil erosion or compaction	☐
55.	OHV users going too fast	☐
56.	Harassment of wildlife	☐
57.	OHV users going off established roads or trails (cross-country)	☐
58.	Injury to or death of individual members of a wildlife species	☐
59.	Lack of spark arrestors on OHVs	☐
60.	Excessive noise	☐
61.	Dangerous drop-offs, mines, etc.	☐
62.	Conflicts with mountain bikers on trails	☐
63.	Crowding at trail access points	☐
64.	Dangerous routes	☐
65.	Lack of safety wear	☐
66.	Litter or trash at trail access points (parking lots and/or trailheads)	☐
67.	Vegetation damage (food source and/or cover)	☐
68.	Graffiti or other vandalism	☐
69.	Reduction in size of habitat	☐
70.	Inexperienced drivers in difficult terrain	☐
71.	Conflicts with people on horseback on trails	☐
72.	Alcohol or drug use	☐
73.	Crowding on roads or trails	☐
74.	Litter or trash on roads or trails	☐
75.	Conflicts between hunters using OHVs and hunters not using OHVs	☐
76.	User-created trails	☐

77. Other issues? Please list:

78. From the issues you selected above, what are the top 3 issues related to OHV use on your District?

1.

2.

3.

V. Management tactics. For the top 3 issues you selected above, what tactics do you use to manage those issues? Check all that apply.

	TACTIC	
79.	Posters or signs	☐
80.	Brochures	☐
81.	User ethics and etiquette	☐
82.	Maps	☐
83.	Public service announcements	☐
84.	Local newspaper articles	☐
85.	Bulletin boards	☐
86.	Trail descriptions	☐
87.	Trail use recommendations	☐
88.	Close or limit use	☐
89.	Non-issuance of outfitter, guide, or event permits	☐
90.	Organized events to do trail maintenance	☐
91.	Relocate or designate OHV trails	☐
92.	Seasonal closures	☐

	TACTIC	
93.	Provisions for special use permits	☐
94.	Law enforcement	☐
95.	Users ride in dispersed patterns	☐
96.	Separate trails	☐
97.	Separate user groups	☐
98.	Alternate access times between different user groups	☐
99.	Specify a maximum grade on trails	☐
100.	Specify a minimum grade on trails	☐
101.	Drain dips (reversal of grade)	☐
102.	Flexible water bars	☐
103.	Artificial tread (e.g., geofabric with sand and gravel, concrete blocks)	☐
104.	Lengthen trails to disperse riders	☐
105.	Staging areas with parking facilities	☐
106.	Designated campsites	☐
107.	Personal contacts	☐
108.	Local OHV club meetings	☐
109.	Meetings with state OHV groups	☐
110.	Adopt-a-trail programs	☐
111.	Public meetings	☐
112.	Volunteer patrols	☐
113.	Partnerships with OHV shops	☐
114.	Workshops	☐
115.	Private sector/industry involvement (e.g., partnerships)	☐
116.	Maintain trail with local groups and volunteers	☐
117.	Open more trails	☐

118. Other tactics? Please list:

119. Please add any comments on management issues or other concerns you have related to OHV use on your District.

VI. Demographic information. Finally, some information about you:

120. What is your age?	_____	Years
121. Are you (please check one)	Male	☐
	Female	☐
122. How many years have you held your current position on this Forest?	_____	Years
123. How many years have you worked for the USDA Forest Service?	_____	Years

124. What is the highest level of formal education (in years) you have completed? Please circle one.

9	10	11	12	13	14	15	16	17	18	19	20	21	22+

125. What is the highest degree you hold? _____

APPENDIX III: FOLLOW-UP LETTER

December 8, 2006

Dear District Ranger:

About a month ago, you should have received a copy of the enclosed survey. **If you completed it and sent it back, I thank you for your time and ask you to discard this survey. Please do not respond twice.** If you have not had a chance to complete the survey, I would appreciate your response. Whether or not you have OHV recreation opportunities on your District, I would like to know what you think about off-highway vehicle use on National Forest System lands.

