

Sustainable Trail Management in Costa Rica National Parks: The use of photography for trail surfacing decisions under tropical rainforest conditions ¹

Juan A Aguirre G.ⁱⁱ

Universidad Latinoamericana de Ciencia y Tecnología (Costa Rica)

Resumen: El Parque Nacional Volcán Poas (PNVP) es el parque mas visitado de Costa Rica. Sus facilidades físicas, accesibilidad, y su proximidad a las mayores ciudades del país hacen del PNVP un destino preferido por visitantes locales y extranjeros. Además de su cono volcánico activo, los senderos del parque son muy apreciados. Las condiciones lluviosas que prevalecen a través del año y la alta visitación anual hace muy importante determinar las preferencias de los visitantes por el tipo de superficie para poder garantizar la sostenibilidad de los senderos del parque. El propósito de este estudio fue el de explorar la viabilidad de utilizar fotos en combinación, con encuestas para identificar las características socio-demográficas y otras variables relacionadas y que afectan la selección del tipo de superficie preferida por los visitantes en condiciones de alta precipitación, con el fin de poder indicar a la administración del PNVP, como mejorar las decisiones y asignación de los recursos presupuestarios relacionados con el diseño, construcción, conservación y mantenimiento de los senderos del parque. El estudio se realizó durante los meses de mayo, junio y julio del 2005.

Palabras clave: Fotografía; Selección del tipo de superficie; Senderos; Selección; Condición lluviosa; Costa Rica.

Abstract: Volcan Poas National Park (VPNP) is Costa Rica's most visited park. Its facilities, accessibility, and proximity to the major cities of the country make VPNP a preferred destination for local and foreigner visitors. Aside from its active volcanic cone, the park trails are a major asset. The extremely wet conditions prevailing throughout the year and heavy visitation made it essential to determine visitor's trail surface preferences to guarantee park trail sustainability. The purpose of this study was to explore the feasibility of using photos in combination with a regular survey to identify the socio-demographic characteristics and other trail related variables that affect trail surface selection to guide management decisions and resource allocation related to trail design, construction, and maintenance. The study was conducted during May, June and July of 2005.

Keywords: Photos; Trail surface selection; Rainy conditions, Costa Rica.

ⁱⁱ • Juan A Aguirre es Decano de Extensión Universitaria y profesor de Emprendedurismo. Facultad de Ciencias Empresariales. Universidad Latinoamericana de Ciencia y Tecnología. San Jose. Costa Rica.. E-mail: jaguirre@ulacit.ac.cr - jaguirre@racsa.co.cr

Introduction

Tropical rainforests are characterized by their low resistance and intermediate to high resilience to impact associated with human visitation. Trail erosion caused by recreational use threatens the resources in many parks. Managers of wilderness areas are normally mandated to assess recreational use impacts on trail erosion and degradation. The assessment of erosion includes a body of work that spans almost 40 years in developed countries, some examples of the methods used for trail erosion assessment being: condition class assessment, morphometric assessments, census/tally assessments, census of erosional events, and photographic assessments using stereo photography to name a few (Bayfield and Lloyd 1973; Bratton et al, 1979; Jewell and Hammitt, 2000; Giles, 2002; Turton, 2005).

The idea of trade off is essential to visitor's surface choices. Normative research in outdoor recreation is conventionally conducted using quantitative methods that generate numerical estimates of respondent norms or evaluative standards of quality for park and outdoor recreation conditions. Cognitive mapping as a means of gathering data related to recreational use patterns (RUP) and impacts on the hiking trail system alludes to an individual's ability to construct a mental representation of the geographical environment. Visitor management in parks, wilderness, and other protected areas requires information about visitor-environment interactions and particularly the distribution and flow of visitors in space and time (Manning et al, 2005; Lankford et al, 2004; Cole and Daniel, 2004; Leung and Marion, 2000). The importance of trail analysis and visitors impact on trails has been well documented around the world (Holden, 2002; Nepal and Nepal, 2001; Bratton and Hickler, 2002; Magro, 2003; Ploner and Brandenburg, 2004; Bruehler and Sondergaard, 2004; Hornsten, 2000). The work in Belize and Costa Rica clearly demonstrates the importance of adequate trail management in the overall management of any national park (Farrell and Marion, 2001; Lueng and Marion, 2000).

