

## Tourism, volcanic eruptions, and information: lessons for crisis management in National Parks, Costa Rica, 2006<sup>†</sup>

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**Resumen:** El Parque Nacional Volcán Poás, ubicado en el valle central de Costa Rica, es el parque más importante y que recibe más visitantes en el país. Entre el 24 de Marzo y el 10 de Abril del 2006, hubo una serie de erupciones que, la administración del parque prohibiera primero y restringiera después el acceso del número de visitantes al PNVP por tres semanas. El estudio examina el impacto de tales restricciones en las comunidades de Poasito y Fraijanes, las comunidades ubicadas en la entrada del parque, las cuales dependen económicamente de los gastos de los turistas que visitan el parque para sobrevivir. El estudio examina además el impacto social, de la falta información durante este tiempo en la opinión de las comunidades y los negocios sobre la gestión del desastre por parte de la administración del parque. Se encontró que para mejorar los planes para el manejo de esta clase de desastres, el parque y la comunidad deben mejorar la comunicación entre ambos, y la participación y coordinación de actividades. Para disminuir los riesgos de desastres físicos y económicos, la comunidad tiene que organizarse para pedir y obtener más información sobre las crisis generada por futuras erupciones y diversificar el tipo de turismo de que depende. La administración del Parque Nacional Volcán Poás debería iniciar actividades que ayuden al mejoramiento de la capacidad de participar de las comunidades en las actividades que el parque realiza en épocas de crisis, también debería incluir las necesidades informativas de la comunidad y de los negocios en su plan de gestión de desastres.

**Palabras clave:** Parque Nacional Volcán Poás; Costa Rica; Relaciones entre parques y comunidades; Gestión del desastres; Participación de las partes; Información; Parques Nacionales.

**Abstract:** Volcán Poás National Park, located in the central valley of Costa Rica, is the most visited and most economically important park in the country. Recently, a series of eruptions caused the park administration to severely limit visitation for a period of approximately 3 weeks. This study examines the economic impact of this policy on the surrounding communities of Poasito and Fraijanes, which are reliant on tourists who stop in the towns on their way to or from the park. The social impact, as seen in the failure of park-community information sharing during this period of disaster management, is also investigated. Improving disaster management and planning both within and outside the park is found to be closely tied to improving the poor communication and lack of multi-stakeholder participation in park-community affairs. Both parties are responsible for improving the situation. To decrease vulnerability to physical disasters and their accompanying economic crises, the community needs to organize to illicit information and to diversify the type of tourism on which they are dependant. PNVP needs to initiate capacity-building activities in the community and include community information needs in their disaster management strategy.

**Keywords:** Volcán Poás National Park; Costa Rica; Park-community Relations; Disaster Management; Multi-Stakeholder Participation; Information; National Parks.

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## Introduction

In 1971 the Costa Rican government created its third national park to protect Volcán Poás (here after VPNP) and the ecosystem that exists on its upper slopes. Today it is the most visited park in Costa Rica, with 273 thousand visitors and 1 million dollars in revenue in 2005. Because of its success, the National System of Conservation Areas (here after SINAC) redistributes the income generated by VPNP to other parks that are less financially successful. Thus it could be said that VPNP actually subsidizes SINAC and Costa Rica's parks in general. Taken together, the above-mentioned factors explain why VPNP has been called the most important of Costa Rica's National parks (Quesada, 2006). Consequently, when unusual volcanic activity was detected for the first time in 12 years, many people were concerned. A series of small eruptions beginning on March 24, 2006 caused the park to close for 3 days; in the following weeks only a limited number of visitors were allowed in the park. They could stay at the crater lookout for just 20 minutes, and had to be accompanied by a park ranger at all times. Restrictions were lifted on April 10<sup>th</sup>, 2006 (Dobles, 2006, pers. com.).

Between the years of 1970 and 2000 there were an average of 32.4 natural disasters in Latin America and the Caribbean, resulting in 7,500 deaths per year and an average annual cost between USD 700 million and 3.3 billion. Factors that lead to high levels of vulnerability to disaster-related losses include widespread poverty, high unemployment, distributional inequalities, high population growth, and lack of strong national and local institutions for dealing with disasters (Charveriat, 2000; Smith, 1996; Anderson, 1995; and ECLAC/IBD, and 2000 Pielke, *et al.*, 2003). Park administrators in developing countries face the universal challenge of conciliating the use and preservation of parks with high population rates and widespread poverty. This is due to poor management plans, which have contributed to the loss of economic profits and environmental degradation of parks. Park administrators need

to plan and manage at the eco-system level, not just within park boundaries. They also need to include economics in their management plans in order to address the dilemma of use versus preservation more effectively (Stynes and Sun, 2003; Western & Henry, 1979; Goodwin, 2002; Ashley, 1995; Fiallo, *et al.* 1995; Fredman, 2004 and Saunier and Megnak, 1995).