Please take a few minutes to fill out the enclosed survey. Your answers will not only help me complete my Master's thesis, but they will provide information that can help other District Rangers make decisions about OHV recreation-related issues and management tactics.

Please spend a few minutes answering the enclosed questionnaire and return the survey in the enclosed postage-paid envelope. **Your responses will remain completely confidential, and in no way will your name or District be identified in the results.**

Again, whether or not you have OHV recreation opportunities on your District, your participation in this survey is very important – especially since you are one of a very small number of District Rangers being surveyed. If you have any questions about this survey, please do not hesitate to contact me or my supervisor, Dr. Chad Pierskalla at the following address:

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Thank you for your time and participation. Your input is important!

Regards,

Kate Thompson
Graduate Research Assistant
West Virginia University

APPENDIX IV: RESPONSES TO OPEN-ENDED QUESTIONS

2. Do you have OHV activity on your District? (unsolicited response)

Only OHV use is one trail for people with physical disabilities only. (Respondent 28, low level of OHV recreation opportunities)

4. In the past year, have you had OHV users volunteer to monitor or maintain trails on your District? Check all that apply. (unsolicited response)

Users have volunteered to pick up trash along system roads. On volunteer agreement. (Respondent 14, low level of OHV recreation opportunities)

5. In the past year, have you received any requests to used OHVs on closed roads or trails that exclude motorized vehicles? (unsolicited responses)

(40 requests) Most are associated with oil and gas development, others with snowmobile trail maintenance by clubs. (Respondent 39, high level of OHV recreation opportunities)

16. Do you consider control of OHV use a forest resource management concern? Why or why not?

We have increasing incidence of illegal OHV use in areas designated off limits. Resource damage is occurring across district. Law Enforcement confrontations (up arrow). (Respondent 27, high level of OHV recreation opportunities)

Uncontrolled use has resulted in unacceptable resource damage. (Respondent 15, low level of OHV recreation opportunities)

Disturbance, ease of access, proliferation (Respondent 23, low level of OHV recreation opportunities)

Illegal use off designated trails causes soil & water & wildlife concerns (Respondent 31, high level of OHV recreation opportunities)

Uncontrolled use can result in resource damage (Respondent 37, high level of OHV recreation opportunities)

The heavy use on designated trails needs constant maintenance to avoid soil erosion. The illegal riding in the forest creates more soil erosion than we can repair with existing funds. (Respondent 46, high level of OHV recreation opportunities)

Because if not controlled resource damage would be devastating (Respondent 5, high level of OHV recreation opportunities)

Illegal riding w/trail closed; riding off trail, on closed roads, and rider use made trails (Respondent 18, high level of OHV recreation opportunities)

County has randomly and w/o consultation with FS designated some county roads as OHV routes. This causes spillover use on NF lands. Also lots of unmanaged use throughout district. (Respondent 14, low level of OHV recreation opportunities)

Unauthorized use continues to be a problem the further you are from the authorized trail system. (Respondent 36, high level of OHV recreation opportunities)

Probably 90% of the OHV use on the district is illegal. It is a major problem w/user developed trails everywhere. There is also significant illegal OHV use in the wilderness. (Respondent 13, low level of OHV recreation opportunities; emphasis in original)

Because we have a significant amount of illegal, user created trails that come onto FS land from adjoining private land. (Respondent 11, low level of OHV recreation opportunities)

Unmanaged OHV use has resulted in widespread resource damage on National Forest System lands and in some cases on adjoining private lands. (Respondent 16, high level of OHV recreation opportunities)

Unauthorized use, night time use (Respondent 1, low level of OHV recreation opportunities)

Lots of use out the back yard of neighbors. In some cases use has developed networks of unauthorized roads. (Respondent 26, low level of OHV recreation opportunities)

Unauthorized use/illegal use is a massive problem & is growing causing erosion & negative impacts to plant/wildlife species (Respondent 34, low level of OHV recreation opportunities)

Uncontrolled use – visible impacts – resource impacts – soil and veg loss – noise (Respondent ? – instrument number cut off, low level of OHV recreation opportunities)