Many forms of assessing trail problems have been used over the past half a century. Many methods have relied on direct measurement of the problems and the others on interviews with visitors. The very recent advances in digital photography open new options not available before. The blend of immediate recollection with well structured traditional survey techniques has been pointed out by many outdoor recreation researchers as offering great potential (Manning and Freimund, 2004; Stewart and Floyd, 2004).

The use of photography may be recent but definitely not new. Several studies have demonstrated that altering the format (question wording or presentation format) can alter responses obtained from normative questions. It appears that closed formats, like photographs, offer a cognitively easier and more meaningful approach. In the case of Image Capture Technology (ICT), respondents indicated that the images served as useful reminders of their visit and helped them to articulate their norms. The use of visitors employing photography is becoming normal technique as a "recollection and evaluation of the experience" particularly in the United States and around the world (Hall and Roggenbuck, 2002; Freimund et al, 2002; Vistad, 2004; Turner and Funicelli, 2000; Lueng and Marion, 2000; Gimblett, 1987; Hem et al, 2004; Arriaza, et al 2005; Fairweather and Swaffield, 2001; Taylor et al, 1998; Flick and Taylor, 2002; Stedman et al, 2003; Loeffler, 2004; Nelson, et al, 2001).

Two studies, Rollins and Mcallum and Kim et al, reinforce the idea that digital photography could be used in assessing the visitor's surface preferences under very rainy conditions at VPNP. The first study used the normative approach involving digital photography in a recreation setting to depict progressively more intense changes in conditions, and in the second photos of different methods were used for selecting impact indicators for trail management conditions by comparing a photo survey method (PSM) with a written survey method (WSM). The major photo components in order of importance were six: area of large rocks on trail, area of wood steps, area of bare roots, area of bare soil,

area of small stones, and area of stone steps (Rollins and Mcallum, 2001; Kim et al, 2003).

In Costa Rica, because of the heavy visitation pressure and the permanent shortage of funds for trail maintenance, the national park system needs new ways to reduce cost and sharpen management decisions related to trail management. Therefore, the purpose of this study was to explore the feasibility of using photos in combination with a regular survey to identify the socio-demographic characteristics of the visitors, their reasons for coming to the park, trail physical characteristics, and the trail surface preferences as a result of the heavy rain conditions affecting trail use in VPNP to guide management decisions and resource allocation related to trail design, construction and maintenance.

Objectives and Hypothesis of the Study

The objective of the study was: To determine and evaluate the affect of socio-demographic characteristics and how these elements affect the visitor's trail surface preferences under the heavy rains which affect VPNP every year from May to December.

The hypothesis of the study was: The visitors to VPNP, local and foreign, given their socio-demographic characteristics and reasons for coming to the park, under the very humid and rainy climatic conditions prevailing almost from May to December at VPNP, will prefer hard over natural surfaces.

Materials and Methods

Location of the Study.

Volcan Poas National Park is located in Costa Rica's Central Mountain Range, 37 km north of the city of Alajuela, the second largest city of the country. It was established in September 24, 1970, and dominates an area of 6506 hectares. The precipitation in the park fluctuates between 3500 and 4500 millimeters per year, most of which falls between the months of May and early December. Of the 273 thousands visitors that visited the park in 2005, 51% are foreigners and 49% locals (VPNP, 2005; Aguirre, 2006; Dobles Zeledon, 2005).

Sampling Size and Method of Selection.