Evidence gathered indicates that parks (or communities) that face repeated disaster phenomena are more likely to be better planners, more able to place a consistent level of importance on disaster planning and risk management and stress the importance of community participation in the effectiveness and efficiency of disaster management policies (Look and Spennemann, 2001; Manock, *dna*). The lingering disillusionment from past initiatives and negative historical interactions with park administration and staff seems to be one of the main problems in creating functional multi-stakeholder relationships (Jamal and Getz, 1999; Look and Spennemann, 2001; Ormsby and Kaplin, 2005).

At the same time barriers to entry exists for certain members of the community, and although the right to participate is generally acknowledged, the capacity to do so is not always present. There seems to be a problem of "manufacture[ed] consent," and destructive and creative conflict relationships. The need for authorities to create education and awareness programs in the community has been found to be essential (Jamal and Getz, 1999). In trying to outline a framework for understanding community perceptions of near-by parks, a lack of clear communication has been found and a "full disclosure of park administration related information" has been called for. If this is true in day-to-day operating circumstances, surely the importance of communication is highlighted during times of crisis. (Ormsby and Kaplin, 2005)

National parks that are at high risk to natural disasters, specifically those with active volcanoes, need a specialized management plan to deal with the threat of possible eruptions and communicate necessary information to surrounding communities. The eruptions of Ruapehu that occurred in 1995-1996 in New Zealand

brought forth issues regarding the lack of communication between affected communities, volcanologists, and other scientific experts before and during the event. Inaccurate reporting of information by the media resulted in heightened anticipatory anxiety in surrounding communities. Frequent media speculation over minor volcanic activity psychologically and economically affected the community. Scientific and community perceptions differed because community perceptions relied heavily on what the media conveyed. The study suggested that in the future, communities be well-informed prior and during an eruption by means of educational workshops and special seminars. It is important to underscore the idea that developing relationships with important media outlets can be quite beneficial in helping attenuate the consequences of the social amplification of risk. This means using the media to help prepare for and cope with the effects of volcanic eruptions (Miller *et al.*, 1999 and Ronan *et al.*, 2000).

The need for an integrated approach to disaster analysis in volcanic eruption involving a multidisciplinary team of volcanologists, social scientists, and the media has been clearly demonstrated. A key role for multidisciplinary teams is reducing the social impact of volcanic hazards through assisting communities, organizations, and individuals following an eruption and, importantly, during quiescent periods. The emphasis is the facilitation of volcanological knowledge and expertise in threat communication, mitigation, community development, emergency planning, and response management, but particularly in preparing volcanologists for the social demands encountered in playing an active crisis management role. (Ronan *et al.*, 2000). The need for a team approach is particularly important when national parks and protected areas face natural disasters, which are generated inside the parks but affect directly the lives and economic conditions of neighboring communities.

Communities respond in a variety of ways to natural disasters. There are three types of effects on individual welfare by disaster: physical, assets, and income (Charveriat, 2000; and Malilay *et al.*, *dna*). Economic resilience to disasters is hard to

quantify. However, it has been defined by Bruneau *et al.* as “the ability of social units to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate effectors of further disasters” (Bruneau *et al.*, 2003). It is important to measure resilience in order to facilitate the creation of future post-disaster policies (Rose, 2004). Paton *et al.* found that community resilience could be improved by community development programs that include hazard education (Paton *et al.*, 2001). Economically diverse tourism communities are more resilient because they are not solely dependent on one industry that could easily be destroyed by disaster (Kariel and Kariel, 1979).

The impacts of disasters are not only confined to local communities, but also impact the country's economy on a larger scale. One model that illustrates this process is the continuous framework model, which suggests that the flow of goods must be considered to estimate the damage caused by a disaster because of the forward and backward linkages of many communities (Kreimer, 2000; van der Veen, 2004; Hallstrom and Smith, 2004; Otero, *dna*; and Pelling *et al.*, 2002). Small scale, local businesses are particularly susceptible to post-disaster losses. Business failure rates increase dramatically after natural disasters due to damage to buildings, inventory, and access, as well as an interruption of commerce (McClure, 2000). Small businesses are more likely to close because they do not have access to sufficient funding to plan for or take action against a disaster or to recover afterwards (Blair, 2001; Damaso, 2002; and Ham *et al.*, 2004).