Resource damage. Other associated illegal activity (poaching etc) (Respondent 8, high level of OHV recreation opportunities)

OHV's must be controlled or elinated [eliminated?] b/c of resource damage they cause (Respondent 2, high level of OHV recreation opportunities)

A lot of public interest but use is not authorized on forest (Respondent 40, low level of OHV recreation opportunities)

Resource damage, conflicts with other users & wildlife (Respondent 10, low level of OHV recreation opportunities)

illegal OHV use is rampant causing resource impacts & damage to trails not open to OHVs (Respondent 4, high level of OHV recreation opportunities)

A lot of illegal use creating a lot of resource damage. (Respondent 20, low level of OHV recreation opportunities)

It consumes a great deal of my time & that of my staff. We get a lot of complaints about illegal OHV use. (Respondent 24, high level of OHV recreation opportunities)

Erosion problems, wildlife harassment and poaching (Respondent 33, low level of OHV recreation opportunities)

Resource damage (Respondent 42, low level of OHV recreation opportunities)

Resource damage, contributes to illegal activities (Respondent 3, high level of OHV recreation opportunities)

21. In the past year, have you seen any evidence of resource damage from OHV use? If yes, please describe.

Erosion, wetlands & ponds being used for mudding, streams & stream banks being degraded. Sensitive vegetation areas being impacted. (Respondent 27, high level of OHV recreation opportunities)

Soil erosion resulting from OHV use off trails or designated areas. (Respondent 15, low level of OHV recreation opportunities)

Rutting, soil & water issues (Respondent 31, high level of OHV recreation opportunities)

Severe gullying, cutting bypasses, running up and down streams causing bank erosion (Respondent 37, high level of OHV recreation opportunities)

OHV use in the general forest area leaves tracks which become ruts until they are rehabilitated. (Respondent 46, high level of OHV recreation opportunities)

Siltation [sic] of streams, native vegetation damage, seeded logging roads torn up (Respondent 5, high level of OHV recreation opportunities)

Ruts; mud bogs; off trail damage (Respondent 18, high level of OHV recreation opportunities)

One area of district suffered serious riparian damage from years of use. Also seen evidence of numerous user created trails. (Respondent 14, low level of OHV recreation opportunities)

Unauthorized use in gen. forest areas (Respondent 36, high level of OHV recreation opportunities)

User developed trails in riparian areas, steep slopes & on sensitive soils. (Respondent 13, low level of OHV recreation opportunities)

Illegal, user created trails that damage vegetation and cross small streams (Respondent 11, low level of OHV recreation opportunities)

Soils; illegal hunting (Respondent 1, low level of OHV recreation opportunities)

Unauthorized roads in riparian areas (Respondent 26, low level of OHV recreation opportunities)

Illegal trails, damage to watersheds, illegal hunting, etc. (Respondent 34, low level of OHV recreation opportunities)

removal of barricades, eroding of berms, go-arounds, vegetation breakage, cutting, compaction, rutting, soil loss (Respondent ? – instrument number cut off, low level of OHV recreation opportunities)

Soil erosion, damaged vegetation (Respondent 8, high level of OHV recreation opportunities)

Closed rds and restricted access areas. Rutted trails, muddy creeks, bank errosion [sic] from climbing ATV's thru creeks and roads (Respondent 2, high level of OHV recreation opportunities)

Rutting/sedimentation (Respondent 40, low level of OHV recreation opportunities)

Erosion, rutts [sic], mud bogging (Respondent 10, low level of OHV recreation opportunities)

Erosion, rutting, damage to trails not open to OHV, sedimentation, streambank disturbance & erosion, & wildlife habitat improvements damage (Respondent 4, high level of OHV recreation opportunities)

Erosion, trash (Respondent 20, low level of OHV recreation opportunities)

Hill climb areas, rutted roads, green vegetation that has been run over. (Respondent 24, high level of OHV recreation opportunities)

Erosion & sedimentation (Respondent 33, low level of OHV recreation opportunities)

Driving through streambeds, hillclimbs (Respondent 42, low level of OHV recreation opportunities)