The interviews were conducted during the months of May, June and July of 2005 months that represent, the beginning, take off and stability of the rainy season in the park. The sampling size, was determine using the "rule of a minimum of 5 surveys" or what is known as the *subject to variables ratio (STV)* per item, when multivariate type of analysis is conducted to have a 95% probability level or a 5% error. (Bryan and Yarnold, 2003).

However by *personal decision* and to be on the safe side, since there was not previous studies of this nature in the country, we multiply by a factor 5, the "STV" rule, meaning that for every item measure we finish with 25 surveys.

The decision made, to increase by a factor of five the "STV rule", it was felt that provided a safety net big enough to make Type I and Type II errors, unlikely. The second decision was to split the sample in 50% locals and 50% foreigners, to make sure we respect the 51% foreigners to 49% locals proportion, base on park data.

The surveys were completed by 690 foreigners and 690 locals. The interviews were conducted during May, June and July of 2005 and conducted as visitors were getting ready to leave the park premises at the main visitor center and selected randomly.

The ninety days of field work, due to the money limitation and the permission provided were split in 3 periods of ten days, meaning that the first period, of 10 days of interviews was completed in the first ten days of May, the second period in the second ten days of June and the third period in the last ten days of July, looking to replicate a month and have visitors of all the ninety days of field work.

The visitors to be interview, were *selected randomly*, picking and approaching every tenth person leaving the visitor center. Those that refuse to be interviewed were replace by the next individual. One "real" problem was that in national parks heavily visited like Volcan Poas, counting visitors is somewhat of a physical challenges, so we adopted the strategy of groups of 3, while two people interviewed,

another one was, more or less counting.

Survey Instrument Design.

A "Likert type scale" was used in which 1 meant either not important, totally unsatisfactory, or an equivalent condition and 10 the other extreme, very important, very satisfactory or an equivalent condition, as suggested by Kachigan and others (Kachigan, 1991; Johnson and Creech, 1983; Gray and Kraenzle, 1998). The experimental questionnaire use was pre-tested and versions in Spanish and English were available and it contain a number of

The general structure of the survey included the following sections:

1. Socio-demographics characteristics.
2. Reasons for coming to the park.
3. A set of photos depicting representative pictures of the major types of surfaces used in the trails of VPNP for dry and wet climatic conditions.
4. A special questions section: a) How would you rank the trails in VPNP? b) How would you describe your hiking experience and c) How would you rank your general satisfaction with your visit to VPNP?

5. Willingness to Pay Section: The willingness to pay section started with the following statement: "Trail maintenance cost under tropical conditions is normally very difficult because of the heavy rain conditions that create a need for additional investment and maintenance due to the additional drainage, surfacing, and erosion control practices that are usually needed" and question: "Would you be willing to pay and additional amount for trail maintenance over and above the entrance fee that you were charging to enter the park". Possible answers were "yes" or "no". If the answer was yes the question "How much? (Dollars or Colons) are you willing to pay" followed. If the answer was no respondents were asked to explain "Why not?"

Analytical Procedure.

The descriptive statistical analysis consisted of an ANOVA analysis to compare local and foreign visitors that included a Tukey's family error test. The data was prepared first in an Excel database and later transferred to Minitab for Windows

Version No 12. An ordinal logistic regression with a normit/probit link using the Pample procedure was utilized to detect the relative importance of the variables on the variable trail rating given the ordinal nature of the likert scale using a forward elimination process. An indication of the relative size of the effects within a probit equation came from multiplying the probit coefficient by the standard deviation of the independent variables, calculation that it would show the changes in the inverse of the cumulative standard normal transformation of the dependent variable for one standard deviation increase in the independent variable (Pample, 2000).

Six trail locations were selected with the support of the park maintenance unit and the administration of the park, and digital pictures taken. A one page composite was developed. Photo one represented a natural surface photo two a concrete surface, three a red volcanic gravel trail with a very slight gradient, four an asphalt surface, five a large gravel crush stone surface on a flat terrain, and photo six a cinder block surface. The picture composite was shown to the interviewee at two moments during the interview when they were requested to express their trail surface preference under dry and rainy weather conditions (photo 1).

