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Research Paper

An index of viewer sensitivity to scenery while engaged in recreation activities on U.S. National Forests

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A B S T R A C T

Consideration of viewer sensitivity is an important part of visual resource management and visual impact assessment. However, there is scant research to support the assessment of viewer sensitivity, particularly across viewers engaged in different recreation activities. This study uses data from the U. S. Forest Service's National Visitor Use Monitoring program to investigate the role of a reported behavior (the frequency of viewing scenery) and perceptual judgement (the importance of a site's scenery to the overall recreation experience) as part of a visit to engage in one of 24 primary recreation activities. The results are recoded as an index of viewer sensitivity for those engaged in each of the primary activities.

1. Introduction

The basic tasks of visual resource management and visual impact assessment have been well established and in practice for decades. They involve inventorying scenic or visually sensitive areas, determining visibility and distance zones, and establishing viewer sensitivity. The procedures for conducting the first two activities are generally straightforward. However, the problem of how to determine the sensitivity of potential viewers presents a conundrum that has been little researched, and for which there is little guidance. It is guidance concerning this last task that is the topic of this article.

1.1. Visual resource management

Together the Bureau of Land Management (BLM) and US Forest Service (FS) manage 18.9 percent of the United States (Vincent, Hanson, & Argueta, 2017). Both agencies inventory visual resources, prepare visual resource management (VRM) plans, and establish VRM objectives, which establish the acceptable level of modification or visual impact.

The BLM describes this process as consisting of:

> *A scenic evaluation, sensitivity level analysis, and a delineation of distance zones. Based on these three factors, BLM-administered lands are placed into one of four visual resource inventory classes. These inventory classes represent the relative value of the visual resources.* (BLM, 1986a, p. 1)

The procedures and criteria for evaluating scenic quality and delimiting distance zones are well established and relatively objective, or at least sufficiently systematic to be reliably implemented. This is less so for the determination of sensitivity levels, which "are a measure of public concern for scenic quality" (BLM, 1986a). The determination considers several factors which are relatively objective, such as designation as a special area, the amount of use, or demonstration of significant public interest. In addition, the type of user is one important determinant:

> *Visual sensitivity will vary with the type of users. Recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.* (BLM, 1986a, p. 3)

Beyond the extremes of sightseers and workers, no research is cited or guidance provided in how to determine visual sensitivity.

The FS's Scenery Management System (SMS) addresses viewer sensitivity through its assessment of "concern levels."

> *Concern levels are a measure of the degree of public importance placed on landscapes viewed from travelways and use areas. Divide concern levels into three categories: levels 1, 2, and 3. At the inventory stage, the type of area and its level of use is an adequate indicator of the level of interest that people are likely to have in the surrounding landscape. Base concern levels on past experience and existing planning data. Supplement this data as new constituent information becomes available.* (FS, 1995, p. 4.8)

The examples given seem to shuffle together places and people—e.g., beaches and swimming. However, working through the

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guidance it becomes clear that determining concern level is mostly about evaluating the "interest in scenery." All areas with high interest in scenery have a concern level of 1 and all areas with moderate interest in scenery have a concern level of 2. If the interest in scenery is low and the area has high use, the concern level is 2 and if use is low it is 3. Even though the determination of "interest in scenery" is critical, there is no guidance about how to do this or reference to supporting research.

Similar to the BLM, SMS uses inventoried scenic attractiveness, distance zones and concern levels to determine scenic classes and scenic integrity objectives (SIO). Proposed landscape modifications, such forest harvests, are evaluated for conformance with the SIO goals and objectives; there is no separate VIA procedure.

1.2. Visual impact assessment

Visual impact assessment is the relatively straightforward process of describing the visual characteristics of a proposed project, determining its visibility in the surround landscape, and describing the visual magnitude of the project as seen from various viewpoints. The general process for conducting this analysis has been understood for decades (Hadrian, Bishop, & Mitcheltree, 1988). The analysis may be extended to describe the visual contrast of the project with the existing landscape (BLM, 1986b). While there is room for error, and some differences in judgement, it is a relatively straightforward and objective process. This is in contrast to the process of assigning social values to the people and places that are affected by visual impacts. For instance, we may all agree that the views within designated National Parks should be protected, and the view within an active sanitary landfill should not, but there is no objective process by which we make this determination.

The Federal Highway Administration's (FHWA) VIA guidance describes the need for incorporating the sensitivity of different viewer groups, based on their activity.

> *The receptivity of different viewer groups to the visual environment and its elements is not equal. This variable receptivity is viewer sensitivity and is strongly related to visual preference. It modifies visual experience directly by means of viewer activity and awareness: indirectly, sensitivity modifies experience by means of values, opinions, and preconceptions. Activities such as commuting in heavy traffic or working on a construction site can distract an observer from many aspects of the visual environment. Head-mounted cameras, for instance, have demonstrated that a driver can look directly at a landmark and still not see it. On the other hand, activities such as driving for pleasure or relaxing in scenic surroundings can encourage an observer to look at the view more closely and at greater length. Therefore, viewer activity is another identifying characteristic of viewer groups.* (FHWA, 1981, p. 9–10)

Unfortunately, no guidance is given to help determine the sensitivity of different viewer groups, or the importance of scenic quality to different viewer activities.

