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Conceptualizing and Measuring Demand for Recreation on National Forests: A Review and Synthesis

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Abstract

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This analysis examines the problem of measuring demand for recreation on national forests and other public lands. Current measures of recreation demand in Forest Service resource assessments and planning emphasize population-level participation rates and activity-based economic values for visitor days. Alternative measures and definitions of recreation demand are presented, including formal economic demand and multiattribute preferences. Recreation assessments from national-level Renewable Resources Planning Act Assessments to site-level demand studies are reviewed to identify methods used for demand analysis at different spatial scales. A finding throughout the multiple scales of analysis, with the exception of site-level studies, is that demand measures are not integrated with supply measures. Supply analyses, in the context of resource assessments, have taken the form of mapped spatial inventories of recreation resources on the national forests, based on the classification of recreational settings according to the opportunities they produce (e.g., the Recreation Opportunity Spectrum). As such, integration of demand analysis with these measures of supply requires measuring the demand for recreational settings. To support management and planning decisions, recreation demand analysis must also permit projection of changes in visitation at multiple scales as changes in management and policy alter recreational settings, and as the demographics and behavior of the user base changes through time. Although this is currently being done through many formal economic studies of site demand, methods are needed that scale up to higher levels of spatial aggregation. Several areas for research, development and application of improved methods for demand analysis are identified, and improved methods for spatially explicit models of recreation visitation and demand are identified as a priority area for research.

Keywords: Recreation, presentation, supply and demand, national forests.

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Introduction

Various trends among recreational users of public lands pose serious challenges to recreation planning and management. These include increasing urbanization of the population, an aging population base, greater racial diversity, and other changing demographics of the user base; as well as the growing diversity of activities and attendant changes in compatibility among user groups. After some 35 years of Forest Service-sponsored research on recreation supply and demand, a variety of tools, measures, and conceptual frameworks have been produced from various social science and other perspectives. However, a unified framework for conceptualizing and measuring these two phenomena remains elusive. Indeed, the terms recreation supply and demand themselves mean different things to different people, including researchers, policymakers, site-level managers, and forest supervisors. As the task of developing forest plans to guide management of the National Forest System (NFS) over the next 15 years commences, a review of recreation demand and supply concepts and their application to resource planning and assessment is timely.

This paper focuses on measurement of recreation demand for resource policy, planning, and management at multiple scales. The paper begins with a review of the problem of integrating measures of recreation supply and demand, and the need for an improved conceptual framework for demand that meshes with the existing spatial measures of recreation supply. A review of different concepts of recreation demand in the technical literature follows, with a brief primer on economic consumer theory as it applies to the spatial problem of recreation demand. The “Needed Research” section of this paper reviews selected Forest Service and other public agency recreation demand assessments and planning documents to identify past attempts to quantify recreation demand, with a focus on what has been gained from these efforts in terms of decision support for recreation resource management. This is followed by a brief review of the technical economic literature on economic demand analysis of recreation and other amenity resources. A discussion of priority areas for further research concludes this problem analysis.

The intent of this paper is to suggest potential research that will aid resource managers and policymakers in understanding recreation demand and improve its integration with recreation supply analyses. Although a review of previous research that emphasizes technical research methods and findings comprises a substantial part of the paper, it is hoped that this paper will be of interest to an audience concerned with recreation demand from a broader perspective as well. Readers approaching the paper from a planning and policy perspective may wish to focus on sections “Spatially Integrating Recreation Supply and Demand Analysis”

and “Demand Concepts in Recreation.” These sections, respectively, address recreation demand in a spatial context, and review definitions of demand that have been applied to recreation resources with a focus on the economic definition of demand for public land recreation. The “Review of Recreation Demand Assessments” section may be of interest to a variety of nonresearch oriented readers as well, particularly those engaged in preparation of similar assessments. The review of the recreation economics literature, although brief, addresses largely statistical and modeling issues and is addressed mainly to researchers. The “Needed Research” section discusses issues that have been identified through the review of literature and from other sources and are suggested as warranting research to improve understanding the spatial aspects of recreation demand and integrated analysis with supply and resource inventories. Along with the more focused suggestion for one priority area for research, it is hoped that both researchers and management-oriented readers will find these suggestions useful for framing research intended to provide decision support for recreation planning and management.

The Problem: Spatially Integrating Recreation Supply and Demand Analysis

There is an extensive literature on supply of and demand for recreation. Theoretical contributions such as the Recreation Opportunity Spectrum (ROS) (Clark and Stankey 1979, Driver and Brown 1978), Benefits-Based Management (Driver 1996), and Limits of Acceptable Change (Stankey 1984) have provided essential conceptual tools for understanding the nature of recreation supply. A large amount of literature on recreation demand models has advanced formal methods for estimating recreation demand at the site level (Rosenberger and Loomis 2001), and a number of applied national and regional assessments detailing population-level trends in recreation behavior and inventories of recreation resources has been produced to support NFS recreation programs (Cordell and Overdevest 2001, English et al. 1999, Gartner and Lime 2000). Standards for analysis of recreation supply are relatively well-developed (USDA Forest Service 1986, 1995, 2003a), and most NFS units have spatially explicit (i.e., mapped) inventories completed or underway (an example, the Southern Appalachian Assessment [SAA] analysis of recreation resources is reviewed in the “Review of Recreation Demand Assessments” section below). However, no framework for measuring recreation demand that integrates with measures of supply has been extensively applied for purposes of Forest Service decision support. To render demand analysis more useful for planning and management decisionmaking at a variety of scales, a more complete

and integrated conceptual framework is needed for understanding recreation supply and demand in a spatial context and at multiple scales.

At the core of most recreation inventories is a classification system used to identify the location and quantity of recreation lands. The ROS is the most commonly used classification system.¹ It classifies recreation landscapes along a continuum ranging from primitive lands characterized by minimal human intervention to rural and urban recreation landscapes where virtually all elements of the landscape are managed. Although the general criteria that describe elements of the recreation setting and that are used to classify the landscape have changed somewhat in different applications, they have typically included naturalness, managerial regimentation, remoteness, social encounters, access, and size, each with one or more qualitative or quantitative indices (see USDA Forest Service 1986 for a more detailed description). The technical guide developed to assist recreation planners in completing the 2005 forest plan revisions (USDA Forest Service 2003a) identifies ROS as the principal tool for supply analysis of NFS recreation resources, and provides protocols for geographic information system (GIS) analysis and mapping of national forest landscapes according to ROS criteria. Thus, most contemporary analyses of recreation supply are in terms of recreation opportunities, described by mapped cultural, social, and geophysical attributes of recreation settings.

In the context of larger scale assessments, particularly the 1974 Resource Planning Act (RPA) decennial assessments,² recreation demand analysis has focused on quantifying two elements of recreation demand (Rosenberger and Loomis 2001). The first, consistent with assessment of supply and demand of renewable resources required by RPA, is participation in a variety of activities among broad populations. The second element, required as part of the RPA assessment of the costs and benefits of resource programs, is estimation of mean

¹ Although the ROS was not initially conceived (Clark and Stankey 1979, Driver and Brown 1978) as a framework for recreation inventories, it is recognized that demand for recreational experiences in various settings can be best met by providing a diversity of settings.

² The Forest and Rangeland Renewable Resources Planning Act of 1974 requires the Secretary of Agriculture to conduct an assessment of the Nation's renewable resources every 10 years. The original act had four requirements for the assessment: "(1) an analysis of present and anticipated uses, demand for, and supply of the renewable resources, with consideration of the international resource situation, and an emphasis of pertinent supply and demand and price relationship trends; (2) an inventory,...of present and potential renewable resources, and an evaluation of opportunities for improving their yield of tangible and intangible services,... (3) a description of Forest Service programs and responsibilities...; and (4) a discussion of important policy considerations, laws, regulations, and other factors expected to influence and affect significantly the use, ownership, and management of forest, range, and other associated lands.

willingness to pay (WTP) values by recreational activity type in terms commensurate with commodity prices. Participation rates and WTP values provide planners and policymakers with a broad picture of the types of recreation preferred by the general public and relative value of “activity days.” However, neither provides needed information on what resources and places visitors actually use, or might use under alternative policy or management scenarios. That is, neither provides the basis for measuring demand in the same dimensions that are used to measure recreation supply: cultural, social, and geophysical attributes of recreation settings in particular places.