Results

Table 1 presents the basic socio-demographic data of the VPNP foreign and local visitors. In general the average visitor is between 28 and 32 years of age, a university graduate, and within the ratio of 40 % females to 60% males. For those that reported their average monthly income, in the case of the Costa Ricans, which were 74% of all of those interview was US\$1270, in the case of the Unites States 51% of those interviewed reported an average monthly income of US\$8230, in the case of Europeans, 67% of those interviews reported and average monthly income of US\$5230 and all the others nationalities reported an average monthly income of US\$2531. In terms of the reasons for coming to the park the most important reasons to visit the park were to observe the active volcanic crater and nature. The foreign visitor added some hiking and trekking,

while the Costa Ricans come to enjoy a leisurely moment in the company of friends and family as can be observed by the ratings awarded to the different activities.

conditions (no rain) the rating of all six trails is between 5.6 and 7.4, with the asphalt surfaces receiving the lowest scores by local and foreign visitors, followed by cinder block surfaces. The concrete and gravel surfaces received the highest ranking from 7 to 7.8. The natural trail surfaces get a rating of 6.7 by locals and 6.5 by foreigners. Foreign and local visitor's ratings for asphalt and cinder blocks are significantly different between the groups while all the others are not.

Table 3 also presents the results of comparing within each survey group- locals and foreign visitors- preference ratings for trail surfacing material under dry and wet (rainy) conditions. Foreign visitor's rating for natural surfaces reduces under rainy climatic conditions from 6.7 to 3.9 or a rating reduction of 41.7%. The concrete surface rating remains the same. Volcanic gravel surface rating preference reduces from 7.3 to 6. The asphalt surface preference rating increases from 5.6 to 7. Stone gravel surface rating reduces from 7.5 to 6.7 and cinder block surface rating increase from 5.8 to 6.9.

In the case of local visitors the natural surface (photo 1) rating reduces from 6.5 to 3.2 or 50.7% and the asphalt surface rating increases from 6.5 to 8.1, or an increase of 24.6% from dry to wet (rainy) condition. The concrete surface rating increases from 7.2 to 7.7 and the cinder block rating increase 6.9 to 7.8. In the cases of the volcanic and stone gravel surfaces (photos 3 and 5) the ratings decrease from 7.4 to 6.6 and from 7.8 to 6.7 respectively.

Table 4 presents the results of the willingness to pay an additional amount for trail maintenance. The results indicate that roughly half of the visitors in both cases are willing to pay an additional amount to be used specifically for trail maintenance. The

Table 1. Main Characteristics of the Foreign and Local Visitors.				
Basic Socio Demographics	Foreign	Local		
	Visitor	Visitor		
	Foreign	Local		
	%	%		
below 30	65.2	52.9		
30 to 50	24.6	41.2		
over 50	10.1	5.9		
Average	28.0	32.0	years	
Education Level				
below HS	87.0	70.6		
University or over	13.0	29.4		
Education				
Females	37.7	41.2		
Males	62.3	58.8		
Sex				
	100.0	100.0		
Rating of the Reasons for Coming to the Park				
	Mean	Mean	F	P
Observe Nature	8	9	11.97	0.008
See the Volcanic Crater	10	10	0.56	0.453
Walk the Trails	7	7	4.00	0.046
Hiking and Trekking	6	5	36.94	0.000
Walk with the Family	6	7	10.49	0.001
Walk with Friends	7	8	10.25	0.001
See the Animals	8	7	2.63	0.105
See the Birds	8	7	24.04	0.000
See the Plants and Flowers	8	7	18.91	0.000
Rest and Relax	7	7	0.67	0.414
Learn about nature	7	6	8.83	0.003
Learn biodiversity	7	7	1.46	0.227
Learn about the volcano	8	7	14.93	0.000

Table 2 gives the ratings awarded to the different elements of trail design by the two groups. The results indicate local and foreign visitors give basically the same rating to layout, length, clearing width, lookouts, and trails maps. The local visitors rank higher thread width, surface material, gradient, rest areas, signage, trail interpretation and points of interest.