It is probable that the most widely used reference for VIA is the *Guidelines for Landscape and Visual Impact Assessment* (GLVIA). The sensitivity of visual receptors is central to the determination of the significance of visual effects. Because the GLVIA provides the most detailed guidance in determining viewer sensitivity, it is quoted at some length here (LI & IEMA, 2013, p. 113–114).

> *The visual effects that have been identified must be assessed to determine their significance, … this requires methodical consideration of each effect identified and, for each one, assessment of the nature of the visual receptors and the nature of the effect on views and visual amenity.*
>
> ***Sensitivity of visual receptors***
>
> *It is important to remember at the outset that visual receptors are all people. Each visual receptor, meaning the particular person or group of people likely to be affected at a specific viewpoint, should be assessed in terms of both their susceptibility to change in views and visual amenity and also the value attached to particular views.*
>
> ***Susceptibility of visual receptors to change***
>
> *The susceptibility of different receptors to change in views and visual amenity is mainly a function of:*
> - *The occupation or activity of the people experiencing the view at particular locations; and*
> - *The extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at the particular locations.*
>
> *The visual receptors most susceptible to change are generally likely to include:*
> - *Residents at home (but see Paragraph 6.36);*
> - *People, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focused on the landscape and on particular views.*
> - *Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contribution to the experience,*
> - *Communities where views contribute to the landscape setting enjoyed by residents in the area.*
>
> *Travelers on road, rail or other transport routes tend to fall into an intermediate category of moderate susceptibility to change. Where travel involves recognized scenic routes awareness of views is likely to be particularly high.*
>
> *Visual receptors likely to be less sensitive to change include:*
> - *People engaged in outdoor sport or recreation which does not involve or depend upon appreciation of views of the landscape;*
> - *People at their place of work whose attention may be focused on their work or activity, not on their surroundings, and where the setting is not important to the quality of working life (although there may on occasion be cases where views are an important contribution to the setting and to the quality of working life).*

While there is more description, the GLVIA still provides only very general guidance—people engaged in outdoor recreation activities where their attention is likely to focus on the landscape are likely to be sensitive; people engaged in sports that do not depend on landscape views are unlikely to be sensitive. It also fails to cite empirical research to support its guidance.

This introduction has reviewed the assertion that the references used to manage visual resources (e.g., BLM, 1986a; FS, 1995), and prepare visual impact assessments (e.g., BLM, 1986b; LI & IEMA, 2013) all assume that "visual sensitivity will vary with the type of users" (BLM, 1986a). However, no empirical research is cited or included in the bibliographies to support this assertion.

1.3. Related research

The research investigating landscape preference is rich. The primary focus of this research has been on how landscape attributes influence preferences. Tveit, Ode, and Fry (2006) reviewed the literature covering the perception of landscape character and proposed an analysis framework composed of nine visual concepts. This framework is further refined by Ode, Tveit, and Fry (2008), who present indicator metrics appropriate to each visual concept. There have also been extensive reviews of the physical and cognitive dimensions that affect the scenic value of different landscape types. For instance, Ribe (1989) and Hoffman and Palmer (1996) reviewed the literature investigating forest scenic beauty, and van Zanten, Verburg, Koetse, and van Beukering (2014) conducted a meta-analysis of preference for agrarian landscape.

The relation between viewer characteristics and scenic preference has also been extensively studied. For instance, Stamps (1999) conducted a meta-analysis of how demographic characteristics affect landscape preference. He included results from 107 reports involving 3,281 landscape scenes and more than 19,000 respondents. Overall, there was high similarity between different demographic groups ($r = 0.82$), though differences may come to the surface when special interest groups contest specific landscape changes. However, how

viewer activity affects scenic preference has not been the focus of systematic investigation.

There is also a highly developed outdoor recreation literature that supports recreation planning and management. Most studies monitor the volume of recreation activity and characterize recreationists, their demographics, expenditures, and preferences (FS, 2017). Manfredo, Driver, and Tarrant (1996) used data from 36 studies, involving 12,119 respondents to conduct a meta-analysis of recreation motivation. The "enjoy nature" domain and its "scenery" scale were found to have very high internal consistency, and to be independent from other domains. Outdoor Foundation (2017) survey of recreation participation found the desire to observe scenic beauty motivated 49 percent of participants age 6 or more to get outside. This was the fourth highest motivation, behind get exercise, be with family and friends, and keep physically fit. However, evaluating the role of scenery as part of different recreation experiences was not investigated.