For example, the evacuation necessitated by the 1999 eruption of Mt. Tungurahua in Ecuador completely eliminated tourism income within the community for two years. Some crises may have limited physical damages, but lasting psychological effects associated with the perception of risk in the specific tourism area. Disasters such as major disease epidemics and terrorist attacks can deter tourists from frequently visited areas (Evans and Elphick, 2005; Henderson and Ng, 2004; Chen, 2003; Lane, 2003; and Andorka, 2006).

Disaster management is important because effective management plans can help prevent disasters from turning into crises and potentially lessen the physical and economic impacts of a disaster. Careful management of the potential impact on the economy is essential, as the local, national and even international economies may be affected by a disaster (Nam *et al.*, 2005; Avery, 2002; and Hahn *et al.*, 2003).

In a report commissioned by the Inter-American Development Bank, Hahn *et al.* define disaster management as having six stages: prevention, mitigation, preparedness, response, rehabilitation, and reconstruction (Hahn *et al.*, 2003). These stages can be divided further into pre-event and during-and-post-event actions, using a military analogy to distinguish between good disaster preparedness “strategy” and the “tactics” of specific, real-time emergency management. There is a focus on the latter, with ten criteria for good disaster management. Further problems can result from the handling of the disaster as well as directly from the event in question; unlike the disastrous event that is by definition unpredictable and case specific, there will always have to be some sort of response. This allows for at least some planning with the goal of mitigating the inevitable anthropogenic problems. Other necessities for good management are co-ordination of responding organizations rather than centralized control, effectively managed personnel and resources, and above all a free and accurate flow of information (Quarantelli, 1997; and Williams and Ferguson, 2005).

The conclusions of these studies may not be applicable or even feasible for disaster management in developing countries because the bulk of disaster management research has been done by authors from more developed countries on case-specific strategies (Quarantelli, 1997). This could also be considered a specific manifestation of the broader problem of inability to compare the success of management practices in different communities or disasters.

A study on disaster mitigation outlined a more generalized strategy for helping communities deal with crises; it calls for community mobilization through contingency planning, psychological and physical preparation, and task force creation. Such

task forces would serve needs internal to the community, such as monitoring and on-the-ground organization, but also serve as the community’s connection with larger outside actors such as aid agencies, NGOs, and national government agencies (Newport and Jawahar, 2003).

Tourism crisis management literature examines the effects of disasters on the tourism industry and how the public and private sectors can reduce the risks to tourists and the potential economic losses from decreased visitation during and after a crisis. There are few well-developed disaster management plans for tourist destinations. International travel has been increasing and only recently has the tourism industry begun to realize the extent and impact of serious disasters. Recent examples range from epidemics to terrorism to natural disasters (Henderson and Ng, 2004; and Ritchie, 2003).

Effective management needs to deal with the initial reactions of shock and denial after a crisis. However, much of the current research focuses on how to deal with the aftermath and the perceptions held long after the restoration of services in a particular, which, although negative, can help the community and national government to see the importance of tourism and the need to incorporate it into future management plans (Williams and Ferguson 2005; Faulkner, 2003; Huan *et al.*, 2003; and Henderson and Ng, 2004).

To ensure effective volcanic eruption management, three critical social management techniques should be considered: public education, access controls, and evacuation systems (Perry and Godchaux, 2005). Clear responsibility for coordination and adequate communication and information dissemination are essential, as are detailed analyses of community needs and resources sources (Paton *et al.*, 1998).

A study specific to volcanic eruption management cites four stages: assessment, warning, impact, and recovery. Research and monitoring groups may collect information about different topics such as community perceptions of risk and the impact of volcanic eruptions on health, agriculture, and insurance of local households. Creating restricted entry zones and evacuation plans are also necessary tasks. A success-

ful information-management tool was implemented during the eruption of Mt. St. Helens in 1980 when a toll-free telephone number was created with constant updates on safety concerns for locals and tourists (Murphy and Bayley, 1989).

The situation at Volcán Poás is different from most of what has been discussed previously due to the level of disturbance caused by the eruptions. The flow of visitors that passed through the gateway communities was greatly reduced, but it did not stop, and it has since been restored. More importantly, neither the infrastructure of the park nor the community was damaged; this makes it possible to separate the economic impact of reduced tourism from the more obvious economic impact of loss of infrastructure, on which most post-disaster studies have focused. This provided an opportunity to study the economic and social impact of both the eruptions and the resulting restrictions on the communities surrounding PNVP, which could lead to a better understanding the reliance of the gateway communities on tourism drawn by the park. In a time of crisis management it follows that the relationship between the park and various gateway communities may be more stressed. This could pose serious problems for effective disaster management, considering that PNVP-community relationship has been described at times as non-existent or even tense due to unfulfilled economic expectations of the community and a serious lack of communication on the part of both parties (Sedback, 2001).