Perhaps the place to begin in developing a better approach to assessing demand for recreation might be agreement on a consistent definition of the term demand. Both the terms demand and supply are commonly appropriated from the field of economics, often inaccurately. One source of ambiguity in the context of recreation studies is the tendency to use demand as shorthand for different aspects of recreation behavior and preference without adequate understanding of the conceptual economic underpinnings of the term. That is, demand is commonly thought to describe, loosely, “what people (consumers, visitors) want.” The most critical point with regard to the formal economic definition of demand, however, is that it reflects **tradeoffs** that consumers make between available goods and services when allocating scarce resources of time and money. Thus, measuring recreation demand requires us to address the tradeoffs that consumers make between different leisure experiences, alternative goods and services available, time, and money. Although ability to observe those decisions empirically and measure their outcomes is clearly imperfect, recreation planning would be greatly enhanced by systematically applying the tools available to study recreation demand in its many dimensions rather than restricting analysis to the number of participants in a given activity and the average value of a visitor day.³ Those dimensions include tradeoffs between

³ Studies undertaken to estimate WTP use formal economic demand analysis and incorporate, to some degree, attributes of recreation site settings in statistical models of demand. However, recreation demand has been measured in situ only on an ad hoc basis, with relatively small-scale visitor surveys being implemented widely for specific sites or forest units. Although there exists an extensive array of site-specific recreation demand studies (Rosenberger and Loomis 2001), there has been no systematic assessment of the spatial and temporal dimensions of recreation demand at relevant scales. Economic demand studies are typically focused on the tradeoff between cost of access to a site and the number of visits to the site. Rosenberger and Loomis (2001) have integrated formal economic demand studies for public land recreation through meta-analyses of 131 separate primary studies. The purpose of that analysis is to develop protocols for “benefits transfer,” i.e., application of estimates of recreation use values from primary research sites to other sites for policy analysis purposes. Although many of the studies incorporated into the meta-analysis incorporate and control for some quality variables describing the recreational settings where visitor data were collected, the analysis is not focused on integration of demand estimates with supply inventories. The Rosenberger and Loomis (2001) study is discussed in greater detail in “Needed Research” section.

location, cost, and a host of other setting attributes and quality variables (which will be discussed in greater detail in Section IV) that determine consumers' recreational choices.

It has long been recognized that the recreation good that public land provides, and that visitors consume, is the **opportunity** to engage in a preferred activity at a time and place that provides the settings required to gain a desired experience (Committee on Assessment of Demand for Outdoor Recreation Resources 1975). These settings are a result of physical, social, and managerial characteristics or attributes. Many of these attributes are the same as those used in forest planning to inventory recreation supply in terms of ROS settings. Thus, understanding demand in terms of these and other variables provides the basis for integrating the monitoring and analysis of supply and demand. Moreover, understanding recreation demand in the same terms used to characterize recreation supply would allow planners and analysts to anticipate the response of recreation demand (i.e., visitors) to changes in recreation supply. Participation rates and average recreation use values by themselves do not permit analytical approaches to anticipating the level or spatial distribution of recreation demand and visitation.

With the increased emphasis on geographic and temporal scale and spatial context in planning and managing public land resources, the spatial and temporal dimensions of recreation demand, in particular, require better conceptual understanding and tools for measurement. The NFS has long embraced a mission of providing multiple benefits and uses to society (USDA Forest Service 2000). However, increasing attention is being focused on the spatial distribution of those benefits and uses. This attention stems from recognition that attempting to provide for all uses everywhere is inefficient and potentially degrades the value of the resource base. This is true across the range of commodity and amenity resources produced on the national forests; however, it is particularly true in the case of recreation. Past efforts to be too broadly accommodative have in many cases produced homogenized and degraded recreation experience opportunities and resources (McCool and Cole 2001). Thus, a greater understanding of the role of scale and spatial context in recreation planning and management is needed, including the ability to integrate recreation planning across different spatial scales, from site-level management and planning, to forest-, subregional-, regional- and national-level planning and policymaking.

At any given scale of management, understanding the spatial distribution of recreation demand and supply at the next finer and coarser scales would provide planners with the needed context for efficiently allocating resources. This could improve individual forest units' ability to provide recreation benefits to the public,

including underserved groups, and identify recreation opportunities that are undersupplied relative to demand within the context of the larger service area. Greater recognition and systematic analysis of the role of place and the spatial distribution of demand in regional planning and assessment is needed to improve the ability of administrative units to integrate planning efforts, particularly between subregional or forest and finer scales within a regional context.

Assessments of recreation supply have, to a large extent, focused on resource inventories and the opportunities available at specific sites. Increasingly, these inventories are spatially detailed and use extensive geographic mapping resources and technologies. Improved integration of supply and demand assessment will require that demand analysis use spatial tools to a similar extent. This does not require extensive development of new theoretical or analytical tools, or even data, but it will require that existing tools and data be used to answer pressing questions. The principal recreation use monitoring programs administered by the Forest Service are the National Visitor Use Monitoring (NVUM) project (English et al. 2002) and the National Survey on Recreation and the Environment (NSRE) (Cordell et al. 1997). Neither of these surveys has been designed to integrate with ROS-based supply inventories. However, both provide broad-based, spatially referenced data on indicators of recreation preferences and behavior. Integrated analysis of these data with additional spatially referenced sources could potentially produce spatial measures of recreation demand, and results from testing this hypothesis would aid in development of improved monitoring efforts. Monitoring efforts could be redesigned or enhanced to improve or facilitate better integration, but this would require a more spatially articulated conceptual framework for recreation demand analysis. Developing and making this framework accessible to recreation planners, managers, and policymakers is, perhaps, one of the principal challenges to Forest Service recreation demand analysis.

Demand Concepts in Recreation

The concept of demand has a somewhat ambiguous meaning in social science and in planning and management of recreation. Rates of visitation to recreation sites, rates of participation in various recreation activities, economic values, political pressure from providers and users of resources, and public opinion and preferences expressed through public involvement and in terms of sense of place, are variously referred to in shorthand as demand. Although each of these measures and information sources contribute to an understanding of recreation demand, each presents an incomplete picture of demand if considered in isolation. That is, no single measurement of demand can address the full range of issues confronting

recreation resource use and policy. However, a more integrated method of measuring demand at the scale of concern to national forest planners and managers would help them anticipate the response of potential users to management changes and assist in better coordination between forests at regional levels.

The difficulties with the term demand in the context of recreation have long been recognized. In 1975, the National Research Council, Committee on Assessment of Demand for Outdoor Recreation Resources noted:

The notion of “demand” is generally well understood from the tradition of the discipline of economics: recreation demand is the conditional statement of the participation that would result in a given time and in a given place under a specific set of conditions and assumptions about an individual and his or her social relationships and the availability of recreation resources (the traditional “price” of recreation). Individuals together express an aggregate demand, which is aggregate participation, conditional on measures of three sets of factors relevant to an individual (individual characteristics; social relationships and societal constraints and influences; and the available opportunities for recreation)... This economic model of demand is not broad enough, however, to encompass all the factors that are important to recreation decisions. Information about the wishes, needs, and desires of potential and active recreationists does and should enter into decisions in forms other than through the economic concept of demand, and the Committee has chosen to use this broader definition of demand in this report... (Committee on Assessment of Demand for Outdoor Recreation Resources 1975:11).

The authors of the report are concerned with a broad range of recreation decisions, from those of the individual recreationists and site-level managers to broader societal decisions regarding the role of recreation in American life and the role of government in providing access to recreation opportunities. They acknowledge that a formal model of demand is inadequate to address the full range of issues under their consideration. Indeed, the authors rejected the notion that recreation planning must be comprehensive and continuous from national plans and policy through to local site-based decisions, and argue that a single model of demand does not fit all levels of this hierarchy. However, the economic model that they did site is overly narrow in that it treats factors of demand other than price as static.

Some of the principal concerns raised in the committee's 1975 report are the overreliance of large-scale assessments on public participation in local resource allocation decisions and the failure to address the desires of latent or underserved users. To restate the formal definition of demand that they offer, demand is a conditional statement of use at a particular time and place as conditions of supply vary. Price is commonly the principal variable of interest in economic studies, and other conditions, such as other attributes of the recreation resource and demographics of the user base, are assumed to be held constant. However, these other conditions, particularly in the case of recreation, are often of greater concern than price. In fact, management-driven change in price of access to public recreation land is a relatively rare occurrence, whereas road closures or bathroom construction are routine decisions made by resource managers, typically with very little information on the impact these decisions will have on visitation. In recent years, economic studies of nonmarket resource values have concentrated on the implications of nonprice attributes of resource decisions on both economic benefits and consumption. Recreation studies from other disciplines have employed similar models to evaluate visitor tradeoffs of site attributes with a greater focus on visitor experience than in public welfare evaluation (Lawson and Manning 2002). A brief review of the technical development of methods for analysis of quality changes in nonmarket goods is provided below.