2. Objectives

The centrality of viewer sensitivity to the practice of VRM and VIA is clear from the above review. It is supposed that potential viewers will be more sensitive to visual impacts when engaged in some activities than in others. In most cases VIA guidance appears to leave this determination to VIA professionals, who normally have no professional training relevant to this task. In addition, the research investigating this topic is sparse.

This study provides an initial empirical examination of the role of scenery in the recreation experience of national forest visitors engaged in one of 24 primary recreation activities. The specific objectives include:

- Examine participation in viewing scenery while engaged in another primary recreation activity.
- Examine the judged importance of scenery to the overall recreation experience at the site of primary recreation activity.
- Propose an indicator of viewer sensitivity for visitors engaged in a primary recreation activity for use in VRM and VIA.

3. Methods

The data used for this study come from the FS National Visitor Use Monitoring Program (NVUM) for the years 2012 through 2016 (FS, 2018; Zarnoch, White, English, Kocis, & Arnold, 2011). The NVUM surveys the 154 national forests and grasslands managed by the FS on a five-year rotation. The information from these surveys is used to inform management and planning activities on national forests and provides metrics to measure agency and national recreation goals and standards.

The NVUM results for any forest are based on a random sample of visitors obtained at a stratified random sample of days and interview locations distributed throughout a year. The NVUM program concurrently estimates visitation volume and characteristics of visits. Consequently, a national forest's entire population of visits can be represented by the weighted individual responses. For this analysis, we use responses from over 100,000 recreation visitors obtained in the five-year period. Details of the research methods are documented in English, Kocis, Zarnoch, and Arnold (2002).

This study relies on two groups of questions from the NVUM survey: one about recreation activity participation, and the other about ratings of satisfaction and importance at the site or area of the interview. The first is a self-report of their behavior, the second is a preferential judgment.

3.1. Participation in viewing scenery

The visitor is shown a list of 28 outdoor recreation activities, grouped into five themes (Viewing and Learning Nature and Culture,

Table 1
Activity participation for national forest recreation visits, for FY2012–FY2016.

Activity	Percent of visitors who participated in this activity[a]	Percent of visitors indicating it as their primary activity[b]
Hiking or Walking	45.7	24.9
Viewing Natural Features, Scenery	43.8	12.4
Relaxing, Hanging out, Escaping	31.7	4.7
Viewing Wildlife	28.6	1.6
Driving for Pleasure	20.9	4.6
Downhill Skiing / Snowboarding	16.0	15.4
Picnicking	9.7	1.5
Fishing	9.4	5.6
Developed Camping	7.6	3.1
Nature Center Activities	6.2	0.6
Nature Study	5.7	0.3
Hunting	5.6	4.8
Visiting Historic or Prehistoric Sites	5.5	0.4
Bicycling	5.3	3.6
Gathering Forest Products	3.3	0.9
OHV Use	3.0	1.4
Motorized Trail Activity	3.0	1.2
Cross-country Skiing or Snowshoeing	2.8	2.2
Nonmotorized Water	2.8	1.4
Primitive Camping	2.7	0.6
Motorized Water Activities	2.3	0.8
Backpacking	1.8	0.7
Snowmobiling	1.6	1.4
Resort Use	1.5	0.2
Horseback Riding	1.0	0.7

[a] Survey respondents could select multiple activities so this column may total more than 100 percent.
[b] While respondents were asked to select a single primary activity, some selected more than one, so this column may total more than 100 percent.

Table 2
The percent of national forest visitors engaged in a primary activity who also participated in viewing natural scenery.

Primary Activity	View Scenery (%)	95% C.I.	
		Lower	Upper
Backpacking	69.4	67.2	71.5
Visit Historic Sites	65.1	61.5	68.5
Viewing Wildlife	57.1	55.0	59.2
Relaxing/Hanging Out etc.	55.5	54.4	56.6
Resort Use	54.3	49.3	59.0
Hiking/Walking	53.6	53.0	54.2
Nature Study	49.8	44.4	55.3
Driving for Pleasure	49.6	48.1	51.1
Primitive Camping	49.5	45.9	53.0
Developed Camping	41.3	40.0	42.6
Picnicking	40.7	38.6	42.8
Nature Centers	36.7	33.2	40.4
Horseback Riding	35.5	32.4	38.8
Nonmotorized Water Activity	33.5	31.6	35.5
Biking	33.4	31.7	35.2
Cross Country Ski/Snowshoe	30.4	28.4	32.5
Motorized Water Activity	28.5	25.8	31.3
Motorized Trail Activity	24.0	21.3	27.1
Fishing	23.2	22.2	24.2
OHV Use	23.2	20.6	26.0
Gathering Forest Products	22.3	19.4	25.4
Snowmobiling	21.9	19.5	24.5
Downhill Ski/Snowboarding	14.5	13.6	15.4
Hunting	10.4	9.4	11.6

