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Accounting for Trip Frequency in Importance-Performance Analysis

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EXECUTIVE SUMMARY: Understanding customer satisfaction is critical to the successful operation of both privately and publicly managed recreation venues. A popular tool for assessing recreation visitor satisfaction is Importance-Performance Analysis (IPA). IPA provides resource managers, government officials, and private businesses with easy-to-understand and -use information about visitor preferences and satisfaction for selected site characteristics and management issues. Many improvements have been made to IPA since its inception, strengthening the validity of results and providing managers with knowledge for better decision making. This study adds to this list of improvements by examining the effect of trip frequency bias, or endogenous stratification, on IPA scores and then demonstrating a simple bias correction procedure. The issue of endogenous stratification was examined with three variations of an on-site sample of visitors to the Virginia Creeper Trail (VCT). Statistical tests for differences between the typical calculation of IPA scores and a weighting procedure which corrects for endogenous stratification or trip frequency bias were conducted. Findings suggested that accounting for bias, resulting from over-representation of frequent visitors, can lead to IPA results statistically different from those more conventionally calculated. By adjusting for endogenous stratification, the IPA graphs in this study provide a more accurate picture of the tastes and preferences of the visitor population. For managers, conventionally calculated IPA could lead to misclassifying the importance or performance of site characteristics or features into the wrong IPA quadrant and thus adversely affecting management of site resources.

KEYWORDS: Recreation management, user satisfaction, importance-performance analysis, trip frequency bias, endogenous stratification

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It is well known in the private sector that understanding customer preferences is critical to satisfying customers and running a successful business. The same principle is true with respect to parks and recreation management; better understanding "customer" preferences is a key component towards increasing recreation experience satisfaction and developing successful parks and recreation management strategies. A popular tool for assessing customer satisfaction with public recreation sites and opportunities is Importance-Performance Analysis (IPA). IPA elicits information from site visitors or users on the importance of on-site attributes and their satisfaction with the performance or condition of those attributes (Guadagnolo, 1985).

Since its introduction by Martilla and James (1977), examples of IPA applications can be found over a range of research topics including health care (Cunningham & Gaeth, 1989), banking and finance (Ennew et al., 1993), education (Alberty & Mihalik, 1991), and travel and tourism (Vaske et al., 1996). The first study applying IPA to a recreation setting was the evaluation of participant satisfaction with a 10K running race event (Guadagnolo, 1985). IPA has since been applied to evaluate satisfaction with various recreation venues and services such as visitor centers (Mengak et al., 1986), state park cabins (Hollenhorst et al., 1992), wilderness areas (Hollenhorst & Gardner,1994), and alpine ski areas (Hudson & Shephard, 1998). A core construct of IPA is the recognition that customer satisfaction is a function of both importance, i.e., what the attribute is worth to the user, and performance, i.e., how well the attribute is provided (Bruyere et al., 2002). Attractive aspects of IPA for managers and researchers alike include the ease in which it can be performed, straightforward interpretive ability of results, and its ability to capture user input for management decisions (Martilla & James, 1977; Bruyere et al., 2002; Tarrant & Smith, 2002; Hendricks et al., 2004).

In the case of a public recreation site, IPA provides public resource managers, government officials, and private businesses that cater to site visitors with easy-to-understand information about visitor preferences and satisfaction for selected site characteristics and management issues. Data for IPA is most often obtained through on-site sampling and survey methodology. This allows managers to capture information directly from the users themselves.

A potential statistical and management problem with on-site recreation surveys is that opinions and preferences reflected in survey responses may be biased toward the most frequent users, since they are more likely to be captured in the survey. That is, survey responses may not accurately reflect the preferences of the site user population as a whole. In previous studies, failure to account for this "avidity bias" or "trip frequency bias" has been shown to lead to inaccurate estimates of user preferences and values including over-estimates of recreation demand and economic impact measures (Shaw, 1988; Loomis, 2007). When on-site surveys are used to gather data on user preferences and satisfaction for the purpose of improving recreation site management decisions, failure to account for this phenomenon could lead to misguided provision of site facilities and amenities that are most important to site users resulting in reduced recreation experience satisfaction and/or site visitation.

The primary purpose of this paper is to report on a study of the effects of trip frequency on IPA estimates of recreation site preferences, and the implications of these effects on parks and recreation management. The case study site was the Virginia Creeper Rail Trail (VCT) in southwestern Virginia, which is managed by the USDA Forest Service (USFS) and other public and private partners. In the next section of this paper, the general IPA model for measuring recreation user preferences is presented. Following this presentation of the general IPA model, we discuss the potential effects of endogenous stratification or avidity bias on IPA results. Next, we discuss the importance of considering market or user segmentation when analyzing IPA results.

We then describe an empirical test of avidity bias or endogenous stratification which contrasts and statistically tests for differences between conventionally calculated IPA results and adjusted or weighted IPA results, wherein the potential effects of trip frequency bias are mitigated. These results show that failure to account for trip frequency in on-site samples may lead to erroneous perceptions of recreation user preferences. The implications of these empirical test results for parks and recreation management are then discussed. We conclude that our methods, which account for trip frequency or avidity bias, provide recreation researchers and managers of the VCT and other recreation sites with an important and useful research and management tool which can be applied to better understanding recreation user preferences and improve site management decisions.

Conceptual Background

The General IPA Model

Importance-Performance Analysis (IPA) involves a three-step process: (1) identification of management-influenced attributes associated with a venue/service, (2) analysis of these attributes based on user data that rates attribute importance and performance (typically Likert scales), and (3) graphical presentation of the results (Hendricks et al., 2004). This final step generates perhaps the most recognizable aspect of IPA, which are data coordinates based on mean importance/performance ratings for an attribute or feature. These coordinates are superimposed on a four-quadrant graph.

The graph is constructed based on the mean value of the importance/performance scale and provides insight for future management recommendations for each attribute based on its position in one of the four quadrants. The intersection of importance/performance axes is a critical aspect of IPA with potential impact on interpretation. Some IPA studies determine the intersection based on the mean value of importance and performance of observed attributes. However, recent research has shown that this placement can lead to problems with interpretation and recommended mean centering of the importance/performance scale (Oh, 2001).