As the Committee on Assessment of Demand for Outdoor Recreation Resources pointed out, public land managers supply, and visitors demand, opportunities to engage in recreational activities and gain recreational experiences. Driver and Brown (1978) developed a definition of what, precisely, is the nature of the recreational good that is transferred from the provider to the user, resulting in a recreation opportunity demand hierarchy. Driver and Brown (1978) suggested that recreationists' demand for **opportunities** could be broken down into four tiered components. The most tangible component, most easily recognized by users, is activities (e.g., wilderness camping, whitewater canoeing, or family picnics). The second tier of demands, which are somewhat less tangible and somewhat less easily defined by users, is for opportunities to experience situational attributes of the physical, social, and managerial settings. The third tier is described as demand for opportunities to realize specific psychological outcomes produced from activities engaged in within preferred environmental settings. The fourth tier of recreation demand is for opportunities to realize benefits that flow from satisfying experiences.

As noted above, the first tier of demand identified by Driver and Brown (1978) has been the focus of recreation demand assessment. The second tier, which was

one of the principal insights that gave rise to the development of the ROS, is noted by the authors as the more relevant element of demand for public land recreation, because, except in certain circumstances, public land agencies do not produce activities, but provide the settings for them. Indeed, activities could be viewed as an output produced by households combining privately owned recreation resources (skills, equipment) with publicly owned recreational settings (Cordell 1990). Despite this, settings have not been the focus of most recreation demand analyses. However, because of the success of the ROS as a conceptual framework for understanding recreation resources, settings have been the unit of analysis for most supply analyses.

In contrast to the formal definition of demand used by economists, recreation demand assessments conducted by the Forest Service, until recently, and other land management agencies typically use household survey data to estimate the proportion of the regional population that participates in a given activity (where the list of activities tracked by national- and state-level recreation surveys is long and growing; e.g., sailing, motorboating, jet skiing, rafting, tubing, kayaking, canoeing, surfing, sailboarding), and the number of recreational trips generated by the population on an annual or seasonal basis. With demographic information collected from survey respondents, trends in participation rates among population segments are tracked. In some cases these trends are modeled by using contemporaneous trends in demographic characteristics of the population to facilitate projections of changes in participation rates on the basis of regional demographic projections (discussed in greater detail below). This provides some measure of responsiveness of recreation demand to changes in other dynamic factors. The complexity of estimating participation rates and the value of projected changes in participation should not be understated. However, measures of participation and population-level trends do not provide users of this information with any insight into the effects of changes in recreation supply (particularly in the attributes of recreation opportunities such as site quality) on demand, whether defined simply as participation, or in terms of the number of trips generated or visitation to particular recreation places that users desire. An approach focused on participation alone overlooks the fundamental relationship between supply and demand and the multidimensionality of both phenomena, thus providing no insight into the effects of changes in the very factors over which planners and managers have a degree of control.

Similarly, at the finer spatial scales at which resource planning takes place, i.e., forest or subregional clusters of forests, demand analysis has tended to focus on visitor counts, occasionally supplemented with site-level formal economic demand

analyses. Only recently, with the implementation of the NVUM survey (English et al. 2002) have consistent and scientifically valid⁴ visitor counts become broadly available for forest and regional planning. Although visitor counts provide a greater level of spatial detail than participation rates, by themselves they remain a single-dimension measure of demand that provides only a snapshot of current use. Although the information on participation and visitation available to both regional assessments and forest planning provide a much improved picture of current conditions than that available in previous analyses, this information nonetheless provides little guidance to planners regarding how use might change under policy or planning alternatives. What is fundamental in this case about formal demand analysis is that it provides some projection of how recreational behavior is likely to change under conditions over which managers have some control and thus provides a far greater basis for decision support.

Recreation supply

The issue of supply in recreation is no less complex than the issue of demand. The conception of supply has largely focused on classification systems for inventory of recreational resources (e.g., ROS, Scenery Management System). In particular, because recreational experiences are ultimately the “products” that are consumed by visitors and users, the capacity to support those desired experiences is typically regarded as the physically measurable quantity most relevant to recreation supply. An extensive array of tools has been developed by Forest Service research and other investigators and used for supply assessment and inventory purposes. Supply analysis, however, must go beyond inventory of existing resources, itself a daunting task in the context of the hundreds of millions of acres of public lands, to address both the ecological and social capacity of public lands to support desired recreational experiences. This is a complex area of research and analysis and goes beyond the scope of this paper. See Haas (2002) for further discussion of efforts to assess capacity limits of public lands.

Review of Recreation Demand Assessments

One objective of this paper is to review past work done in support of recreation demand assessments, both for the NFS as well as for other agencies involved in large-scale recreation management programs. The purpose for this review is to

⁴ Note that the NVUM survey was implemented for the first time in 2000 through 2004 and the success of the data collection protocols are currently being evaluated. Statistical properties of the data are known insofar as collection protocols are complied with by individual forest units.

identify the methods that have been used and how effective those methods have been in providing useful measures of recreation demand for planning and management purposes. The review is organized by the scope of analysis, starting from national-scale assessments to site-level studies.

The USDA Forest Service, as well as state and other federal agencies, routinely undertakes resource assessments for the purpose of planning and management. The 1974 RPA is the guiding legislation that specifies the goals of Forest Service resource assessments, to include “an analysis of present and anticipated uses, demand for, and supply of renewable resources, with consideration of the international resource situation, and an emphasis on pertinent supply, demand, and price relationship trends” (sec. 3(a)(1)). The RPA explicitly requires that recreation be placed on par with other renewable resources and that assessment of current condition and trends in recreational resources be included in national RPA analyses. Under the 1965 Land and Water Conservation Fund Act, similar assessment of demand and supply conditions are required of state governments as a condition of eligibility for federal recreation development funds. Preparation of statewide comprehensive outdoor recreation plans has been conducted by all 50 states, and the Oregon and Washington state plans are reviewed below.

RPA Assessment of Outdoor Recreation

Bergstrom et al. (1994) reviewed the first three RPA recreation assessments conducted by the Forest Service, 1975, 1980, and 1989, and presented results of a survey of RPA users conducted following the latter assessment. Through the 1989 assessment, both demand and supply data improved considerably as surveys were improved for purposes of complying with RPA and developing the methods to achieve its objectives. Primary data sources for the 1989 assessment demand component were the Public Area Recreation Visitors Study and U.S. Bureau of the Census data. In each of these early assessments, the objective was to estimate community-level demand functions. The 1989 assessment model estimated the quantity of trips for a given activity generated in aggregate at the regional level (Cordell 1990) as a function of regional demographics, cost per trip, average suitability of sites available to the community for that activity, and availability of substitute recreational activities.⁵ Projections of recreation demand to 2040 were made based on U.S. census projections of demographic change and were used to

⁵ Earlier assessments modeled trips demanded at the level of the individual survey respondent rather than in aggregate. The different specification of the dependent variable in successive models renders analysis of long-term trends somewhat problematic.

analyze alternative scenarios under which demand and supply equilibrium would be met in what was referred to as a “gap analysis.” In a constrained recreation scenario, it was assumed that supply would remain constant and price per trip would increase over time as the demand curve shifted out. The price differential, i.e., gap, between the current level and the increase as demand shifted out was used to provide a measure of the need for increased supply to maintain current or “unconstrained” access levels. Analysis of demand and supply trends and equilibria were formal and quantitative, although at a high level of spatial aggregation. At this level of aggregation, the gap analysis did not provide any analytical guidance other than to illustrate conceptually that failure to expand supply (i.e., shift the supply curve outward) would result in an increase in equilibrium price per trip. The utility of the gap analysis also appeared to be limited by ambiguity in the discussion of supply. Two measures of supply were discussed in the assessment document, including both an aggregate inventory of settings and visitor capacity as well as a model of household supply of recreation trips based on a household production function approach. The latter was presented, but little inference was drawn from the analysis and it was not integrated with the demand analysis.

In a survey of RPA assessment users from 1992 through 1993, Bergstrom et al. (1994) identified several areas for further development in future recreation demand and supply analysis sections of RPA assessments. These included regional supply and demand trends, effects of qualitative changes in settings on demand and supply trends, improved connection between units of measure of supply and demand, effects of demographic and socioeconomic changes, and net economic value and regional economic impact of recreation. The conjecture of the authors was that some of these, in particular the effect of quality changes, would not be included in future RPA assessments without substantial allocation of resources to the study of these effects. The authors do not identify methods of analysis that would achieve these objectives. However, the suggestions for further research support the thesis of this report that spatially explicit analysis of demand is required to provide the needed decision support for planning and management of forest recreation resources.