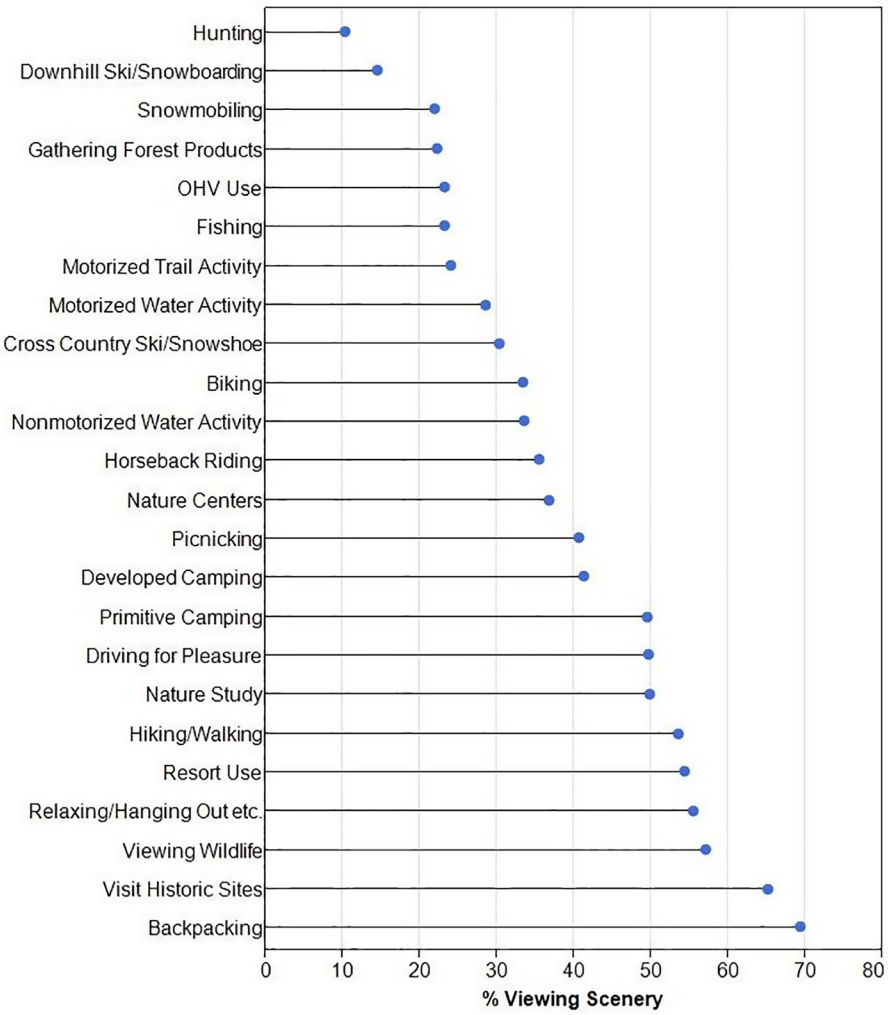

Fig. 1. The proportion of National Forest visitors by primary activity who also participated in "viewing or photographing natural features such as scenery."

Nonmotorized, Motorized, Camping or Other Overnight, and Other Activities) and asked:

Q11. In which of the following activities have you participated or will you participate during this National Forest visit?

The visitor can choose more than one activity. When they have finished, they are asked:

Q12. Which ONE of those is your primary activity for this recreation visit on this NF?

This results in each visitor identifying a primary activity that describes the purpose of their visit, and additional participating activities that contribute to their recreation experience. The cue card used to assist visitors in identifying activities is included as Appendix A. Three activities are not included in the analysis, because they are ill defined: other motorized activity (endure events, games, plane, etc.), other nonmotorized activity (swimming, games, or sports), and other activity (write in activity).

The mean percent participation values are weighted to reflect the relative level of visitation at each National Forest. This study focuses on participation in "Viewing/photographing natural features, scenery, flowers, etc." (here after referred to as "viewing scenery") while the visitor is engaged in some other primary activity. Confidence intervals are calculated for the proportion of each primary activity sample where the visitor also participates in viewing scenery using procedures described by Cumming (2012, p. 399) and Newcombe (2008).

3.2. Importance of scenery

Approximately a third of the respondents were shown a list of 16 recreation services and facilities, including "Scenery at this site/area." Visitors were asked:

Now I would like to have you rate the recreation services and quality of the recreation facilities on this Forest. As I read this list, I will ask you to rate two things. First, rate your satisfaction or dissatisfaction with the item using a scale of 1–5 where 1 means very dissatisfied and 5 means very satisfied. Next rate the importance of this item to the overall quality of your recreation experience on this trip. To rate importance use a scale from 1 to 5 where 1 means very unimportant and 5 means very important.