Graphical representation of IPA results is ambiguous with respect to choice of importance and performance axes. Martilla and James (1977) plotted attribute importance along the y axis and performance along the x axis, as did Hendricks et al. (2004). However, other IPA studies have transposed this placement with importance plotted on the x axis and performance on the y axis (Vaske et al., 1996; Huan et al., 2002). This choice is a researcher judgment and does not affect the outcome of analysis.

With importance plotted on the x axis and performance on the y axis, the upper right quadrant can be described as "good work" since attribute importance is high and current performance is good. The upper left quadrant could be categorized as the "over emphasis" quadrant. Attributes found in this quadrant are less important despite above average performance. Within the lower left or "low priority" quadrant, attributes are relatively less important and relatively less well provided. Lastly, the "needs work" quadrant is the lower right, where attribute importance is relatively high but, current performance is below average.

Several conceptual problems have been identified and addressed when using IPA. These include the static nature of attribute evaluation (Tyrrell & Okrant, 2004), market segmentation (Bruyere et al., 2002), conflicts between the use of means or medians to plot data coordinates (Hendricks et al., 2004), small sample sizes and their statistical relevance (Oh, 2001), correlation between importance and performance variables (Oh, 2001), and the importance of precision in relation to IPA means (Tarrant & Smith, 2002). Many of these methodological issues were first raised when using IPA to investigate outdoor recreation venues. In most cases, the studies were performed using some form of on-site sampling procedure. While the literature has addressed, and in many cases provided, viable corrections for other IPA maladies, no known literature exists that has explored the potential bias that can be introduced as a result of on-site sampling.

Endogenous Stratification and Trip Frequency Bias

On-site survey sampling has been shown to suffer from at least two maladies that affect modeling individual recreation behavior or attitudes: length-of-stay bias (Loomis, 2007) and endogenous stratification (Shaw, 1988). Length-of-stay bias, encountered with intercept sampling, can occur as those staying at a site longer are more likely to be captured in the on-site sample. Sampling only last exiting (leaving the site for the final time in a given visit/trip) or first entering (entering the site for the first time in a given visit/trip) visitors will avoid this problem.

Endogenous stratification or trip-frequency bias occurs due to the higher probability of sampling frequent visitors when intercept, last-exiting, or first-entering sampling is used on-site (Shaw, 1988; Englin & Shonkwiler, 1995). Consider two visitors both visiting a site and staying one day. If one visits once per year and the other 14 times per year, then even with a properly designed and administered exit sample, the latter is 14 times more likely to appear in the sample. If trip frequency is related to an underlying population parameter of interest, then without adjusting for this phenomenon, a bias may be introduced.

Shaw (1988) identified and demonstrated the effects of trip frequency bias in a camping study and provided a corrective equation. Englin and Shonkwiler (1995) developed an estimator that corrected for trip frequency in the context of modeling the demand for and the economic value of access to recreation in public, officially designated U.S. Wilderness Areas. Ovaskainen et al. (2001), in a study of forest recreation, showed that sometimes the effects of endogenous stratification are minimal. However, Nakatani and Sato (2005) expanded Englin and Shonkwiler's (1995) demand estimators across a number of discrete distributions and showed that failing to account for endogenous stratification can lead to large over-estimates of economic benefits derived from recreation access to a site.

Loomis (2007) showed that avidity bias could affect estimates of on-site recreation spending and thus economic impacts. Loomis (2007) also makes the point that if aggregate visit estimation to a site is to be derived solely from the sample, i.e., no other pulse counters like traffic or infrared counters, then an endogenously stratified sample will lead to an over-estimate of annual visits as the sample mean of visits per individual will be biased by the disproportionate inclusion of higher frequency users.

There are no studies to date that have explored the effect of trip frequency on IPA. However, from a conceptual standpoint, it stands to reason that endogenous stratification has the potential to bias the results of IPA when samples originate from on-site capture methods.

Market or User Segmentation

Market or user segmentation is a common practice in various types of research that allows for the capturing of detailed information about the preferences of various sub-populations that make up the users of a recreation resource. Segmentation allows for improved management and marketing as the understanding of preferences and attitudes from distinct users groups becomes clearer (Jurowski et al., 1993). This is of particular importance at recreation sites such as national parks faced with the tasks of both protecting natural resources and attracting visitors.

In the case of IPA, sample segmentation based on homogenous user groups is an important step in gaining an accurate picture of management issues (Vaske et al., 1996; Frochot & Morrison 2000; Huan et al., 2002; Wade & Eagles, 2003). Vaske et al. (1996) argued that failure to account for the divergent interests of a heterogeneous population of users can lead to sub-optimal management solutions. If the goal is to use IPA to provide an optimal management strategy for multiple interests, it is paramount to consider the importance/performance from the context of differing user types. Hendricks et al. (2004) extended the segmentation concept to benefit-based groupings showing that this type of segmentation can greatly enhance the capability of IPA to provide clear data for management decisions. Benefits-based segmentation has been employed using a number of criterion, including use type or primary activity, geographic origin, age, gender, or specific attributes (Backman, 1994).

Of specific relevance to this study, geographic origin as a segmentation marker has been employed in previous IPA research focusing on recreation and natural resource management (Tarrant et al., 1999; Bruyere et al., 2002). Segmenting by local versus nonlocal users is an example of segmenting by geographic origin (Wedel & Kamakura, 2000) and is very common in studies where economic impacts are estimated. Intuitively, any segmentation procedure, which is highly correlated with trip frequency, could mitigate the potential effects of trip frequency bias.