As documented in the most recent RPA recreation assessment, Cordell and McKinney (1999) analyzed long-term trends in U.S. outdoor recreation based on data provided by the NSRE, the first population-based recreation survey designed specifically to address RPA requirements. Some notable findings of the study include the following: bicycling participation is up from 12 million in 1960 to 63 million in 1995, which the authors attribute to technological change; and camping has increased 350 percent since 1960. Up through the early part of the period,

technological change was minimal, and most campers were young families. In more recent surveys, recreational vehicle (RV) camping by retirees accounts for a large part of the growth, and camping by more diverse users as a secondary activity to gain access to other recreation resources is increasingly common. Primitive camping is the fastest growing component, increasing 72 percent over the 35-year period compared to 42 percent for developed camping. This is largely attributed to improved equipment, making campers more self-contained. The authors do not address the question of compatibility of types of campers, i.e., whether those choosing primitive camping have been displaced by the increased use of developed facilities by RVs. Horseback riding and hunting both declined in absolute terms, attributed to declining access to undeveloped land and increasingly urbanized populations. Shorter term trends are similar: from 1983 to 1995, numbers of people participating in outdoor recreation increased for most activities measured. Bird-watching increased the most (155 percent), followed by hiking (94 percent), backpacking (73 percent), primitive area camping (58 percent), off-highway vehicle (OHV) driving (44 percent), walking (43 percent), sightseeing (40 percent), developed area camping (38 percent), and other land-based activities. Downhill skiing and snowmobiling also increased substantially (59 percent and 34 percent, respectively).

In a further analysis of activity participation rates using the NSRE cross-sectional data, Bowker et al. (1999) projected participation to 2050 for the North, South, Rocky Mountain, and Pacific regions of the United States (results were not presented for the nine regional administrative units of the Forest Service). Combining U.S. census projections of demographic change (Torgerson 1996) with estimates of regional supply of recreation resources, (e.g., acres of federal wilderness, acres of nonfederal forested land, number of developed camping sites within 200 miles of a given population center), the authors developed two sets of models: (1) logistic models using individual observations from NSRE to estimate individual participation by activity and (2) count data (negative binomial) models using aggregate counts of participants using the same explanatory variables (estimation results not published; available from the authors). Broad regional findings of the study indicate that the Pacific region will exhibit the highest increase in participation rates among individuals, as well as the largest number of activities with expected increases among those analyzed. Although the analysis of demand in terms of recreation participation for the 1999 assessment used the same methods as the 1989 assessment, the formal analysis of equilibrium conditions in supply and demand was not carried out to the same degree. The 1999 analysis relied more on qualitative analysis and expert opinion (Cordell and McKinney 1999: 31-32) with

the suggestion that the complexity and assumptions made in the gap analysis used in the 1989 RPA rendered communication of the findings too difficult.

The 1999 RPA recreation assessment responded to the recommendations of Bergstrom et al. (1994) by producing greater regional detail in demand analysis, including some results presented at the county level. As anticipated by Bergstrom et al., however, many of the recommendations were not addressed, including greater focus on the effect of changes in site characteristics and greater connection between units of measure of supply and demand. An extensive review of available outdoor recreation resources was conducted (Betz et al. 1999), along with a specific focus on private land provision of recreation resources. The status and trends in resource inventories across regions, by agency and ownership, were addressed in terms of acres, miles, and numbers of developed sites for various types of land and other resources. Apart from qualitative characterizations of resource availability, supply trends were measured in terms of national-, regional-, and county-level per capita inventories of land and water resources, again in terms of acres, miles, and numbers of facilities rather than in terms of visitor capacity. Integration of these measures with the demand assessment was largely limited to a qualitative interpretation of the results (English et al. 1999), namely that resources for which demand was likely to outstrip supply over the time horizon of the assessment (2000-2050) were those associated with activities growing at rates greater than population growth. The effects of changes in resource supply, either in terms of quantity or site characteristics, on demand do not appear to have been addressed in any detail. Thus, as the 1999 assessment was not characterized by a substantial reallocation of research resources, the greater integration and detail suggested by assessment users in the Bergstrom et al. (1994) survey were not incorporated. As discussed below, improved availability of visitation data, at least with regard to NFS lands, may permit some advance on these objectives for the next RPA assessment.

Regional Resource Assessments and Planning Analyses

Southern Appalachian Assessment

Several regional and subregional recreation supply and demand studies have been conducted over the last decade. These studies were conducted to support regional and forest-level planning and thus provided a less aggregated level of analysis and focused more on regional planning issues than did the RPA. Despite this, formal analyses of recreation demand and supply consisted largely of more detailed presentation of regional RPA results rather than conducting more localized studies or

surveys, although the Southern Appalachian Assessment (SAA), in particular (Southern Appalachian Man and the Biosphere Cooperative 1996), included considerable spatial detail in the inventory of recreation resources.

The SAA study was completed in 1996 and comprises a detailed analysis of the status and trends in resource conditions in the Southern Appalachian ecosystem. The area covered by the analysis extends over 37 million acres and includes parts of seven states extending from Virginia southwest to Alabama. Chapter 4 of the “Social, Cultural, and Economic” volume of the report addresses the demand and supply of outdoor recreation in the area. The supply analysis section of the report developed the most detailed typological approach to describing recreation resources on a large spatial scale yet used in regional assessments.⁶ The ROS (Clark and Stankey 1979, U.S. Department of Agriculture Forest Service 1986) classification of recreational landscapes provided a base for the mapping classifications, and was enriched with further landscape characteristics defined in the Scenery Management System used by Forest Service landscape architects (USDA Forest Service 1995).

Demand analysis in the SAA was largely limited to regional results of the NSRE and earlier iterations of national recreation surveys. The form of these results, namely participation rates by activity across the population base of the region and the number of trips generated by the population, as well as projected trends in these figures, is described in the previous section. Statewide Comprehensive Outdoor Recreation Plan (SCORP) documents for six states were reviewed and findings extracted; results were similar to those found in Oregon and Washington, including aging populations, increase in passive-use activities, and shorter trips. To supplement the participation figures, the authors reviewed some 75 visitor surveys that had been conducted in the study area beginning in 1980. These addressed visitor motivations, attitudes, and satisfaction levels.

Using limited data and published results from previous studies, the SAA assessed the net economic value (NEV) of 14 activities, which ranged from \$5.79 per day for day hiking to \$126 per day for river rafting. The SAA authors noted

⁶ This review focuses on demand analysis; the supply and capacity elements of regional assessments have not been extensively reviewed here. The SAA, however, developed a particularly detailed classification system with documented protocols for spatial analysis of settings (Riitters 1995), ultimately developing detailed spatially referenced inventories of recreational resources. This system is particularly notable in that it provides a basis for analysis of demand by providing a framework of physical and cultural attributes of recreational sites and landscapes in dimensions that can be quantitatively defined. These quantitative measures of settings can thus provide the basis for analysis of demand for recreational settings in terms that permit commensurate comparisons of physical units of demand and supply.

that the calculation of NEV estimates is of limited quality and recommend two improvements for further research. Controlling for the characteristics of settings would improve value estimates; because site qualities are subject to change as a matter of management, understanding the value of site improvement would increase the ability of managers to efficiently allocate resources to maintain and improve recreation sites. Second, the authors called for improved estimates of visitation.

As noted above, the SAA provides the most detailed assessment of recreation resources performed at the regional scale. This inventory of settings and facilities is the most spatially referenced supply analysis to date, and arguably represents a best practice standard for regional assessments. Nonetheless, the analysis of demand fails to address the distribution of visitation across the well-described recreational landscape. Although there is an effort to associate activities with the types of settings to which they are suited, there is a gap between the descriptions of supply and demand in that they are not described in commensurate terms. The authors suggest that future work on controlling for settings in estimating demand curves for recreation activities would come closer to describing supply and demand in the same quantities. Before estimating economic values for changes in site qualities, however, the response of visitation itself must be understood. For planning and management purposes, visitation response is likely to be more directly useable information than WTP estimates.

Columbia River Basin

Haynes and Horne (1997) provided a brief overview of recreation supply and demand in the interior Columbia basin region of the Pacific Northwest. The authors reported activity-based annual average counts of visitor days, spatially referenced to 13 ecological reporting units that defined the spatial framework of the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (2000), of which their study was a component. As a supplemental document to ICBEMP, English and Horne (1996) developed a model of recreation demand for spatial settings. Generally, the authors' objective was to be able to predict the change in value of recreation for the Columbia River basin as ecosystem management is implemented for the basin, where anticipated changes are mainly produced by road closures. In an extension of Rosenthal (1987), the authors modified the general approach of multiple-site travel cost models by dividing the model of site visitation into a two-equation system, with trip generation and trip distribution as

independent variables.⁷ The trip generation analysis uses Cordell and Bergstrom's (1989) model of regional recreation demand to measure trip generation from a given origin (county), for 12 activity groupings. Trips from a given county are modeled as a function of recreation resources available regionally. Recreation resources are described in terms of three ROS class groupings (primitive/semiprimitive [PSP], roaded-natural [RN], and rural/urban [RU]) and acres of land within the county in five ecoregion classes (Bailey et al. 1994). The ROS acres are indexed to county by using a distance-weighting scheme in which the "pull" of recreation land decays with distance from the county. The trip distribution model analyzes the number of visits per year to a given site for each activity group as a function of variables describing the site including ownership, ROS class, and ecoregion, acres of the site, and the distance-weighted sum of activity trips generated from counties in the market area of the site. Using the model results, English and Horne (1996) found that they were able to predict observed visitation levels fairly closely, with boating and OHV use slightly overestimated and hunting and fishing underestimated. Using the Deschutes and Malheur National Forests as empirical examples, English and Horne (1996) modeled three resource scenarios by using population demographic projections for 2005. With the no-change scenario, motor viewing was predicted to increase from 1993 to 2005 by over a third for both forests, as well as 20 to 30 percent increases in trail use, camping, wildlife viewing, day use, fishing, and winter sports. Two alternative scenarios were modeled, one closing roads (thus shifting RN acres to PSP acres), and one in which roads would be built in current roadless areas, decreasing the amount of PSP land. Large increases in trail use were predicted for the road-closure scenario, with more modest decreases in nonmotor boating. Trail use declines under the road-building scenario, particularly in the Malheur, with both forests seeing over 40 percent increases in scenic driving.