The adequacy of two services—signage and condition of roads—were rated for the forest as a whole, but the interviewer was instructed for the other 14 items to:

Have the visitor rate ONLY for the site or area at which you are interviewing them. It is helpful to repeat the words 'at this site' or 'at this area' or 'in this Wilderness' as you say each item.

Only respondents who reported visiting one site on the forest were included, so that it was clear they were rating the site of their primary activity. Respondents must have provided a satisfaction rating to be asked for an importance rating.

Table 3
Ratings by national forest visitors engaged in a primary activity of the importance of scenery at this site or area to the overall quality of their recreation experience.

Primary Activity	Percent		
	Not Important[a]	Somewhat Important	Very Important
Visiting Historic or Prehistoric Sites	2.0	9.1	88.8
Backpacking	1.3	12.2	86.6
Viewing Wildlife	4.4	9.2	86.4
Nature Center Activities	5.8	8.1	86.1
Driving for Pleasure	5.7	9.9	84.4
Motorized Water Activities	4.8	11.2	84.0
Relaxing, Hanging out, Escaping	3.5	12.7	83.8
Nature Study	4.1	12.7	83.2
Cross-country Skiing or Snowshoeing	4.2	12.7	83.1
Hiking or Walking	4.4	12.6	83.1
Picnicking	5.8	12.8	81.4
Developed Camping	8.1	11.7	80.2
OHV Use	7.9	12.7	79.4
Primitive Camping	8.0	13.0	79.1
Resort Use	5.1	16.1	78.8
Downhill Skiing / Snowboarding	5.7	19.1	75.2
Horseback Riding	15.0	10.0	75.1
Snowmobiling	8.1	17.4	74.6
Bicycling	9.0	17.9	73.1
Nonmotorized Water	8.1	19.1	72.8
Fishing	12.0	16.4	71.6
Gathering Forest Products	12.1	21.2	66.7
Motorized Trail Activity	22.6	21.3	56.0
Hunting	29.9	16.6	53.6

[a] "Not important" is the sum of three ratings: very unimportant, somewhat unimportant, and neither unimportant nor important.

3.3. Index of viewer sensitivity

The NVUM provides two measures of the sensitivity of viewers engaged in different primary activities to the surrounding scenery, one behavioral and the other a preferential judgement. Both are expressed as percentage—the percent of visitors engaged in a primary activity who also engaged in viewing scenery, and the percent of visitors engaged in a primary activity who rated the scenery at the recreation site as very important to their overall recreation experience. The following procedure was used to standardize these two measures and combine them to create an index of viewer sensitivity.

The percentage of visitors engaged in each primary activity who participated in viewing scenery was rescaled so that the primary activity with the highest participation in viewing scenery had a value of 1.0 and the lowest had a value of 0. The general formula for this linear transformation is:

$$Range_{participation} = (x - Min_{participation})/(Max_{participation} - Min_{participation})$$

A similar transformation is performed for the percentage of visitors engaged in each primary activity who judged scenery as being very important (i.e., $Range_{very\ important}$)

The Range values for participation in viewing scenery and scenery being very importance are averaged for each primary activity.

$$Range_{avg.} = (Range_{participation} + Range_{very\cdot important}) / 2$$

This average value is simplified to an integer rating:

$$IVS = Round((Range_{avg.} * 5) + 0.5)$$

The result is a five-point Index of Viewer Sensitivity (IVS).

4. Results

4.1. Visitor participation

The results of the 2012–2016 NVUM estimate that national forests support 148 million recreation visits annually (FS, 2018). The distribution of participation in 25 activities is reported in Table 1. Forty-four percent of visitors engage in "viewing or photographing natural features such as scenery," making it the second most common activity, just behind hiking or walking (46%). Participation was greater than 10 percent for only four additional activities: relaxing and hanging out (32%), viewing wildlife (29%), driving for pleasure (21%) and downhill skiing (16%). Viewing natural features and scenery is the third most common primary activity at 12 percent, after hiking or walking (25%) and downhill skiing/snowboarding (15%); these three are the only primary activities engaged in by more than 10 percent of visitors. While these results indicate that a few activities dominate recreation visits, they also indicate that visitors participate in a great number of other activities, which may also be the primary purpose of the visit.

While visitors identified a single primary activity, they may also have participated in other activities. Appendix B reports the participation in all of the activities as a percent of main activity visits.

4.2. Viewing scenery and primary activity

The proportion of National Forest visitors participating in "viewing or photographing natural features such as scenery" for each of the primary recreation activities is shown in Table 2, along with the confidence intervals for the proportion. Fig. 1 makes it easier to visualize the extent of participation in viewing scenery while engaged in a primary activity. The extremes are most easily identified: viewing scenery is very common for those whose primary activity is backpacking and visiting historic sites; it is very uncommon for those hunting or downhill skiing. There is also a clear group for which viewing scenery is common: viewing wildlife, relaxing and hanging out, resort use, and hiking or walking. Three more activities might be part of this common group: nature study, driving for pleasure, and primitive camping. On the other side there is a group of activities where viewing scenery is relatively uncommon: snowmobiling, gathering forest products, driving OHVs, fishing, and motorized trail activity. For participants in the remaining activities, view scenery as neither relatively common nor uncommon: motorized water activities, and cross-country skiing or snowshoeing, biking, nonmotorized water activities, horseback riding, nature centers, picnicking, and developed camping.