Empirical Test of Trip Frequency Bias

Study Area

The Virginia Creeper Trail (VCT), located off U.S. Interstate Highway 81 in southwestern Virginia, is often considered a model for rail-trail development. The VCT has become a destination for rail trail enthusiasts with users traveling from as far away as California and Canada to visit (Bowker et al., 2007). Management of the VCT is an interesting mix with half the corridor owned and managed by the federal government and half privately owned and managed by local governments, creating a unique collaboration between city, county, and federal governments with additional input from private owners and volunteers. The 34-mile trail extends from the city of Abingdon,VA (elevation 2,065 ft) to Whitetop Station in the Washington-Jefferson National Forest, VA (elevation 3,576 ft), with the midpoint located in the town of Damascus, VA.. The trail is completely contained within two counties, Washington and Grayson. The VCT has nine major public access points along its length. Permitted activities on the trail include travel by foot, horseback, or bicycle.

Data Collection

Data for this study were obtained using a stratified random sample of site days on the VCT (Cochran, 1977; English et al., 2002). Strata were selected based on historical exit volumes at the nine exit sites. Without previous records, volumes were derived through focus group meeting with local trail-related business people, members of the Virginia Creeper Trail Club, and personnel familiar with the VCT from both the Virginia Department of Conservation and Recreation and the U.S. Forest Service. Strata were defined by two seasons (winter, summer), two exit volume types (high volume for Abingdon and Damascus, low volume for the remaining seven exit points) and three day types (Saturdays; Sundays/Fridays/holidays; and non-holiday weekdays). Thus, a Friday in July in Damascus would fall into the same stratum as a Sunday in August in Abingdon.

Trained interviewers counted exiting trail users and employed a two-staged (screener and survey) procedure to administer questionnaires. First, a screener was used to determine if the trail user was exiting and whether he or she was a local or nonlocal (living or working within the two-county area or not). Additional information recorded by each screener via observation included race, group size, gender, activity mode, and approximate age ($\geq$16 or <16)[1]. The screener process was concluded by asking exiting individuals to participate in a detailed five-minute interview.

Based on screener response, the exiting user received a detailed local questionnaire or one of two non-local questionnaires (NLA or NLB). Local and NLA versions were "management centered," containing questions about benefits associated with trail use, the importance and condition or performance of trail and area attributes, use fees, and acceptable trail uses. Respondents to the local and NLA questionnaires were asked to use a 4-point Likert scale to rate two categories of attributes, those immediately related to the trail and those related to complementary area features. The eight trail attributes were: safety/security, crowding, parking, scenery, restrooms, user conflicts, trail surface, and structures/bridges. The nine area features were: lodging, trail camping, campgrounds, restaurants, shopping, historical attractions, outdoor attractions, bike/shuttle rentals, and guide services. Each attribute and feature was rated for importance and condition/performance. Importance rating options were high, medium, low, or none, and performance/condition options were excellent, good, fair, or poor. Each of these scales employed a 1 to 4 measurement, 1 being none or poor and 4 being high or excellent. Coordinates for importance/performance on the IPA graph was based on mean response for each attribute.

The NLB version had an economic focus, containing detailed trip expenditure questions (Bowker et al., 2007). This survey instrument satisfied the requirements of the original study and sought to generate the information needed to estimate the economic impact on local communities from non-local trips to visit the VCT. During sampling, the trained surveyors were instructed to distribute the NLB survey in a 3:1 ratio to NLA distribution. This was done to ensure that estimates for economic impact were based on a robust dataset and because locals are typically not included in such analyses. Common to all questionnaires were sections about current trip characteristics, annual use, and household demographics.

Survey methodology and instruments were vetted among an expert panel of local and federal managers, local business owners, and members of the VCT Club. Pre-testing of the instrument was also performed on trail users during successive weekends two months before the one-year sampling effort commenced (November 2002 through October 2003). The pre-test resulted in the original non-local survey being broken into management and economic versions to accommodate the five-minute time constraint.

Primary Data

A total of 1,430 screeners were administered during the sampling period with 1,308 (91%) providing useable information from exiting visitors. The number of local users screened totaled 618 (47%), while non-local screeners totaled 690 (53%). Of these 1,308 persons, 1,036 (79%) completed a detailed survey questionnaire that contained all requisite information for analysis.

For the purposes of this study, the primary dataset was reduced to a combined dataset containing 547 observations (after deleting NLB surveys, non-primary purpose trips, and incompletes). The NLB version of the survey was not included in this analysis since the questionnaire did not elicit any "management centered" information. Univariate analysis on the dataset's continuous variables was used to identify potential outliers. Any observation that exceeded the 99th percentile for one or more continuous variables was deleted from the final dataset used for analysis. Variables used for outlier analysis included: time on trail, distance traveled on trail, number in party, nights spent in area, times trail was visited during trip, trips in previous 12 months, household size, household trail users, distance traveled to the trail, and time spent in travel to the trail. This process identified 26 observations that were outside the 99th percentile, reducing the sample to 521 observations (417 locals and 104 non-locals). Sample sizes used for analysis in this study are consistent with samples and subsamples in previously published IPA research (Tarrant & Smith, 2002; Wade & Eagles, 2003; Hendricks et al., 2004).

Data Analyses

As previously discussed, on-site sampling can introduce two forms of bias: length-of-stay bias and endogenous stratification or trip-frequency bias. By using exit sampling, length-of-stay bias is avoided. To adjust sample means for endogenous stratification, each observation was weighted by the inverse of the observation's reported annual visits. This particular weighting strategy is useful since the application of IPA involves calculating the mean of observations using a Likert scale, rather than nonlinear regression demand models. This solution avoids the need for complex data manipulations and modeling requirements while easily being accomplished using standard spreadsheets or analytical software common to social sciences. The weighting procedure is an adaptation to IPA of the correction Loomis (2007) applied to estimates of rafting expenditures and can be expressed as:

$$\overline{x}_{jw} = 1/\mathrm{n} * \sum_{i=1}^{N} w_i X_{ij} \qquad (1)$$

where, $\overline{x}_{jw}$ = weighted mean for attribute j, n = sample size, w_i = weight (inverse of annual visits) for individual i, and X_{ij} = the Likert score for attribute j by individual i. It is important to note that this weighting procedure is appropriate when the analysis is intended to apply to individual attitudes or behavior. This procedure would be inappropriate if management wished to assign more importance to the opinions of frequent users, as is sometimes the case.