Improvements and extensions suggested by English and Horne (1996) center mainly on improving the detail and resolution of visitation data and resource descriptions, including fish and game populations, scenic condition, biological diversity, and others. Greater availability of spatial data as well as richer information on visitation collected through the NVUM (English et al. 2002) survey should

⁷ It is not clear what the benefit of this approach has over single equation systems in that English and Horne (1996) do not address problems of endogeneity, nor does it appear that they estimated the equations simultaneously; rather, trip generation by county is estimated and then included as exogenous in the trip distribution model.

permit significant advances over this analysis. English and Horne (1996) noted that the access description used in the data was too coarse and should include road condition (noting that this should be incorporated into ROS classifications but was not for this analysis). The authors also suggested greater integration of recreation models with other resource models, e.g., reflecting the effect of road density on fish and wildlife population levels. Nonetheless, the study represents the first attempt to apply a spatial model of visitation on a regional scale, assessing effects of changes in site attributes on a large scale.

Statewide Comprehensive Outdoor Recreation Planning

Oregon and Washington

Both Oregon and Washington have recently completed semidecadal recreation plans (Oregon Parks and Recreation Department 2003, Washington Interagency Committee for Outdoor Recreation 2002) as required for eligibility under the federal Land and Water Conservation Fund. Both documents provide detailed analyses of the current status and trends in recreation supply and demand on a statewide basis and represent state-level assessments very similar to those conducted nationally under the RPA. Similar information is available for other states participating in the Land and Water Conservation Fund, providing useful supplements to the work of Cordell and others (Bowker et al. 1999, Cordell 1990, 1999, Cordell and McKinney 1999, Cordell and Super 2000, Cordell et al. 1997, English et al. 1999), in addition to providing detailed inventories of outdoor recreation facilities and resources.

The Oregon SCORP describes results of a survey of recreation participation, in which 4,400 residents of Oregon in 11 regions of the state, and 800 residents of non-Oregon counties adjacent to Oregon's borders, were contacted by phone and with a followup mail survey. Similar to the NSRE analyses, the SCORP survey measures proportion of the population engaging in a broad range of activities, some 77 in all, as well as the intensity of participation as measured by number of annual activity days. These data are more spatially disaggregated than those gathered by NSRE and are more closely calibrated to the range of activities common in Oregon. The Washington SCORP analysis included a survey of 1,500 residents of the state, using a diary-based form to record recreation participation over a calendar year. As this format incorporated more open-ended participation questions, 170 distinct activities were identified and measured. The survey sample was not stratified by region, however, so participation estimates are not statistically valid for subregions of the state.

Although the survey method and sampling design are different for the two state SCORP analyses and the NSRE, broad results and conclusions are largely the same. The most common activities were those that participants engaged in close to home, e.g., bicycling, walking, sightseeing, often in urban settings or in natural areas adjacent to urban areas. Much of the most significant growth occurred in wildland-related activities, including nature and wildlife observation, RV trailer camping, and sightseeing, with picnicking, horseback riding, and car and tent camping exhibiting some of the sharpest declines. Notable demographic changes with implications for public land recreation managers included rapid population growth, increasing ethnic diversity in the population, and a growing gap at the center of the income distribution. The Oregon SCORP echoes the findings of Dwyer (1994) that the implications of these demographic changes include:

- Decrease in participation in most activities seems to occur as the individual reaches middle age. Participation in physically strenuous activities starts to decline at early ages, with participation in other activities beginning to decline later in life. Exceptions are walking and observing nature, which are enjoyed by people of all ages.
- Significant differences in recreation participation occur between different racial and ethnic groups. For example, Caucasians and Hispanics had significantly higher participation rates than African Americans in almost all recreation activities. Participation rates for athletic activities are higher for African Americans and Hispanics than for Caucasians.
- Rural residents are more likely to participate in activities associated with wildland areas than their urban counterparts. Urban residents are more likely to participate in activities requiring specialized facilities. These differences reflect the availability of nearby recreation opportunities.
- The implications of demographic changes for future recreation behavior are difficult to predict. Recreation resource managers may face reduced growth in the number of customers; increased customer diversity; and changing demands for activities, the design of settings and facilities, and visitor programs.

Although the analyses reviewed above provide a detailed assessment of the range of activities engaged in by residents of the Pacific Northwest region, they provide little information on where individuals engage in recreation activities. Because of this, like the RPA assessments, these assessments of recreation demand capture one component, which could be called “trip generation” (English and Horne 1996). Planners can use this information to anticipate the numbers of recreation trips likely to be generated from a given population center within a given year or season. However, these demand assessments do not differentiate between Forest Service and other ownerships, or even between public and private

land recreation resources. Forest Service planners and managers who use the information provided must therefore make inferences regarding not only what activities take place on public forest land but what proportion of activity rates generated in a given population center are likely to impact a particular national forest unit. The typical approach is to use the standard 200-mile travel-distance zone to identify the relevant user base at Forest Service recreation destinations. Although this provides a degree of spatial linkage of the participation measures of recreation demand to recreation sites, it provides little information at scales of spatial disaggregation at which site-level planning is implemented, and does not provide insight into how changes in resource qualities and settings are likely to affect visitation and demand.

Southern Alaska

A number of studies have been performed to assess recreation demand in Alaska, particularly the south-central region composed largely of the Chugach National Forest (Bowker 2001, Brooks and Haynes 2001, Colt et al. 2002). Colt et al. (2002) provided a broad descriptive assessment of recreation and tourism in south-central Alaska, focusing principally on the Chugach National Forest and Prince William Sound. The study assesses the regional development contributions made by recreation and tourism associated with the Chugach and other natural areas of south-central Alaska, and broad-scale trends in development of the recreation and tourism sector of the south-central Alaska economy. The stated objectives are to (1) describe recreation and tourism use on the Chugach, (2) describe overall trends in recreation and tourism use, and (3) present a more detailed analysis of two questions: How do people get to the Chugach? and What do they do when they get there? Colt et al. (2002) pointed out that indicators of the recreation and tourism economy are difficult to gain from sectoral economic data given the nature of recreation expenditures, which are defined by their purpose and not on the whole by the nature of the goods and services purchased (e.g., the purchase of 4x4 vehicles for recreational use versus commuting, or lodging purchased by tourists versus business or other nonrecreational travelers). This is a common problem in studying the economics of tourism, making the importance of this industry to economic development more difficult to determine than that of other industries.

The Colt et al. (2002) study provides an extensive review of these existing sources of data on visitation, activities, visitor attitudes and satisfaction, cruise ship travel, and tourism impacts.⁸ Primary data were collected through 100 focus groups and interviews of tourism operators and providers and general community members. The principal findings of the study with regard to demand are associated with the growth of outfitting services and mediated trips. Noted is the need for greater access, particularly to “midcountry” areas, i.e., roaded natural settings with interpretive facilities, and that, where such facilities exist, they are highly impacted. Although not quantitatively treated, the study does address the demand for settings, in addition to activity-based participation rates, more directly than many other studies. However, this was based principally on visitor attitude and satisfaction surveys and interviews with representatives of the tourism industry in Alaska.

Perhaps owing to the dominant role of out-of-state visitors and the extensive tourism economy of southern Alaska, the study largely focuses on the implications of tourism development rather than forest management for recreation demand and supply in the region. In discussing resident versus visitor recreation demand, Colt et al. (2002) note that most studies of visitation and planning efforts largely neglect Alaska residents as a source of demand for recreation services. By a rough calculation, however, the authors suggest that overall, outdoor recreation demand among residents is likely to be four times that of out-of-state visitors.