Table 3 results revealed that under dry

overall trail rating and the overall enjoyment of the hiking experience are in the range of 8 to 9 in a scale of 10, which are relatively speaking very high ratings if they are compared with the individual ratings observed in other categories and that in the case of visitors locals or foreigners that are willing to pay and additional amount for trail maintenance the mean amount difference is not statistically significantly different at the 95% level and it ranges on the average from US\$2.30 in the case of the foreign visitors and US\$1.63 in the case of local visitors. This represents a sobering reminder for those that advocate “extracting” the most out of the visitors to protected areas.

The probit models for foreign visitors are presented in table 5 and they indicate that all the coefficients conforming to the final probit model were significant at the 95% probability level or better. In the case of the foreign visitors the variables entering the final model were: Age, Education, B1 or photograph number one depicting the natural trail during the dry season, B4 or the photograph which depicts the asphalt surface during the dry season, C3 or the clearing width, the third component included in the trail design section, C6 or percent gradient, the sixth component included in the trail design section, D1 or photograph number one depicting the natural trail during the rainy season, and D4

photograph depicting the asphalt surface during the rainy season.

In the case of table 6 which covers local visitors, all of the coefficients entering the final probit model were significant at the 95% probability level or better, while the variables entering the final model were: Age, Education, B4 or photograph depicting the asphalt surface during the dry season, C3 or clearing width the third component included in the trail design section, C2 or trail length, the second component included in the trail design section, and D4 photograph depicting the asphalt surface during the rainy season.

Table 7 indicates using Pample’s suggested procedure that the estimated coefficient ranking in importance of each of the independent variables. In the case of the foreign visitor the two most important variables were age and C3: clearing width, the third component included in the trail design section and in the case of the locals visitors the variables were: age and level of educations (years of schooling equivalent). The important element of the probit analysis portrayed in table seven is the fact that four variables: age, education, B4 or photograph depicting the asphalt surface during the dry season and D4 or photograph depicting the asphalt surface during the rainy season were included in both probit models.

Table 2 . Rating the Trail Design and Management Elements.				
Features	Foreign Visitor	Local Visitor	F	P
	Foreign	Local		
Trail Layout	8	9	4.87	0.28
Trail Length	8	8	0.66	0.418
Clearing width	7	8	0.75	0.387
Tread width	7	8	21.36	0.000
Surface Material	8	9	30.35	0.000
Gradient	7	8	3.85	0.050
Rest Areas	7	8	23.17	0.000
Lookouts	9	9	0.39	0.532
Signage	8	9	6.56	0.011
Points of Interest	8	9	6.54	0.011
Trail Interpretation	8	9	11.31	0.001
Trail Maps	8	8	0.33	0.567
Results confirm by Tukey’s family error test.				