4.3. Importance of scenery and primary activity

A third of respondents to the NVUM were asked to evaluate "the importance of [scenery at this site or area] to the overall quality of your recreation experience on this trip." The results are reported in Table 3 and graphed in Fig. 2. In general, national forests are located in scenic landscapes and these results show that a majority of visitors judge this scenery to make a very important contribution to their overall recreation experience whatever their primary activity is. Nonetheless, there is significant variation in the importance of scenery among the primary activities. In particular, scenery was judged as not important (i.e., very unimportant, somewhat unimportant, and neither unimportant nor important) by a substantial proportion of visitors whose primary activity was hunting, motorized trail activity, horseback riding, gathering forest products, and fishing.

4.4. Index of viewer sensitivity

The behavioral measure of participation in viewing scenery and the perceptual judgement of the importance of scenery to the recreation experience provide somewhat different approaches to determining the

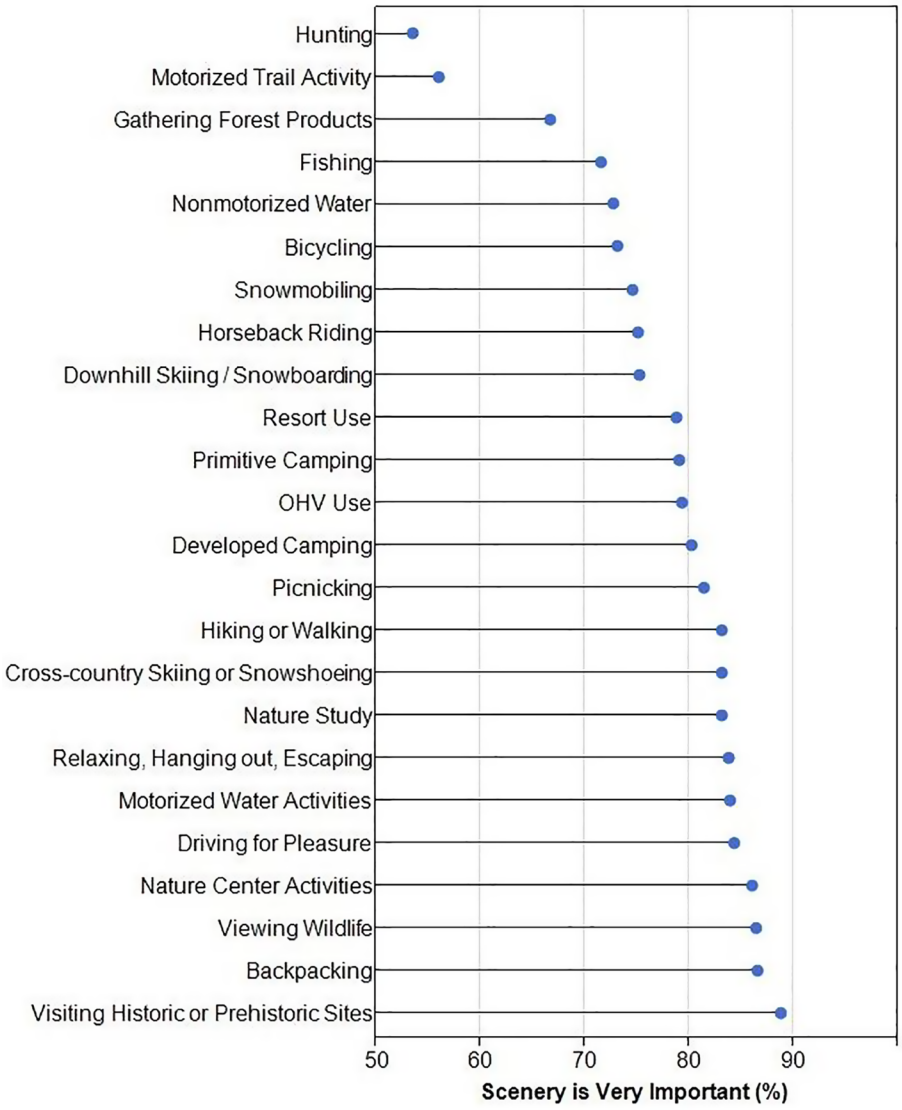

Fig. 2. The proportion of National Forest visitors who rated ""the importance of [scenery at this site or area] to the overall quality of your recreation experience on this trip" as very important.

sensitivity people engaged in a primary recreation activity have to scenic quality. The ranged values for viewing scenery participation and judged importance of scenery are given in Table 4 for each primary activity. These values are averaged and converted to an integer rating between 1 for very low viewer sensitivity and 5 for very high viewer sensitivity. This rating is an index of viewer sensitivity for the 24 primary recreation activities.