Bowker (2001) undertakes a more quantitative analysis of recreation demand among Alaska residents, although the study largely represents a regional expansion of the RPA participation rate analyses (Cordell and Super 2000). The study’s objectives are to estimate current annual Alaska resident participation and use of the Chugach in 13 activities identified by planners as important, and to project

⁸ Data sources used for the analysis include recreation information management (RIM) reports and raw data, collected on the Chugach for forest planning purposes from 1989 to 1995, including trail registries, concessionaire reports, permit data, cruise ship passenger data, and traffic counts at developed sites; USDA Forest Service Integrated National Forest Resource Assessment (INFRA) data system reports documenting infrastructure and inventory data; district-level permit data from outfitters and guides; and Chugach data from 1992 USDA Forest Service “CUSTOMER” nationwide recreation survey. Several caveats are stated about data sources, including periods (1996-1997) where no data were collected, changes in data collection methods over analysis period, spotty reporting by permit holders, and other problems. Consequently, the authors attempted to address acknowledged shortcomings in the data by pulling from as many sources as available.

future annual participation in the same activities. The analysis supplemented the RPA participation estimates with additional recreation data sources, all of which were probability sampled, state-level household surveys with no information on sites visited.⁹

Bowker (2001) identified three types of recreation demand models: site-specific user models, site-specific aggregate models, and population-specific models. Given the intensive data needs of the first two, Bowker developed state-wide population models, using both count and individual data similar to those used by Bowker et al. (1999). Model coefficients from activity models were combined with census-based projections of demographic characteristics of population growth to develop participation and consumption projections for each of the activities, producing 76 models and activity-rate projections in all. Because of the lack of site-specific data, Bowker (2001) stressed caution in applying model projection numbers directly to the Chugach and noted the need for planners to use managerial knowledge in applying estimates to any given site. Nonetheless, projections indicate that forest use will increase in most activities analyzed, and resource capacity is likely to be exceeded before 2020. Planners should expect public pressure to maintain quality of recreation experience, requiring increasing capacity over at least the next 20 years.

Brooks and Haynes (2001) synthesized and critiqued the studies performed by Colt et al. (2002) and Bowker (2001), addressing the broader context of recreation planning and its effect on economic development in south-central Alaska. Brooks and Haynes (2001) noted that, although these two studies provided a substantial analytical base for recreation and tourism planning on the Chugach National Forest, significant oversights of both studies included failure to (1) address the management and planning of landowners adjacent to the Chugach National Forest, (2) address capacity of recreation lands, both on the Chugach and elsewhere within the region, and (3) address the relationship between the quality of visitor experience and demand for recreation.

The principal point of criticism noted by Brooks and Haynes (2001), which applies to many similar population-level studies of recreation demand, is that the projections of participation assume that resource capacity plays no role in constraining participation. In fact, the authors pointed out, most developed sites on the Chugach are used at or above capacity at peak periods, and even dispersed

⁹ Recreation data sources used included the Alaska State SCORP and the 1995 NSRE surveys. These were supplemented with the National Survey of Fishing, Hunting and Nonconsumptive Wildlife Associated Recreation (FHWAR96, USDC Department of the Census).

recreation areas are limited by concentration of access nodes. Although clearly Bowker (2001), Colt et al. (2002) and RPA authors are aware that supply and demand are not independent, beyond the abstract representation of a constrained supply scenario posed in the 1989 RPA assessment, no broad-based demand analysis yet produced for Forest Service resource assessment or planning exercises integrates demand and supply analytically. Brooks and Haynes noted that, owing to data limitations, both the Colt et al. and Bowker studies lacked site-level information, including destinations, and focused exclusively on current use and activities. The latter is problematic because it provides no basis for addressing newly emerging use trends and activities. Given the degree to which much tourism-based recreational use in Alaska is commercially mediated, and that rapid changes in visitation can be affected by discrete changes in the commercial recreation industry, this may be particularly critical for recreation planning in Alaska. In identifying the lack of a spatial component in these analyses, which is endemic in recreation demand studies conducted at the regional scale, Brooks and Haynes (2001) repeated the critiques made by other authors of most recreation assessments conducted to date.

Site-Level Recreation Demand Analysis: Travel Cost and Hedonic Price Analysis Studies

The above review has covered selected studies conducted to support regional planning and national assessments of recreation demand. As such, the studies reviewed thus far have been addressed to a large spatial scale. By far, the majority of economic studies of recreation demand, however, have been conducted at a far smaller scale, focusing on the benefit-cost implications of management changes at particular sites. This and other related nonmarket valuation literature is referenced below to identify research approaches to addressing spatial aspects of demand that have potential for application to a broader study of recreation demand at multiple scales.

Formal economic demand analysis has been applied extensively in recreation economics to measure the response of recreation consumers to changes in the opportunity cost of recreational experiences (Loomis and Walsh 1997). Because public land recreation is a public good¹⁰ and market transactions cannot fully

¹⁰ Public goods are characterized by two properties: nonexcludability, in which the ability to restrict access and ration by price is constrained; and nonrivalry, in which one consumer's use of a resource does not limit another consumer's use of the same resource, such as a scenic view. Although clearly some public recreation resources are subject to congestion and are not purely nonrival, and exclusion is feasible at many recreation sites, a strong mandate to provide a broader public benefit by providing minimally restricted access to public recreation land is well established for federal and state land management agencies.

capture the value of these experiences to society, economists have developed tools to indirectly measure the relationship between recreation behavior and its associated costs. The extensive literature of travel cost analysis and hedonic recreation modeling is built on the proposition that the nonmarket component of recreation expenditures can be indirectly measured by observing the time cost of travel to recreation sites. To make these models function, it is typically necessary to control for independent factors like demographic characteristics of the recreationists and quality attributes of the recreation site visited. Although the latter are considered demand-shifting factors (Loomis and Walsh 1997), in a broader context they are attributes of the supplied recreation good that the visitor considers in the same decision calculus as cost, and which are similarly subject to limited manipulation by resource managers. Visitation to recreation sites is dependent on preferences of actual and potential visitors, which are subject to change as demographic, social and economic characteristics of populations change. Significant changes in these characteristics occur within local populations, sometimes quite rapidly, and can in principle be tracked spatially. Thus, visitation and the response thereof to changes in user characteristics and constraints and site-quality attributes (e.g., access, cost, and congestion) and other demand parameters are explicitly spatial: recreationists from particular localities are attracted to particular places with particular characteristics.

The economics literature on nonmarket valuation is vast, and an extended review, even of studies pertaining specifically to site-specific recreation demand, is beyond the scope of this document. The purpose of including a brief discussion is to identify potential applications of the techniques developed in the literature to address gaps in recreation demand studies reviewed above that have been consistently pointed out by various authors. Economic studies performed to date are largely focused on estimating economic values for visitor days, WTP for management changes to particular sites, and welfare impacts of fee-based recreation on public lands.¹¹ The three principal valuation techniques, hedonic price analysis, travel cost method (TCM), and contingent valuation method, are all well-documented elsewhere (Freeman 2003, Haab and McConnell 2002, Herriges and Kling 1999, Loomis and Walsh 1997). Houston et al. (2002) also provided a brief review

¹¹ Puttkammer (2001) provides an annotated bibliography of papers on recreation fees, including sections devoted to the influence of fees on recreation visitation and use patterns and visitor response to price and price changes. The bibliography is not restricted to valuation studies and includes social science studies and policy papers on the role of fee-based recreation on public lands. What emerges from a review of the annotations is that the effect of fees on recreation has been well-studied, and that many economic studies have found visitation to be relatively nonresponsive to fees but strongly responsive to other site characteristics like crowding.

of valuation approaches used in estimating the economic value of water resources that broadly applies to recreation resources as well.

Rosenberger and Loomis (2001) listed some 131 separate primary research studies of recreation values, with 701 distinct measures for 21 recreational activities. The majority of these studies used the TCM for estimating economic value per visitor day for recreation uses. Given the lack of price information for recreational use of public land, the TCM uses the variable costs of participation, e.g., transportation, fees, and rentals, as a proxy for the total price of recreation participation. Given variation in these “prices” and the number of trips generated to different locations, economists estimate demand functions that relate these two variables. Freeman (2003), Loomis and Walsh (1997), and other sources provide technical details on implementing the TCM, and the basic structure of the technique is well known in the recreation planning field. Innovations in the technique focus on controlling for the effect of visitation to multiple sites on a single trip and on improved methods for controlling for variation in site qualities (Englin and Mendelsohn 1991, Smith and Kaoru 1987, Woodward et al. 2001). Most theoretical work in the recreation economics and other nonmarket valuation literature is relevant mainly to improving the validity and accuracy of economic welfare measures. Research such as that conducted by Englin and Mendelsohn (1991), however, addresses user response to site characteristics other than relative cost of access, including site characteristics and availability and quality of substitute sites, which have a more direct application to estimating visitation changes. These innovations have occurred through the integration of standard TCM approaches with hedonic price analysis techniques that have been used to measure the value of amenity and other attributes in housing markets (Earnhart 2001, Edmonds 1983, Geoghegan et al. 1997), forming a hybrid technique known as the hedonic TCM (Araujo 2002, Englin and Mendelsohn 1991, Pendleton 1999, Pendleton and Mendelsohn 2000, Smith and Kaoru 1987). Although the hedonic TCM has been in use for some 20 years since it was proposed by Brown and Mendelsohn (1984), more recent improvements in spatial data methods and statistical models render the application of the technique for broader applications more feasible. A continuing problem in the travel cost literature is accounting for opportunity cost of travel differentials between individuals and the validity of economic welfare measures. However, statistical methods developed in these literatures can be used to estimate hedonic models of visitation as a function of site characteristics, while avoiding some of the theoretical problems associated with economic benefits estimation (Lawson and Manning 2002). Visitation modeling is discussed further below in the context of needed research.