Table 3 Trail Surface Rating									
Under Dry Conditions					Under Rainy Conditions				
	Foreign Visitor	Local Visitor	F	P		Foreign Visitor	Local Visitor	F	P
Photo 1	6.7	6.5	0.5	0.479	Photo 1	3.9	3.2	6.62	0.01
Photo 2	7	7.2	0.92	0.337	Photo 2	7	7.7	7.5	0.006
Photo 3	7.3	7.4	0.15	0.699	Photo 3	6	6.6	7.21	0.007
Photo 4	5.6	6.5	11.95	0.001	Photo 4	7	8.1	18.42	0.000
Photo 5	7.5	7.8	2.19	0.139	Photo 5	6.7	6.7	0.02	0.882
Photo 6	5.8	6.9	18.54	0.000	Photo 6	6.9	7.8	13.93	0.000
Under Dry vrs Rainy Conditions					Under Rainy Conditions				
	Foreign Visitor	Foreign Visitor	F	P		Local Visitor	Local Visitor	F	P
	Dry	Rainy				Dry	Rainy		
Photo 1	6.7	3.9	264.28	0.000	Photo 1	6.5	3.2	122.73	0.000
Photo 2	7	7	0.00	1.000	Photo 2	7.2	7.7	2.05	0.153
Photo 3	7.3	6	96.71	0.000	Photo 3	7.4	6.6	9.83	0.002
Photo 4	5.6	7	64.26	0.000	Photo 4	6.5	8.1	25.29	0.000
Photo 5	7.5	6.7	29.15	0.000	Photo 5	7.8	6.7	12.13	0.001
Photo 6	5.8	6.9	53.47	0.000	Photo 6	6.9	7.8	8.24	0.004

Trail Use Related Perceptions	Foreign	Local	F	P
	Visitor Mean Value	Visitor Mean Value		
Overall Trail Rating	8.3	8.6	2.99	0.084
Hiking Experience	7	6.2	12.07	0.006
Overall Enjoyment with Hiking	9	8.8	5.63	0.001
Average Amount of Money Willingness to Pay US\$ dollars	2.3	1.67	1.88	0.171

Table 5. Foreign Visitors Ordinal Logistic Regression

Ordinal Logistic Regression Table				
Predictor	Coef	StDev	Z	P
Const(1)	1,8722	0,2978	6,29	0,000
Const(2)	2,4565	0,2819	8,71	0,000
Const(3)	3,5573	0,2855	12,46	0,000
Const(4)	4,1747	0,2916	14,32	0,000
Const(5)	5,3566	0,3088	17,35	0,000
Const(6)	6,1718	0,3213	19,21	0,000
Age	-0,19733	0,03785	-5,21	0,000
Educatio	-0,32208	0,06932	-4,65	0,000
B1	0,03548	0,01617	2,19	0,028
B4	0,09131	0,01657	5,51	0,000
C3	-0,28808	0,02217	-12,99	0,000
C6	-0,16911	0,01820	-9,29	0,000
D1	-0,13550	0,01822	-7,44	0,000
D4	-0,11575	0,01517	-7,63	0,000
Log-likelihood = -857,587				
Test that all slopes are zero: G = 504,932; DF = 8; P-Value = 0,000				
Goodness-of-Fit Tests				
Method	Chi-Square	DF	P	
Pearson	2685,067	394	0,000	
Deviance	1715,175	394	0,000	
Measures of Association:				
Summary Measures				
Somers' D	0,61			
Goodman-Kruskal Gamma	0,61			
Kendall's Tau-a	0,47			
Cox & Snell(PseudoR2)	22,7%			

Table 6. Local Ordinal Logistic Regression

Predictor	Coef	StDev	Z	P
Const(1)	11.126	1.390	8.01	0.000
Const(2)	15.659	1.983	7.90	0.000
Const(3)	17.337	2.092	8.29	0.000
Age	0.8570	0.1253	6.84	0.000
Educatio	-2.2417	0.2816	-7.96	0.000
B4	-0.28755	0.06324	-4.55	0.000
C2	-1.2624	0.1590	-7.94	0.000
C3	0.33914	0.07688	4.41	0.000
D4	-0.23684	0.04458	-5.31	0.000
Log-likelihood = -113.305				
Test that all slopes are zero: G = 222.097, DF = 6, P-Value = 0.000				
Goodness-of-Fit Tests				
Method	Chi-Square	DF	P	
Pearson	2047,58	394	0.000	
Deviance	2266,11	394	0.000	
Measures of Association:				
Summary Measures				
Somers' D	0.85			
Goodman-Kruskal Gamma	0.85			
Kendall's Tau-a	0.61			
Cox & Snell(Pseudo R2)	49.4%			