A comparison of the ranged values in Table 4 indicates where the two approaches to measuring sensitivity to scenery are in generally agreement; the Pearson correlation is 0.715. In particular there is agreement about the activities when viewers are most sensitive (i.e., backpacking, visiting historic sites, relaxing and hanging out, and viewing wildlife) and when viewers are least sensitive activities (i.e., hunting, and motorized trail activity). The index of viewer sensitivity appears to capture the information represented by both participating in viewing scenery (Spearman rank-order correlation is 0.950) and judged importance of scenery (Spearman rank-order correlation is 0.880).

The largest differences between the two approaches occur for a group of activities where the ranged value for participation in viewing scenery is much less of the value for judged importance of scenery: snowmobiling, nature center activities, cross-country skiing, OHV use, downhill skiing, and motorized water activities. It may be that scenery has low importance for these primary activities, but there is participation in a secondary activity where viewing scenery is very important, such as relaxing and hanging out.

5. Discussion

This paper provides information that is useful to more objectively make determinations about the role of viewing scenery as part of different recreation activities in national forests. It is anticipated that this information will be useful to professionals engaged in VRM and VIA. While the general pattern of viewer sensitivity among primary activities is shown in Figs. 1 and 2, there may still be significant variation among individual national forests, which exhibit their own unique landscape character and mix of recreation opportunities. As a result, the viewer sensitivity of people engaged in the various primary recreation activities may vary significantly across national forest and other similar recreation settings. The recreation opportunity spectrum (ROS) is a management tool intended to capture this variation in settings, and future research may investigate whether this variation among recreation settings is related to the ROS class where the activity occurs.

It is also important to consider that establishing the concern level in VRM or VIA involves more than simply identifying viewer sensitivity.

Table 4
Index of viewer sensitivity for national forest visitors engaged in a primary activity.

Primary Activity	Ranged Values		Index of Viewer Sensitivity[a]
	Participation	Importance	
Backpacking	1.00	0.94	5
Relaxing, Hanging out, Escaping	0.76	0.86	5
Viewing Wildlife	0.79	0.93	5
Visiting Historic or Prehistoric Sites	0.93	1.00	5
Developed Camping	0.52	0.76	4
Driving for Pleasure	0.66	0.87	4
Hiking or Walking	0.73	0.84	4
Nature Center Activities	0.45	0.92	4
Nature Study	0.67	0.84	4
Picnicking	0.51	0.79	4
Primitive Camping	0.66	0.72	4
Resort Use	0.74	0.72	4
Bicycling	0.39	0.55	3
Cross-country Skiing or Snowshoeing	0.34	0.84	3
Horseback Riding	0.43	0.61	3
Motorized Water Activities	0.31	0.86	3
Nonmotorized Water	0.39	0.55	3
OHV Use	0.22	0.73	3
Downhill Skiing / Snowboarding	0.07	0.61	2
Fishing	0.22	0.51	2
Gathering Forest Products	0.20	0.37	2
Snowmobiling	0.19	0.60	2
Motorized Trail Activity	0.23	0.07	1
Hunting	0.00	0.00	1

[a] Index of Viewer Sensitivity ranges from (1) very low sensitivity, to (5) very high sensitivity.

Table 5
Criteria for viewer experience importance weights used in the northern pass transmission project visual impact assessment.

Importance	Rating	Criteria
Very High	5	Scenery is the primary part of a high-quality experience
High	4	Scenery is an important part of a high-quality experience
Moderate	3	Scenery may complement but is not essential to a high-quality experience
Low	2	Scenery is irrelevant to a high-quality experience
Very Low	1	Scenery plays no role in the experience (i.e., there are no views)

The concentration of viewers affected must also play a role in this determination. While the absolute number of viewers is important, ROS also provides guidelines for the relative concentration of visitors in different types of settings (Ackerman, Hass and Associates, 2011). For instance, the White Mountain Trail National Scenic Byway circling through the White Mountain National Forest includes a portion of Interstate 93, which has an annual average daily traffic of 8300 vehicles. In contrast, during peak season there can be hundreds of hikers on the Appalachian National Scenic Trail in the back country. Traffic on I-93 is relatively light compared to normal traffic levels on Interstate highways, and use of the ANST is very heavy for a backcountry trail. Methods must be investigated to sort out how to best account for the relative importance of intensity of use for various primary activities at particular sites.