Needed Research

The review of previous demand analysis work performed by and for the Forest Service principally indicates that there is a need for better understanding of demand at multiple scales, and in additional dimensions beyond that of population-based participation rates and the economic value of activities. As noted above, Driver and Brown's (1978) recreation demand hierarchy identified the multiple levels of recreation demand, from demand for activity experiences, to opportunities to recreate in settings that promote desired experiences, to the psychological benefits that those experiences induce. Because public land managers provide recreation settings and opportunities, it can be argued that the most relevant component or level of demand for managers is that for opportunity settings. Indeed, as Bergstrom et al. (1994) found in reviewing responses of planners and managers to RPA recreation demand assessments, needed information included effects of qualitative changes in settings on supply and demand trends, improved connection between units of measure of supply and demand, and effects of demographic and socioeconomic changes on visitation. McCool and Cole (2001) raised these concerns and called for better planning and decision support to integrate supply and demand at the regional scale. These are not unrelated issues, and in fact, a broader analysis of recreation demand should integrate an understanding of the types of demand information needed at different scales, from site-level management to national assessments and policy analysis. Further integrative work involving recreation researchers, planners, and managers must ultimately be initiated to identify a research agenda for Forest Service-sponsored research on recreation demand.

The following are broad areas of knowledge development suggested to support Forest Service recreation planning and management. First, improved analytical methods to understand recreation demand in a spatial context, integrated with inventories of recreation resources, would address some of the concerns raised about the disjunction of supply and demand measures. Second, there is a further need for integrated decision support and technology transfer to make the emerging body of recreation research available to managers and decisionmakers. Third, unmanaged recreation (i.e., activities and use at levels exceeding management capacity to maintain resource integrity) has emerged as a principal policy concern at the highest levels of federal land management. Changes in Forest Service policy on access for high-impact, unmanaged recreation uses will provide direction for planners and managers. Thus, understanding the response to administrative changes (e.g., rules and incentives), as well as access and settings changes, is critical to responding to the behavior of unmanaged users and maintaining resource

protection. Finally, place-based planning has been suggested and is being used increasingly as a method to align management of public lands with preferences of the public. The approach emphasizes public involvement in decisionmaking for specific places on the landscape. Development of science-based tools to support and inform the process is needed to improve the tractability and fairness of management and planning decisions made in this fashion. More detailed suggestions for research direction in each of these areas are provided below.

Spatial Visitation Modeling

As noted previously, information resources available to recreation planners have increased and improved dramatically over those available when the first cycle of forest planning began in 1982. Applying improved knowledge in planning, however, will become increasingly difficult as other resources available for recreation planning and implementation diminish owing to funding cuts and widespread retirements imminent within the agency (National Research Council 2002). With diminishing resources available to planning and management (USDA Forest Service 2003b), the need to leverage analytical tools will increase. Although models are a poor substitute for the intimate, place-based knowledge developed by managers, models, if used appropriately, are an important complement to manager insight.

Spatial modeling of recreation visitation is one area of research that could effectively leverage existing information from extensive national recreation surveys, particularly the NSRE and NVUM, spatial inventories of recreation resources, and analytical techniques used extensively in nonmarket economics and recently entering the broader recreation literature. Integrated analysis of existing geographic information on recreational resources with site-level visitation patterns could permit evaluation of the impacts of resource and policy changes on spatial patterns of recreation use. For example, access restrictions are more likely to displace recreation use than eliminate it. The ability to project the degree and spatial pattern of displacement would provide an improved analytical basis for forest planning. More broadly, the current direction of NFS recreation planning reverses the past focus on accommodating all uses everywhere in favor of promoting uses to which a given site is most suited, in the context of the variety of desired uses and recreation resources available regionally (USDA Forest Service 2003a). Simulating regional reallocation of recreational resources spatially and among user groups would assist forest planners in identifying the “market niche” for forest units and would enable regional planners to assist forest-level planners to improve coordinated planning for recreation use across units.

Spatial demand models, with capacity to forecast visitation in alternative management scenarios (e.g., road closures, riparian area restrictions, and thinning and harvest scenarios), would provide better and more useful information to regional recreation planners, forest supervisors, and site-level managers. A spatial model of recreation visitation that associates recreation settings and the geographic user base with visitation patterns would allow projection of the effect of resource changes and use trends on the spatial pattern of visitation among user groups. Parameterizing proposed planning alternatives in terms of changes in recreation settings would permit model analysis to project visitation changes resulting from plan alternatives. By specifying visitation as a function of recreation settings, a measurement of demand commensurate with supply would be produced, permitting projection of capacity shortfalls and resource impacts. This would also provide a means for anticipating impacts to the ecological condition of the landscape from recreation use and a bridge to planning and management analyses for other resources.

Formal economic analysis of recreation demand by using travel cost and choice modeling methods has produced powerful analytical tools and improved statistical methods for analyzing demand for recreation resources; however, study results are typically site specific. Benefits transfer (the process of generalizing benefits estimates from site-specific studies) is an exercise of applying averages from disparate locations to particular sites (Rosenberger and Loomis 2001), and is generally constrained to estimation of economic values of visitation. The benefits-transfer process typically loses the detail of user response to site changes captured in individual studies. The reliance on generalizing from site-specific studies is due to lack of the extensive data required for statistical models of larger spatial scale visitation patterns. The NVUM survey provides detailed information on visitation levels, visitor activities and visitor use patterns from a carefully designed sampling of recreation sites on each national forest. To date, this information has been used only to estimate current seasonal visitor loads for each national forest. The NSRE and state SCORP surveys provide spatially referenced “inventories” of the user-base population and activity participation rates. Projections based on these data permit anticipation of future participation in a large variety of activities as local-, regional-, and national-level demographic and socioeconomic changes occur.¹² The scope and detail of the data from both of these studies, however, provide an

¹² The NVUM sample sizes at the forest level are inadequate to support statistically valid visitation projections at finer scales. However, pooling samples over multiple forests at the regional or subregional scale could potentially permit statistical models to render valid projections at forest-level or finer scales.

opportunity for data-driven spatial analysis of recreation behavior on multiple scales. Coupling the site visitation data provided by NVUM and participation data from NSRE and SCORP surveys with the extensive GIS data available on recreation resource inventories will permit statistically testing the influence of physical and managerial (e.g., fees and permitting requirements) attributes of recreational settings on visitation and use patterns. Valuation might be a secondary priority but would be feasible given spatial model projections of visitation coupled with opportunity cost of travel time measures and methods for accounting for multisite trips. Although Rosenberger et al. (2001) have documented the large number of valuation studies performed to date, these have occurred on an ad hoc basis, and to produce a broader analysis of recreation values for forest planning efforts, the authors have produced a set of meta-analyses of these existing studies. Travel cost analysis of NVUM data might permit a complementary method for estimating economic values for recreation management. Current data limitations may preclude development of models with useful predictive properties. However, sufficient data exist to initiate a research program focused on development of methods for analysis and hypothesis testing.

A spatial visitation model would integrate many of the information gaps identified by researchers and agency personnel noted above. This is, of course, not to say that predicting visitation changes would answer all the relevant questions about recreation demand. However, a systematic approach to modeling visitation would provide a structure for drawing together much of the existing knowledge on recreation demand to support planning and decisionmaking, as well as a structure for bridging the various scales of analysis required at different levels of decisionmaking.