Table 7. Relative Size of the Effect within the Probit Equations for Foreign and Local Visitors, to VPNP.			
Variables Foreign Visitors	Ordinal Regression Coefficient	Variable Standard Deviation	Estimated Rank Value
Age	-0.197	13.555	-2.674
Education	-0.322	0.703	-0.226
B1	0.035	3.290	0.116
B4	0.091	3.255	0.297
C3	-0.288	2.471	-0.712
C6	-0.169	2.598	-0.439
D1	-0.136	3.234	-0.438
D4	-0.116	3.290	-0.381
Variables Local Vistors	Ordinal Regression Coefficient	Variable Standard Deviation	Estimated Rank Value
Age	0.857	12.465	10.683
Education	-2.242	3.060	-6.860
B4	-0.288	3.283	-0.944
C2	-1.112	2.107	-2.344
C3	0.339	2.434	0.825
D4	-0.237	2.742	-0.649

Discussion

Socio-demographics and surface selection

Traditionally, environmentalists have argued that visitors to Costa Rica protected areas "loved" natural trails, therefore natural trails are the "ideal" type of trail if one is to preserve the protected areas of Costa Rica and the tropical world. As self proclaimed spokesmen of the protected area's visitors, they seem to overlook the relation of the visitor's socio demographics and its potential relation with trail surface material selection, given what they come to do, who they are, and what the park environment offers.

Volcan Poas National Park visitation has grown by 100 thousand visitors over the past 10 years. Visitors coming to the park are highly educated, with income levels for foreign and local visitors somewhat above what one would expect, foreign visitors coming from around 25 different countries, and 40 % females and are 50% locals and 50% foreigners. The high level of females enjoying the outdoors and using the trails of the park, places a new challenge to the park administrative authorities, traditionally oriented to cater mostly to male backpacking visitors. The survey also recorded along with young adults with ages ranging between 15 to 20 years, many seniors over the age of 65 years, and a substantial group of middle age visitors. To the above we can add a very close proximity to some of the largest cities of the central highlands of Costa Rica, where 65% of the nation population resides and a 45 minute ride from Juan Santamaria International Airport, access that is fully paved and represents some of the best highways in the country.

Volcan Poas is an active volcano, and a restriction of the National Emergency Commission common to all the parks with active volcanoes do not allow camping on the park grounds. Therefore when the socio demographics of foreign and locals visitors are related to the reasons for coming to the park, it is observed that foreign visitors generally come to the park for a nature and outdoor experience, in many cases for 2 hours or less, and locals for a family experience with a half a day time limit particu-

larly on weekends, something that is consistent with the visitor weekly flow and the restrictions specified earlier. In general the visitors seem to want a setting designed to enjoy a few hours of relaxation with no mud or stress. VPNP is not a backpackers park and this is something some people do not understand, or do not want to. The summary synthesis descriptively defines a person that seem to have the ability to identify problems and evaluated critically what he or she is getting in terms of infrastructure, services, and recreational opportunities at the park and that includes trail conditions and characteristics and defines needs and expectations in relation to trail surfaces under very different ecological conditions.

Implications for Management

The trail surface preferences under heavy rains and heavy visitation, results we are about to discuss, are framed by the previous discussion and its logic and supported by the previous socio-economic characteristics and the behavior derived from them. One initial statement that can be effectively made is that under dry conditions all trail surfaces seem to have similar preference ratings by both foreign and local visitors. The situations changes dramatically when the climatic conditions change from dry to wet (rainy). In wet conditions the temporary preference for natural conditions (Photo 1) collapses by almost 50%, gravel surface preferences increase slightly, and the three hard surfaces: concrete, asphalt and cinder blocks, increase appreciable. The message seems to be clear: in a situation of heavy rains and high humidity conditions, like those prevailing in the cloud forest, nobody foreign or local seems to want soft-natural surface trails. These new condition raise a series of implications for park and trail management, in the wake of 1.7 to 1.8 million tourists that may be arriving in 2007 of which around 1 million will visit the country national parks minimum once or twice during an average stay of 11 to 14 days.