It is anticipated that the application of the index of viewer sensitivity makes the most sense at viewpoints or relatively discrete areas where it is easy to identify the primary recreation activity. When planning for large areas, or in areas experiencing competing non-recreation or diverse recreation use demands it will be particularly important to consider sensitivity measures as part of a larger inventory and planning process that evaluates landscape scenic quality as well as other resource values.

In the absence of site-specific empirical data, we recommend using the index of viewer sensitivity presented in Table 4. These may be adjusted slightly based on local conditions such as the regional popularity of the location for the activity or its reputation for spectacular scenery. Any adjustments should be made in consultation with local scenic resources managers. A next step would be to develop a standard rapid assessment procedure to conduct fieldwork and interviews with scenic resource managers to determine the use areas, intensity of use, and viewer sensitivity for various primary activities. Such a step would help validate BLM's determination of visual sensitivity and the FS's determination of concern levels.

5.1. Application of viewer sensitivity in a visual impact assessment

The reaction of some professionals might be that these results are obvious and that there is really no need for a formal guidance. In response, we offer as an example how viewer sensitivity was evaluated in a recent VIA of the Northern Pass Transmission Project (NPTP) prepared for the US Department of Energy (Boyle Associates, 2017).

NPTP is a 192-mile-long 1090 MW transmission line that was proposed to bring hydropower from Canada to New England. The corridor is entirely within the state of New Hampshire, which maintains a GIS database of recreation areas, that includes the area's primary recreation activity (NHOEP, 2009). Viewer sensitivity was defined by evaluating the role of scenery for viewers engaged in various activities, as described in Table 5.

In the absence of research on the importance of viewing scenery while engaged in another primary recreation activity, the VIA professionals relied on their personal experience to evaluate the importance of scenery to the primary activity reported in a designated recreation area database. The ratings for the importance of scenery to 11 activities or areas and why that rating was assigned are given in Table 6.

We have matched the NPTP VIA sensitivity ratings for activities/areas in Table 6 to the index of viewer sensitivity in Table 4. There are

Table 6
Importance of scenery ratings used in the northern pass transmission project visual impact assessment.

Activity	Importance	Comment
Scenic Road	5	Scenic appreciation central to this activity, especially for passengers
Trail area or Hiking trail	5	Area often selected for its scenic attributes—scenic appreciation often mentioned as part of the hiking experience
Campground	4	Area often selected because it is scenic—scenic appreciation often mentioned
Picnic Area	4	Area often selected because it is scenic—scenic appreciation often mentioned
Recreation resort	4	Area often selected because it is scenic—scenic appreciation often mentioned
Fishing	3	Often in scenic areas, but requires focused attention away from scenery
Hunting	3	Often in scenic areas, but requires focused attention away from scenery
Snow Ski Area	3	Often in scenic areas, but requires focused attention away from scenery
Water Sports Area	3	Often in scenic areas, but requires focused attention away from scenery
Winter Sports Area	3	Often in scenic areas, but requires focused attention away from scenery
Historic	2	Typically indoors, or focused on architecture

11 NVUM activities for which we identified a match. Kendall's Tau is used to measure the relationship because it is more appropriate for small samples and tied ranks. The strength of the result ($\tau = 0.357$) might be interpreted as "medium" by many social scientists (Cohen, 1988); however, this level of consistency would be judged inadequate for professional use (Palmer & Hoffman, 2001). This suggests that using an empirically derived index of viewer sensitivity as an alternative to the judgement of landscape architects may provide a substantial contribution to the preparation of VIAs.

6. Conclusions

Viewing scenery is the second most common activity associated with recreation visits to national forests, and the third most common primary activity. However, whether viewing scenery is an activity during a recreation visit and its importance to the overall recreation experience varies widely depending on the visit's primary recreation activity, as summarized in Table 4.

Many of the activities with lower viewer sensitivity seem to be ones either where the participant is focused on a foreground subject to be located and acquired (e.g., hunting elk, fishing for trout, or gathering huckleberries), or the activity involves the thrill of travel that may either happen at higher speeds or may require concentrated attention to navigate hazards (e.g., skiing a mogul field, avoiding obstacles driving an ATV, or running river rapids). An exception appears to be driving for pleasure, where the predictability of maintained paved roads as well as viewshed management can allow both driver and passengers more opportunity to enjoy the scenery.

On the other hand, many activities having higher levels of importance ascribed to viewing scenery include other viewing-related activities (e.g., wildlife, historic sites, or nature study), or slower paced activities where the participant is immersed in the landscape (e.g., hiking or backpacking). These activities also seem to provide the greatest opportunity for contemplative time (e.g., hanging out or visiting a historic site).

This study appears to be the first to investigate participation in viewing scenery and the judged importance of scenery across a large number of other primary activities. The NVUM data used for this purpose are based on a random sample of visits to national forests. Sampling methods used in generating the data are used systematically in all National Forest units. It is reasonable to expect that the viewer sensitivity results obtained in this study can be extended to similar settings.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.landurbplan.2019.03.006.

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