Integrated Decision Support

To address the complex relationship between recreation demand and visitation, to provide recreational experiences that the public desires, and to integrate recreation management with ecosystem management and resource protection, more detailed understanding of the behavior of recreationists on the landscape is required. Thus, further research, including the spatial recreation demand modeling discussed above, is necessary. However, improved synthesis of research and technology transfer are needed to integrate existing knowledge into recreation management and decisionmaking. Ongoing regional- and national-level surveys provide detailed information about (1) the recreational behavior and preferences of the public, and trends therein, measured at the population or community level; and (2) visitation levels, visitor behavior, and visitor satisfaction at specific locations on national

forests. These studies provide much greater information than that available for previous forest planning, in essence, providing detailed inventories of current users. The Natural Resource Information System Human Dimensions Module provides a powerful model of technical transfer to render this information useful to planners and decisionmakers. These data sources provide the potential for powerful analyses to support planning and policy; however, by themselves, they provide a static picture of current conditions (although trends in participation have been projected based on anticipated demographic changes) and only limited capacity to evaluate the impacts of potential changes in the resource base. Perhaps the most fundamental need for advancement in recreation research is for a comprehensive approach to integrated analysis and knowledge transfer that would provide greater decision support at all scales of recreation planning, policy, and management. This would require understanding how recreation demand, particularly visitation and visitor satisfaction, respond to changes in the resource base over which managers and policymakers have some degree of control. Additional exogenous factors, such as regional supply of recreation opportunities (substitutes), population growth, and demographic changes in the user base are also subject to change, with theoretically estimable effects on visitor response. As noted above, numerous studies have been completed by university and Forest Service researchers that provide extensive knowledge and insights on the behavior and preferences of recreationists; however, a systematic approach to integrating and rendering this knowledge available to planners and decisionmakers is lacking.

Unmanaged Recreation

Unmanaged recreation has been identified as one of the principal threats to sustainable management of public lands in the coming decades (Bosworth 2003). Although the term “unmanaged recreation” is rather ambiguous, attention seems focused on unauthorized use of public wildland for dispersed OHV use. National trends indicate relatively rapid growth in OHV use, with the number of participants in OHV activities increasing by 8 million participants between 1982 and 1995 (Cordell and McKinney 1999), with a 16 percent increase projected nationally over the next 50 years (Bowker et al. 1999). The authors of the RPA studies note, however, that growth in OHV use may have been constrained by inadequate supply of areas in which to undertake desired recreational uses. There is currently little research to indicate whether the unauthorized use of roaded and backcountry areas for OHV use, particularly user-developed trails through ecologically fragile areas, is the result of insufficient capacity of officially dedicated OHV-use areas. There is some evidence to indicate that, like many other dispersed area users, many OHV

enthusiasts prefer unmanaged, unregimented settings and may be somewhat unresponsive to an increase in developed settings (Clark et al. 1984). Off-highway vehicle access restrictions and closures of roadless areas have been the subjects of considerable controversy (Associated Press 2003, Israelsen 2003, USDI Bureau of Land Management 2001), and it is unclear how successful these measures are likely to be, even assuming they survive the policy process. Although there is a clear mandate from Forest Service leadership to address intensive unauthorized recreation activities, and a lack of any broad public support for motorized activities on public lands (Shields 2002), no clear strategy has been proposed. Further research is needed to identify how these activities are likely to respond to management and policy initiatives, including fines, fees, development of substitute sites, access restrictions, education, or others.

Place-Based Planning

User conflicts and resource protection objectives make satisfying all feasible uses at all sites an unsustainable management objective. A problem for planning and management is how to identify desirable uses for particular recreation sites while ensuring that the demand for activity opportunities is addressed within a regional context. To match recreation sites to the uses for which they are most suitable, a process is needed that identifies the “market niche” for a recreation resource, in relation to the variety of sites available at scales from the 2-hour-drive zone to regional and national levels. McCool and Cole (2001) addressed this in their suggestion for improved regional planning and integration of planning across scales. One approach that has been proposed for the process of identifying the suitability of uses for recreation resources is place-based planning (Pugh 2003, Williams and Stewart 1998). This process involves identifying “places” on the recreational landscape, i.e., broad sites or zones that are distinguished from others by the subjective experience of visitors to that place. The challenge for research is to develop a process that improves the tractability of both the public involvement process, which is both informationally and managerially intensive, and the integrative process that identifies the union of places with the recreational uses that are emphasized by management and outreach at each place.

In a market context, the discovery of “highest and best use” of a given set of productive resources is driven by the incentives of the market, with each individual agent considering the available resources in the context of the range of demands and competing producers. The entrepreneurial process thus identifies the market niche that produces the maximum net financial return. The market paradigm clearly does not apply directly to public recreation lands, which must be managed

in the public trust for various market and nonmarket benefits, many of which cannot tractably be quantified. Indeed, the market model is undesirable for various reasons, but employing the process of niche development that occurs in the marketplace does not imply that a commercialized recreation experience should be the result. One challenge for the planning process is to approximate the discovery of optimal or preferred niche for places in the recreational landscape, which in the market is driven by entrepreneurship and market segmentation. The challenge for research is therefore to develop information-gathering techniques and tools and conceptual and analytical models to aid the discovery and integrative processes. This includes spatial recreation demand models to predict visitation changes and supply models to identify the desired and sustainable level of recreation use at each place or site. It also includes a process for eliciting public and managerial sense of place for the variety of locations in the recreational landscape. The more complex task is to develop a decision model that integrates these processes at multiple scales to identify market niches for individual recreation sites in the context of recreational demand and supply of recreational experiences available on public and private lands.

Conclusions

The issue of demand for recreation on public lands has been the subject of much theoretical development and applied research. The complexity of conceptualizing and measuring recreation supply and demand has given rise to numerous frameworks for analysis, originating from a variety of social science disciplines. Information needs driven by site-level management, forest planning, and national-scale RPA assessments have given rise to different measures of recreation demand. One result of the many efforts to address recreation demand is that the term itself has come to have many different meanings. Common quantitative uses of the term refer to participation in recreational activities and visitation to recreational sites. Qualitatively, the term often refers to the general preferences of the public regarding use and access to recreation resources. This review suggests a more useful definition of demand, based in economic theory but broader than the common textbook use of the term.

Recreation demand for public land is the consumption (visitation) by users of recreation resources and the response of consumption to changes in supply and other conditions. The simplest application of the economic model of demand measures the response of consumption to changing price while holding all else constant. In the context of public land recreation, however, price is rarely the most important variable. Consumption response to other conditions of supply, i.e., site

conditions like access and setting, are more important for many planning and management purposes. This problem analysis highlights a central problem in understanding recreation demand: no framework for measurement of recreation demand has been extensively applied that integrates at multiple scales with measures of supply for purposes of Forest Service decision support.

A review of recreation demand assessments from the national RPA and site-level formal economic demand studies indicates that additional information is needed beyond that provided by these studies. Forest planners typically have access to data for two measures of recreation demand from RPA assessments: regional population-level participation rates in recreation activities (e.g., per capita number of developed camping trips per year) and estimates of economic value for a visitor-day by activity. Participation rates provide forest planners with partial and indirect information on the use of particular recreation resources. The RPA recreation values provide estimates of the value of recreational experiences, but provide little information on how management affects those values. Visitation estimates produced by the NVUM survey, only recently becoming available, add a much needed dimension to the current picture of recreation demand.

However, current demand information accessible to most recreation planners still provides only a static view of recreation use. As providers of recreation opportunities, Forest Service and other public land managers need richer information on the effects of management changes on recreation use. Evaluation of forest plan alternatives and management decisions are incomplete with static estimates of use. Analytical tools that permit estimation of users' responses to changes in settings, infrastructure, and access will permit better evaluation of prospective changes to these characteristics of the recreation resources on public lands. Understanding the settings that attract different groups of users and quantifying their effects will permit better planning in the face of demographic and behavioral changes in the user base.

This problem analysis proposes four areas for research, both in development of analytical methods and in particular applied areas of recreation planning and policy:

- Improved spatial models of recreation use and visitation
- Integrated decision support and technology transfer to make the emerging body of recreation research available to managers and decisionmakers
- Research on response of high-impact, unmanaged recreation uses to administrative changes (e.g., rules and incentives) as well as access, infrastructure, and settings changes to better support resource protection

- Development of science-based tools to support and inform place-based planning to improve the tractability and efficiency of management and planning decisions made in this fashion

With increasing urban and rural populations drawn to areas with easy access to public recreation resources, public use of national forests and grasslands will increase for the foreseeable future. This increasing use occurs at a time of declining budgets and staff devoted to recreation planning and backlogs in funding for deferred maintenance of recreation infrastructure. Efficient and effective decision-support tools for forest planning and coordination in recreation planning at regional scales will aid recreation planners and managers to meet the mandates of Forest Service policy and serve the outdoor recreation needs of the public.

Recreation demand is widely recognized as an inadequately understood phenomenon, one that will become increasingly critical to understand as human populations expand and natural settings are used more heavily. This review has identified several areas of needed and priority research; however, it reflects the limited perspectives of its author. As noted above, broader consensus on a research agenda for recreation demand is needed, which cannot be achieved in the context of a single document. A broader forum is needed for discussion and identification of short- and long-term research needs and should draw together researchers, managers, and planners to reach a broader consensus.

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Metric Equivalents

When you know:	Multiply by:	To get:
Miles	0.621	Kilometers

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