The decision to hard surface the most heavily trafficked trails of VPNP made a about 10 years years ago by the park ad-

ministration based on the premise that climatic conditions impaired the use of some of the parks trails during the rainy season and increased maintenance cost, that has been habitually severely criticized by environmentalist, is clearly challenged by these results and perhaps the criticism was correct ten years ago, since no visitors data is available for that period we can only speculate, but as the clients constituency looks how it looks today, the hypothesis about natural trails preferences is not correct. The results however tend to indicate that with the type of visitor, the normal length of the visit, the reasons for coming to the park, based on the responses of local and foreign visitors it is clear that hard surfacing the heavy traffic trails is a real alternative for sustainable long term trail management at VPNP.

Finally it is important to bring to the attention of the reader that a new trail management strategy for VPNP is being discussed base on the outcome of this study as this paper is being prepared, and that for the first time the necessities of women are seriously under consideration in the new strategy in predominantly male oriented society. This may not be much, but it is enough to feel that serious management research is beginning to be appreciated even in a developing country like Costa Rica.

Conclusions

1. VPNP visitors were found to be predominantly going on middle age or older, highly educated, fairly well to do, coming from at least 25 different countries, and consisting of 40 to 50 % females. The high level of females enjoying the outdoors places a new challenge to the country parks system administrative authorities, traditionally oriented to cater to male's visitors.

2. Differences in socioeconomic characteristics, reasons for coming to the park, trail design and maintenance elements were found between local and foreign visitors to warrant the separation of the visitors in locals and foreigners for analytical purposes

3. In the case of the foreign visitors the variables included in the model were: Age, Education, B1 or photograph number one

depicting the natural trail during the dry season, B4 or photograph depicting the asphalt surface during the dry season, C3 or clearing width, the third component included in the trail design section, C6 or percent gradient, the sixth component included in the trail design section, D1 or photograph number one depicting the natural trail during the rainy season, and D4 photograph depicting the asphalt surface during the rainy season. The composition of the derived model suggests that behind the foreigners visiting there is an outdoor experience.

4. In the case of the local visitors the variables included in the model were: Age, Education, B4 or photograph depicting the asphalt surface during the dry season, C3 or clearing width, the third component included in the trail design section, C2 or trail length, the second component included in the trail design section, and D4 photograph depicting the asphalt surface during the rainy season. The composition of the derived model suggests that the local visitor comes accompany by family and friends to enjoy nature and spend a few hours of rest and relaxation in their company.

5. Under dry conditions all trail surfaces seem to have similar preference ratings by both foreign and local visitors, with two significant exceptions: asphalt and cinder blocks surfaces which seem to be preferred more by locals than foreigners.

6. Under wet conditions the preference for natural conditions collapses by almost 50%, gravel surfaces preferences increase slightly, and the three hard surfaces: concrete, asphalt, and cinder blocks increase appreciably.

7. The message seemed to be clear: In a situation of heavy rains and high humidity conditions, like those prevailing in the cloud forest, nobody foreign or local visitors seems to want soft surfaces trails.

8. Base on the results the hypothesis that visitors to VPNP, local and foreign, preferred the hard over the natural surface given their socio-demographics and reasons for coming to the park, under the very humid and rainy climatic conditions, prevailing almost all year round at VPNP was proven correct.

9. The senior management of VPNP, based on the study findings, is developing

at this time a new strategy for trail development, construction, and maintenance that includes catering to the ever growing female constituency and rationalizing the use of government resources coming from the central government budget always insufficient to meet park management needs.

10. Finally the use of photos prove to be an excellent way to objectively evaluate visitors' surface preference, taking trail management a step further.

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