A t-test for means from samples with unequal variances (Trochim, 2006) was used to test the null hypothesis of congruency between the conventionally calculated means typically used in IPA and the means adjusted to correct for endogenous stratification. Moreover, because it is possible that segmenting may, when correlated with trip frequency as in the case of local-nonlocal segmentation, mitigate some of the trip-frequency bias, we performed our analysis on the combined sample, and on each of the local and nonlocal segments.

Within each dataset, a test for collinearity between importance and performance variables for each trail attribute and area feature was performed. Oh (2001) posited that correlation between importance and performance variables can decrease the effectiveness of findings and management solutions offered by IPA due to the inability to interpret the actual effects of each attribute's importance and performance. Correlation matrices were created using Statistical Analysis Software (SAS, 2004). Since the management variables

were ordinal data, a Spearman's rank coefficient was used (Zar, 1972). When Spearman's coefficient is used with datasets exceeding 100 observations, a transformation is needed to determine if collinearity is present. Zar (1972) found that converting the Spearman's coefficient to a Student-t distribution produced reliable results. The conversion takes the form:

$$t = \frac{\rho}{\sqrt{(1-\rho\text{^}2)/(n-2)}} \qquad (2)$$

where, t = the test statistic, ρ = Spearman coefficient and n = number of observations. A two-tailed t-test was used in this case because there was no a priori expectation that correlation between importance and condition would be positive or negative. The absence of collinearity could not be rejected.

Once diagnostics were completed, the respective IPA calculations were performed. Data coordinates corresponding to mean importance and performance responses for trail attributes and area features were placed on a four-quadrant grid. Grids are typically centered either by response means (Hendricks et al., 2004) or by scale means (Martilla & James, 1977; Oh, 2001; Tarrant & Smith, 2002). The latter approach was employed here, as this method allows for clear interpretation by the researcher, manager, and layperson, while also facilitating comparison across management variables. Findings showed that when the origin is defined based on the actual means for importance and performance, adjustments are needed to allow for accurate interpretation of ratings (Oh, 2001).

Following Tarrant and Smith (2002), a crosshair for each importance/performance coordinate was included by calculating the standard error for mean response. This creates a two-dimensional confidence interval for mean response and allows the identification of instances where mean response extends beyond the boundaries of a single quadrant, thereby making it difficult to interpret findings and offer definitive management recommendation for the variable in question.

Results

VCT users were predominately Caucasian (99%), male (60%), and college educated (61%). Average respondent age was 47 years old, and average reported income was $63,000. When decomposed, local users were older (48) and reported a lower average household income ($59,000), than non-locals (45 and $116,000). Sixty-one percent of VCT users were employed. However, the local population reported a higher incidence of retirement among users (26%) than the non-local population (17%). The primary activity while on the VCT was walking/jogging for 56% of users in the combined sample. Walking/jogging was the primarily a local-use activity (65%) followed by biking, camping, fishing, viewing nature, and horseback riding. Non-locals were found to predominately use the VCT as a biking venue (77%).

Combined Sample IPA

Table 1 presents the weighted and unweighted means for the importance and performance of trail attributes and area features from the combined sample (n=521). For trail attributes and area features, statistically significant differences were found when trip-frequency bias was accounted for over the majority of importance and performance variables. With respect to importance, congruence was rejected for 12 out of 17 (71%) management variable means. There were no significant differences found in mean response for the importance of crowding, scenery, conflicts, historical attractions, and outdoor attractions. Mean responses for both weighted and unweighted samples indicate a consistently higher importance rating of importance for trail attributes (first eight variables in Table 1) than area features (last nine variables in Table 1).

Table 1. Mean Importance and Performance of Trail Attributes and Area Features: Combined Sample, N=521.

		Unweighted	Weighted
Safety/Security	importance	3.77	3.83*
	performance	3.45	3.57*
Crowding	importance	3.14	3.21
	performance	3.33	3.51*
Parking	importance	3.19	3.31*
	performance	3.41	3.56*
Scenery	importance	3.83	3.87
	performance	3.70	3.84*
Restrooms	importance	3.33	3.46*
	performance	3.44	3.60*
Conflicts	importance	3.08	3.04
	performance	3.43	3.63*
Trail Surface	importance	3.58	3.47*
	performance	3.24	3.46*
Trail Structures	importance	3.71	3.59*
	performance	3.45	3.69*
Lodging	importance	1.66	2.34*
	performance	3.21	3.42
Trail Camping	importance	1.75	1.99*
	performance	2.84	3.10*
Campgrounds	importance	1.79	2.04*
	performance	2.90	3.09*
Restaurants	importance	2.69	3.12*
	performance	3.15	3.20
Shopping	importance	1.87	2.00*
	performance	3.01	2.98
Historical Attractions	importance	2.67	2.71
	performance	3.29	3.31
Outdoor Attractions	importance	2.98	2.99
	performance	3.43	3.58*
Bike/Shuttle Rental	importance	2.41	3.10*
	performance	3.44	3.59*
Guide Services	importance	1.69	1.90*
	performance	2.89	3.12*

Importance: 4=high, 3=medium, 2=low, 1=none Performance: 4=Excellent, 3=good, 2=fair, 1=poor
**significant at the $\alpha = 0.05$ level*

The largest practical differences in mean importance from weighted and unweighted samples were for lodging (41%), bike/shuttle rentals (29%), restaurants (16%), trail camping and campgrounds (14%), and guide services (12%). In all cases, the higher mean was for the weighted sample. Two attributes, trail surface and trail structures, saw a significant decrease in mean response after adjusting for endogenous stratification. The mean response for the remainder of trail attributes and area features was consistently higher when the weighting adjustment was applied.

Mean response for performance between the weighted and unweighted samples for management variables was statistically different for 13 out of 17 management variables (76%). Management variables showing no statistical difference for performance when adjusted for trip frequency included lodging, restaurants, shopping, and historical attractions —all area features. In every case, the difference in mean response for performance variables was higher when measures after adjustment to account for endogenous stratification. Statistical significance notwithstanding, the largest difference for a performance mean was for trail camping (9%).