Soil erosion, stream channel damage, T&E mussel habitat damage (Respondent 3, high level of OHV recreation opportunities)

25: Does your District have areas suitable for OHV use? Why or why not?

limited area – one designated trail but users are abusing it by pioneering new routes, trespassing on private land, and ignoring Trail rules (Respondent 27, high level of OHV recreation opportunities)

The (Trail Name) Trail has been designated as a multi use trail which includes OHV use. (Respondent 15, low level of OHV recreation opportunities)

None designated, no organized demand (Respondent 23, low level of OHV recreation opportunities)

We have a designated trail system (Respondent 31, high level of OHV recreation opportunities)

old, established trail system, no other land for public to use (Respondent 37, high level of OHV recreation opportunities)

Our designated trails which are open to OHV use are primarily located on land which was mined in the past, leaving unnatural terrain and disturbed soils. (Respondent 46, high level of OHV recreation opportunities)

We have two areas with designated trails (Respondent 5, high level of OHV recreation opportunities)

Limit to well designated existing trails (Respondent 8, high level of OHV recreation opportunities)

Some areas are suitable. Limited by terrain (numerous clifflines, steep terrain). Possibility to designate dual use on some FS roads after all studies/analysis completed. (Respondent 14, low level of OHV recreation opportunities)

The forest has issued forestwide closure to OHVs except where authorized. (Respondent 36, high level of OHV recreation opportunities)

We have a designated OHV trail. The rest of the district is closed to OHVs. (Respondent 13, low level of OHV recreation opportunities)

"Suitable" means we can properly manage OHV use. We do not have the funding and personnel to properly manage an OHV area of any size. (Respondent 11, low level of OHV recreation opportunities)

Those trails open to OHV use have been determined to be suitable for that use. These are the factors that limit OHV use in other areas of the Forest. i.e.

- T.E. species
- Erosive soils
- Land ownership patterns
- Safety

- Heritage resources (Respondent 16, high level of OHV recreation opportunities)

Limited – highly erodible [sic] soils (Respondent 1, low level of OHV recreation opportunities)

Stable soils w/appropriate terrain away from other established uses (Respondent 26, low level of OHV recreation opportunities)

We have a designated OHV area managed for this use. (Respondent 34, low level of OHV recreation opportunities)

prohibited in the forest plan (Respondent ? – instrument number cut off, low level of OHV recreation opportunities)

Designated trail (Respondent 8, high level of OHV recreation opportunities)

Small District, already have horse trail and hiking trail across district (Respondent 2, high level of OHV recreation opportunities)

Steep terrain/erodable [sic] soils (Respondent 40, low level of OHV recreation opportunities)

1000-acre block of land, mostly dry ridges, no conflicts due to other recreation activities in the area. "Sacrifice area." (Respondent 4, high level of OHV recreation opportunities)

Old logging roads. (Respondent 20, low level of OHV recreation opportunities)

The Forest Mgmt plan allows it in only a few mgmt areas and we have few of them and not enough for a suitable length system (Respondent 33, low level of OHV recreation opportunities)

Ridgetop trails away from drainages (Respondent 42, low level of OHV recreation opportunities)

77. Other issues? Please list

Some users have a blatant disregard for rules, and a few have created additional problems by confronting law enforcement, adjacent property owners, and other users. Resource damage is occuring [sic] and apparent. (Respondent 27, high level of OHV recreation opportunities)

Riding on non designated roads. (Respondent 15, low level of OHV recreation opportunities)

Easy hidden access from adjacent private land. Conflicts with other non-OHV adjacent landowners. Trash along trail routes. (Respondent 23, low level of OHV recreation opportunities)

Multiple riders. Demand to use vehicles wider than 50" with bench seat. Not enough trails to disperse riders. (Respondent 46, high level of OHV recreation opportunities)

Arson by OHV operators. Illegal drug manufacturing by accessing growing areas on OHVs. (Respondent 14, low level of OHV recreation opportunities)