Figures 1 and 2 display IPA graphs for the combined unweighted and weighted samples, respectively. In the unweighted graph, bike/shuttle rental falls clearly within the "overemphasis" quadrant, implying that the performance of this area feature is relatively good, but the feature is of relatively low importance to users. However, when adjusted for trip-frequency bias, this feature shifts to the "good work" quadrant (Figure 2).

As previously mentioned, certain types of segmentation, if correlated with trip

Figure 1. Unweighted Importance and Performance Graph for Trail Attributes and Area Features: Combined Sample.

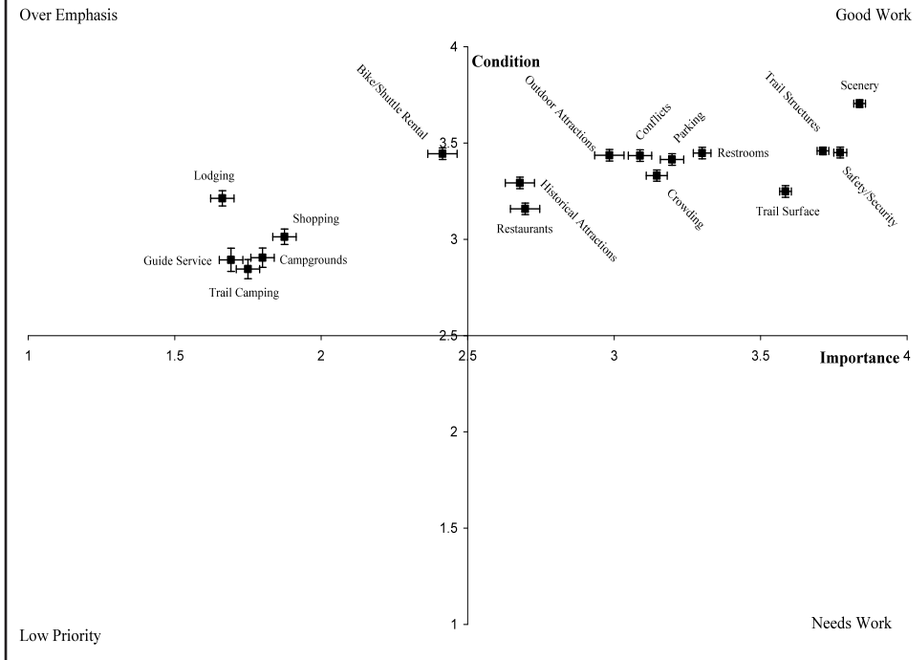
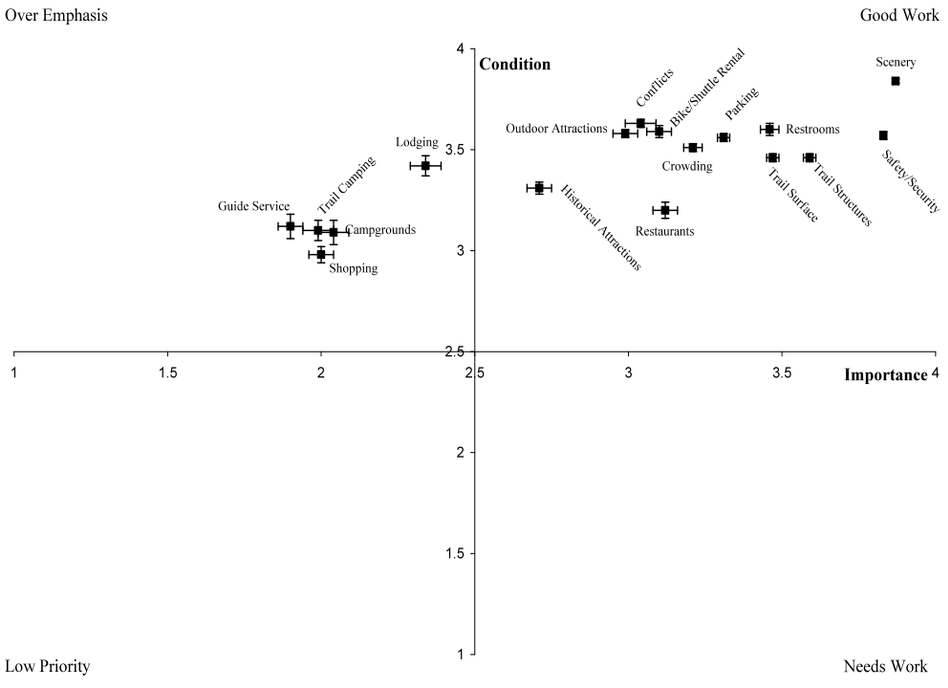


Figure 2. Weighted Importance and Performance Graph for Trail Attributes and Area Features: Combined.



frequency, could be expected to mitigate the effects of endogenous stratification. To further explore this possibility, the combined sample was decomposed into two subsamples, local and nonlocal users. As the VCT runs through a relatively rural area, this segmentation corresponds with distance which, in turn, is often inversely related to trip frequency. In this case, locals averaged 137 averaged visits to the trail in the unweighted sample, but only 31 annual visits after adjustment for trip frequency bias. Nonlocals averaged 11 and two annual visits before and after adjustment, respectively.

Local Sample IPA

Mean weighted and unweighted responses to the importance and performance of trail attributes and area features for the local subsample (n=417) are displayed in Table 2. Statistically significant differences in mean importance were found for 15 out of 17 (88%) attributes and features, with only parking and restrooms as exceptions. Two of the trail attributes, scenery and conflicts, had a significant increase in mean response when weighted, while safety and security, crowding, trail surface, and trail structures all had significant decreases in mean response for importance. With respect to area features, eight

Table 2. Mean Importance and Performance of Trail Attributes and Area Features: Local Sample, N=417.

		Unweighted	Weighted
Safety/Security	importance	3.75	3.56*
	performance	3.41	3.48*
Crowding	importance	3.10	2.98*
	performance	3.27	3.37*
Parking	importance	3.14	3.12
	performance	3.36	3.36
Scenery	importance	3.82	3.87*
	performance	3.66	3.69
Restrooms	importance	3.27	3.19
	performance	3.38	3.41
Conflicts	importance	3.07	3.23*
	performance	3.36	3.39
Trail Surface	importance	3.59	3.50*
	performance	3.19	3.27*
Trail Structures	importance	3.72	3.58*
	performance	3.41	3.48*
Lodging	importance	1.51	1.35*
	performance	3.31	2.85*
Trail Camping	importance	1.70	1.56*
	performance	2.78	2.82
Campgrounds	importance	1.73	1.60*
	performance	2.86	3.10*
Restaurants	importance	2.56	2.31*
	performance	3.13	2.99*
Shopping	importance	1.85	1.57*
	performance	3.01	2.82*
Historical Attractions	importance	2.66	2.33*
	performance	3.30	3.20*
Outdoor Attractions	importance	2.97	2.52*
	performance	3.41	3.41
Bike/Shuttle Rental	importance	2.27	2.44*
	performance	3.38	3.41
Guide Services	importance	1.65	1.51*
	performance	2.82	2.73

Importance: 4=high, 3=medium, 2=low, 1=none Performance: 4=Excellent, 3=good, 2=fair, 1=poor

$H_o: x_w = x_u, * \alpha = .975$

of the nine attributes had significant decreases in weighted mean response to importance. Only bike/shuttle rental saw an increase in mean response after adjusting for endogenous stratification.

Nine of 17 variables (53%) showed statistically significant differences in performance means. Those with insignificant differences included parking, scenery, restrooms, conflicts, trail camping, outdoor attractions, bike/shuttle rental, and guide services. Of the four trail attributes with a significant difference in mean weighted response, all increased. Five of the nine area features had significant differences in mean weighted response. Of these five, four had a significant decrease in mean weighted response with only the feature "campgrounds" showing significant increase in weighted mean response. For both trail attributes and area features that were significantly different, weighted mean response was not consistently larger as in the case of the combined sample. Moreover, the magnitude of the differences was, on average, less than the combined sample.

Unweighted and weighted IPA graphs for the local subsample are displayed in Figures 3 and 4, respectively. Results show that when endogenous stratification is accounted for in the local subsample, interpretation of results is altered. Figure 3 shows area features, historical attractions, and restaurants in the upper right ("good work") quadrant. However, as shown in Figure 4, when adjustments for trip-frequency bias are made, both of these features shifted to the "over emphasis" quadrant.

Figure 4 highlights another potential issue when using IPA to guide management decisions. In this figure, outdoor attractions shifted from a clear position of "good work" on the unweighted graph (Figure 3) to a position on the border of the upper left quadrant near "over emphasis." Using confidence intervals as advocated by Tarrant and Smith (2002), the performance interval enters the "over emphasis" quadrant making the performance of outdoor attractions ambiguous.

Nonlocal Sample IPA

Non-local IPA results (Table 3) indicate fewer statistical differences after adjusting for trip-frequency bias than either the combined of local subsamples. The importance mean for lodging response increased from 2.25 to 2.56 (14%), while the importance of bike/shuttle rental increased from 2.96 to 3.24 (9%). In general, non-local users tended to rank both the importance and performance of trail attributes and area features higher than locals. Non-locals felt that trail attributes were more important than area features, but the area features were more important to this user group than locals. Examination of Figures 5 and 6 reveals that bike/shuttle rental area feature remains in the "good work" quadrant after adjustment. However lodging shifts from "over emphasis" to "good work," although the confidence interval indicates some ambiguity. Without the adjustment for endogenous stratification, this management variable would have been considered to be performing well, yet not be very important.

Discussion

The study reported in this paper performed standard and modified IPA to better understand user attitudes and preferences about trail attributes and area features along the Virginia Creeper Trail in southwestern Virginia. IPA is an important tool by which researchers and site managers can analyze visitor information. It can be fundamental to making management decisions and allocating management resources and efforts, both in the short and long term. When recreation use data are collected in an on-site sample, endogenous stratification or trip-frequency bias may result in IPA becoming an inaccurate tool for making management decisions, perhaps leading managers to make ineffective and/or wasteful decisions.

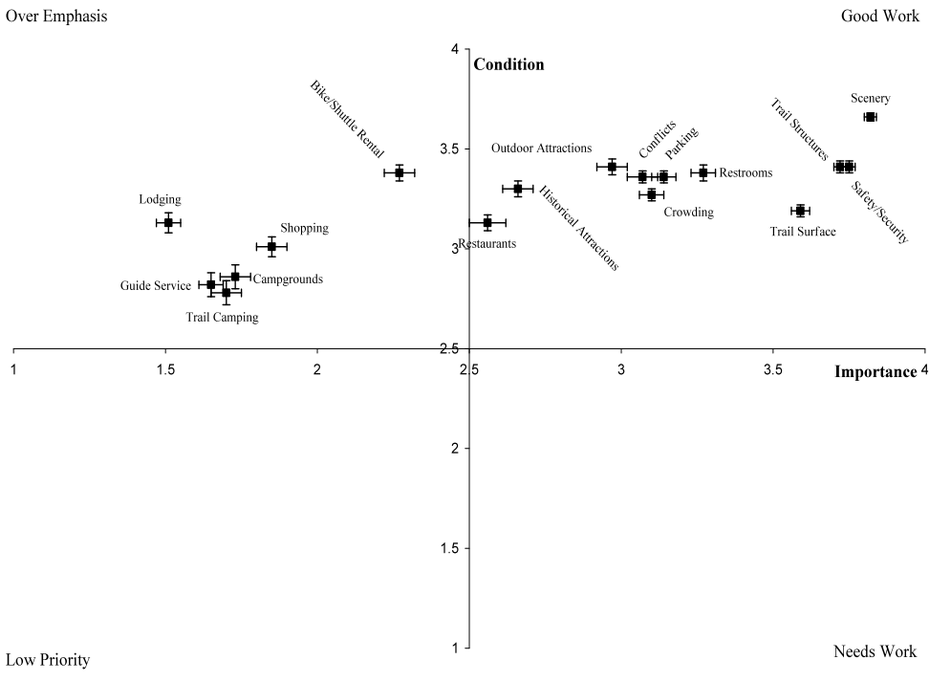
Table 3. Mean Importance and Performance of Trail Attributes and Area Features: Non-Local Sample, N=104.