Primary source of illegal OHVs is from adjacent pvt. land owned by people who have OHVs & ride off of their land on to NF. This creates hundreds of origins of OHVs. Rural neighborhood (interface) create user developed trails on the adjacent NF. (Respondent 13, low level of OHV recreation opportunities)

Trailers and the vehicle turning the trailer don't fit into our typical campsite, their vehicle & trailer are too long. OHV users repair their OHVs in campgrounds and spill oil and other mechanical fluids. OHV users tend to camp in large groups which discourages other campers from using the same areas. (Respondent 11, low level of OHV recreation opportunities)

Impacts on water quality and aquatic T&E species. Hill climbs. "I have a birth right to ride anywhere I want, when I want." ATV's are used in some communities as a form of local transportation. Dune buggies or rail cars are common on this Forest and do significant resource damage. (Respondent 16, high level of OHV recreation opportunities)

Conflicts among OHV groups – family groups vs. guys drinking beer & riding (Respondent 26, low level of OHV recreation opportunities)

78. From the issues selected above, what are the top 3 issues related to OHV use on your District?

OHV trailhead is in Class II arch. site and we have to constantly monitor use to prevent damage. (Respondent 36, high level of OHV recreation opportunities)

Trail maintenance – it's expensive & time consuming. Conflict w/adjacent property owners – noise & trespass (Respondent 24, high level of OHV recreation opportunities)

118. Other tactics? Please list.

Tactics are limited by lack of staff & budget to address problems. (Respondent 27, high level of OHV recreation opportunities)

Special adaptations and devices to make roads & trails inaccessible to OHVs (Respondent 23, low level of OHV recreation opportunities)

Close and obliterate illegal trails. User notes on the back of trail permits. User notes posted in Spanish. Make attractive displays on bulletin boards to draw in riders/readers. (Respondent 46, high level of OHV recreation opportunities)

Apply for Fed Highway grants (TEA-21) to get money to maintain our designated OHV trail. (Respondent 13, low level of OHV recreation opportunities)

Internet web sites (Respondent 16, high level of OHV recreation opportunities)

119. Please add any comments on management issues or other concerns you may have related to OHV use on your District.

Recieved [sic] two of these, the (A) and (B) Districts (Forest) have been consolidated into the (new) District. This reply is for both. Current address is (address). Would welcome your

participation on district (we are located in [location]) to assess & recomend [sic] tactics. (Respondent 27, high level of OHV recreation opportunities)

Illegal use of trail permits (switching from one machine to another) (Respondent 39, high level of OHV recreation opportunities)

Unmanaged OHV use occurs all over the district every day. Actual measurable resource damage is minimal due to fat tires, but impact on wildlife preferring isolation may be significant, and OHV's facilitate more hunting success in these areas, maybe more than they can sustain some day. The biggest problem may be with other users who have a right to expect peace and quiet in the back country.

We could really use funding geared to more law enforcement on this subject, and for installing better closure devices on roads & trails. (Respondent 23, low level of OHV recreation opportunities)

Use fees (Respondent 31, high level of OHV recreation opportunities)

I really want to open more trails but usually run into problem w/other resources i.e. arch sites, T&E species

I would like to see the state open more of their lands to OHV use, need private property owners to get more involved by developing camping/trails on private land. (Respondent 37, high level of OHV recreation opportunities)

We may be raising the fees for riding permits and/or changing some of our permit processes. Our trail permits are for sale at several OHV shops and gas stations. Our forest sells more than 20,000 permits annually for our motorized trails. Thats [sic] for riders on 2 districts. (Respondent 46, high level of OHV recreation opportunities)

We have an excellent working relationship with our local OHV club. They provide the bulk of the trail & trailhead maintenance. Without their help the facility would either have to be closed or change so much it would probably deter use. (Respondent 36, high level of OHV recreation opportunities; emphasis in original)

See 77. Next to horse use, OHVs are the biggest resource impact we must contend with. (Respondent 13, low level of OHV recreation opportunities)

The Forest Land Mgt Plan restricts use of OHV's to designated routes on NF lands. Local governments (counties) have designated some county jurisdiction gravel roads as open to OHV use. (Respondent 16, high level of OHV recreation opportunities)