		Unweighted	Weighted
Safety/Security	importance	3.84	3.90
	performance	3.60	3.59
Crowding	importance	3.30	3.26
	performance	3.52	3.54
Parking	importance	3.40	3.36
	performance	3.59	3.61
Scenery	importance	3.89	3.87
	performance	3.85	3.87
Restrooms	importance	3.40	3.52
	performance	3.62	3.63
Conflicts	importance	3.15	3.00
	performance	3.68	3.69
Trail Surface	importance	3.54	3.46
	performance	3.45	3.50
Trail Structures	importance	3.64	3.60
	performance	3.61	3.73
Lodging	importance	2.25	2.56*
	performance	3.40	3.51
Trail Camping	importance	1.95	2.09
	performance	3.07	3.15
Campgrounds	importance	2.06	2.14
	performance	3.02	3.09
Restaurants	importance	3.22	3.29
	performance	3.21	3.23
Shopping	importance	1.96	2.10
	performance	3.00	3.02
Historical Attractions	importance	2.72	2.79
	performance	3.22	3.33
Outdoor Attractions	importance	3.03	3.09
	performance	3.53	3.62
Bike/Shuttle Rental	importance	2.96	3.24*
	performance	3.61	3.62
Guide Services	importance	1.82	1.98
	performance	3.17	3.21

Importance: 4=high, 3=medium, 2=low, 1=none Performance: 4=Excellent, 3=good, 2=fair, 1=poor

$H_o: \bar{x}_w = \bar{x}_u$, * α = .975

Figure 3. Unweighted Importance and Performance Graph for Trail Attributes and Area Features: Local Sample.

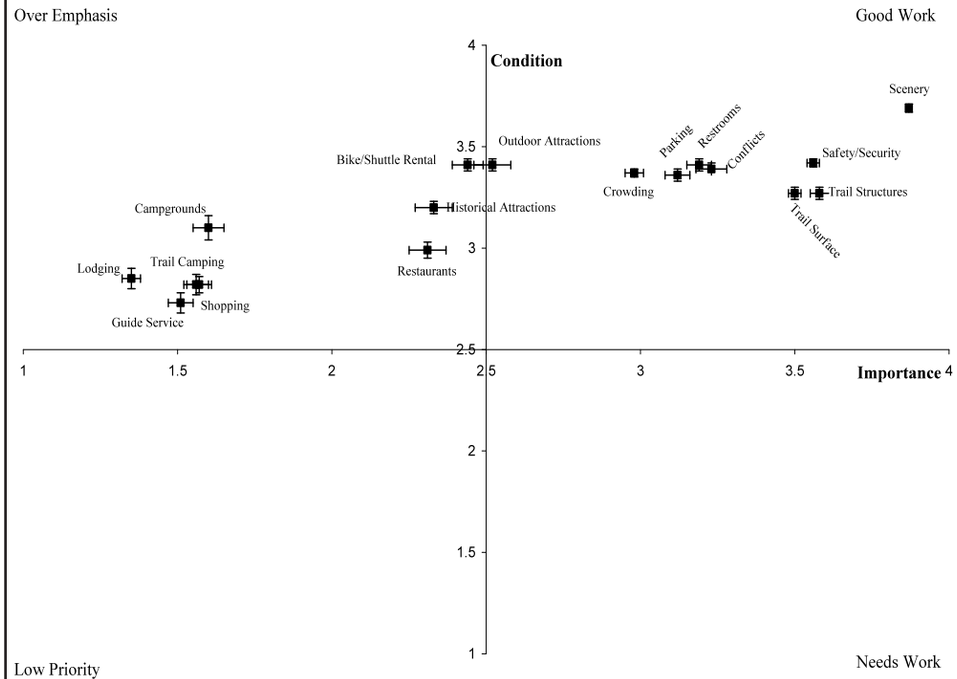


Initially, an unsegmented on-site sample of VCT users was examined. Findings indicated statistically significant differences for over 70% of the importance and performance measurement means derived from conventionally calculated IPA and a weighted version of IPA, which accounts for endogenous stratification. The biggest differences occurred for the rated importance of lodging, bike/shuttle rentals, restaurants, campgrounds, and guide services. For each of these attributes, the weighted IPA led to higher importance scores. This result appears to suggest that when the probability of high-frequency users appearing in the sample is taken into account, factors that are often more important to low-frequency users (e.g. tourists) became more important.

For performance variables in the unsegmented sample, the pattern of higher scores from the weighted IPA continued. However, the differences were smaller, which suggested that trip-frequency bias had little practical effect on visitor assessment of current trail attribute and area feature performance. Nevertheless, differences from the two methods remained statistically significant for over 76% of the performance measures.

Regarding IPA quadrants, the conventionally calculated method led to bike/shuttle rental being classified as over emphasized, while accounting for trip frequency shifted this feature to the good-work category. Overall for the unsegmented sample, the results did not indicate large practical differences; nevertheless, a bias toward frequent users was present.

Figure 4. Weighted Importance and Performance Graph for Trail Attributes and Area Features: Local Sample.



To further examine the effects of trip-frequency bias, the sample was segmented into locals and nonlocals. These groups showed large differences in average respondent trip frequency, and thus the segmentation could be expected to affect some of the trip-frequency bias. For the local sample, statistically significant differences between weighted and unweighted IPA appeared for 88% of the importance means and over 50% of the performance means. In most cases, the differences were practically small. However, failure to account for trip frequency led to incorrectly classifying historical attractions and restaurants into the "good work" rather than "over emphasis" quadrant.

When applied to the nonlocal sample, the weighted IPA led to fewer statistical differences than the two cases above. These included importance of lodging and bike/shuttle rental. Both means increased after accounting for trip frequency. Fewer statistical differences could have been partly due to smaller sample size for the nonlocal segment. Another possibility for the lack of divergence could have resulted from nonlocals being more homogeneous in their preferences. Nevertheless, evidence of a potential problem with endogenous stratification remained.

With today's austere local, state, and federal funding sources for parks and recreation, recreation site managers can ill afford to waste any of their scarce budgets on, for example,

Figure 5. Unweighted Importance and Performance Graph for Trail Attributes and Area Features: Non-local Sample.

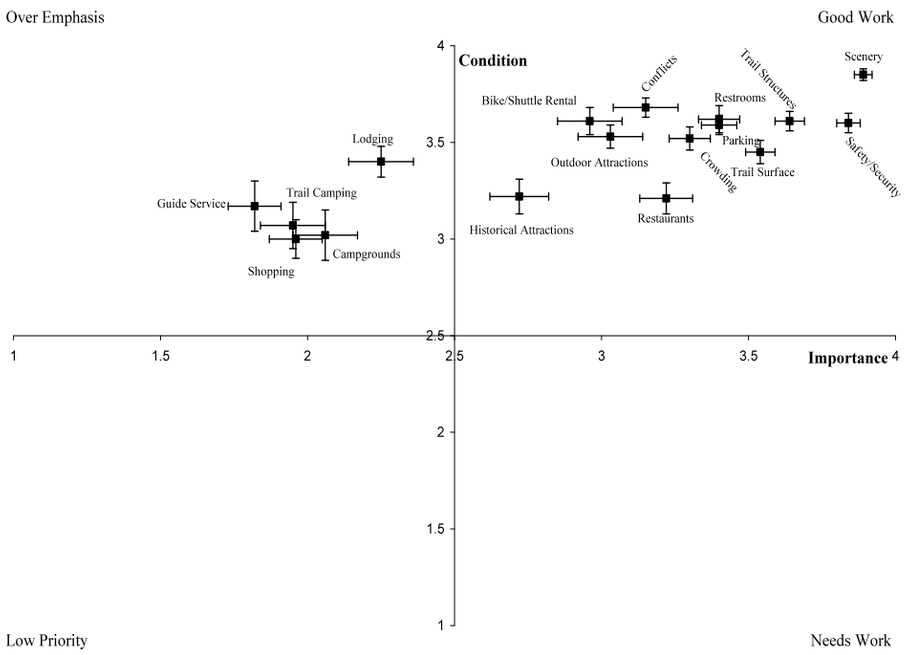
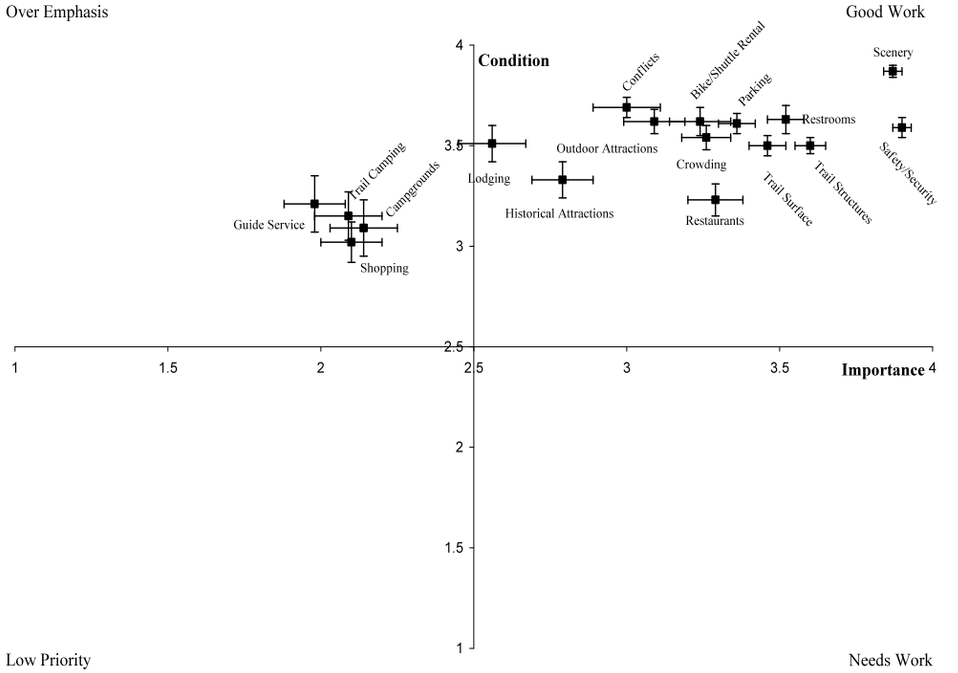


Figure 6. Weighted Importance and Performance Graph for Trail Attributes and Area Features: Non-local Sample.



improvements to site attributes that users do not care much about and/or are in satisfactory condition. Similarly, if managers do not allocate scarce management resources and efforts to improving site attributes that users find most important and/or are in unsatisfactory condition, customer or user satisfaction with their site may fall along with visitation. Falling visitor satisfaction and numbers, in turn, may result in reductions in annual disbursements from both public and private funding sources. Thus, it is in the best interest of both recreation site visitors and managers to have tools that can be applied to provide unbiased and accurate measures of recreation site user preferences.

In this case study, conventionally calculated IPA led to conclusions favoring preferences more frequent visitors. A straightforward and easily applied weighting procedure was examined under different on-site sample scenarios and was found to mitigate the effects of trip-frequency bias. When the sample was segmented by factors related to frequent use (e.g., local vs. nonlocal) the effects of trip frequency were lessened. However, some effects of the bias remained. While this study did not show large differences in the overall management implications derived from the bias adjustment, i.e., under conventionally and weighted approaches, most management variables ended up in the "good work" quadrant, there is no guarantee such will always be the case. -Therefore, it would be prudent for managers and researchers interested in using IPA from on-site samples, especially at regional and national recreation sites, to be aware of and take into account trip-frequency bias. The improved IPA tool can be used alone or in concert with other proven mechanisms to make better park and recreation management decisions that make more efficient and effective use of scarce management resources and efforts.

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Footnote

[1]The screener, local, and nonlocal questionnaires are available at http://www.srs.fs.usda.gov/recreation/VCT.pdf