The purposes of the study were: to provide PNVP and SINAC with information on the social and economic effects of the eruptions and suggest based on the findings management strategies to deal with similar disaster at volcanic national parks in the country. The main objectives of the study were two: a) To determine the socio economic effects of the recent eruptions of Volcán Poás on the surrounding communities and b) to determine which of the disaster management measure the administration of PNVP could take the community considered most helpful to them in times of an volcanic eruption crisis. The hypothesis that guided the study was that providing

more information is the preferred disaster management measure in this case and that the best way to facilitate this is for PNVP to take the initiative and provide extra information”.

### Materials and methods

There are two main towns on the road that leads from the main highway to VPNP. Fraijanes is the first and the smaller of the two, with 35 houses. A cemetery that lies 3 kilometers from the highway is generally considered the boundary between Fraijanes and Poasito, its larger neighboring community with about 120 homes. The entrance to VPNP lies 10 kilometers beyond this commercial corridor, which includes not only tourist-related businesses but also agriculturally focused industry. The combined population of the two towns is approximately 700-800 inhabitants. Since there was no up-dated census of the businesses in the two communities a census was developed of all the tourism and non-tourism businesses and total 28 businesses were identified.

Questionnaires were used to gather socio-economic data on community members and business owners. Both the residential and business surveys included questions that aimed to establish the interviewee's socio-demographic background, sections that asked the interviewee to rank his or her involvement with and knowledge about several aspects of the park's current events, and a final section asking him or her to rank the importance of certain activities the park could pursue to strengthen their relationship with the communities during times of crisis. A scale of 0 to 5 was used for all ranking questions, and a total of 15 persons conducted the interviews from the 7<sup>th</sup>-11<sup>th</sup> of April, 2006.

The community interviews were conducted on weekend when people are more likely to be at home, and the business owner's interviews on Monday, Tuesday and Wednesday after the weekend rush. All interviews were done in the morning. Community interviews (125 in total, with 123 usable) were conducted on a door-to-door basis in the two communities of Poasito and Fraijanes, and business interviews were conducted by appointment, af-

ter the inventory of the businesses have been completed. Out of 28 businesses inventory 26 agreed to participate and provide information.

The analytical sequence was the following: a) One-way analyses of variance (ANOVA) were used to determine any statistically significant differences (probability of at least 95% or  $p$  value  $\leq .05$ ) between the survey responses in the towns of Poasito and Fraijanes; b) One-way analyses of variance (ANOVA) were used to determine any statistically significant differences (probability of at least 95% or  $p$  value  $\leq .05$ ) between the consolidated communities surveys and the businesses responses; c) standardization of the variables to mean zero and variances one, and d) identification of the models using a stepwise regression procedure that best explain the variation in the dependent variables which in both cases was the rank given to the perception in a scales of 0 to 5, as to the way the park administrative authorities has managed the crisis created by the erup-

tions, and d) ANOVA to detect significant differences between the popularity of four actions that the park administration could undertake in case of a new emergency.

### Perceptions of the Communities and Businesses: Results

The initial ANOVA analysis results are presented in Table 1, in which it can be observed that the two communities can not be differentiated in their opinions and perceptions about the way the park administration dealt with the crisis created by the temporary closing of the park for the first three days of the emergency and the temporary access restrictions put in place between the March 27 and April 10 when full access to park facilities was restored. These results, most likely due to the proximity of the two communities, permitted the consolidation of the two communities into one data set that was compared in the second ANOVA to the businesses.

Variable Compare	Mean Fraijanes Towns	Mean Poasito Towns	F Value	P probability	Tukey Family Error Test
Age	35	40	3.08	0.082	nsd
Sex	0.57	0.68	1.52	0.22	nsd
Education	0.61	0.64	0.03	0.86	nsd
Family Income	176	219	0.83	0.37	nsd
Job Related to Tourism	0.1	0.19	1.76	0.19	nsd
Years in Community	24	22	0.26	0.609	nsd
Here for Last Eruption	0.48	0.61	1.85	0.177	nsd
Involved with Park	1.12	1.01	0.17	0.68	nsd
Knowledge of Volcanic Activity	2.24	1.94	1.13	0.29	nsd
Feel Well Informed	2.36	2	0.87	0.35	nsd
Park mean of information	1.23	1.39	1.29	0.26	nsd
Agree with Restrictions	2.97	3.53	2.09	0.15	nsd
Feel Prepared for Eruption	1.72	1.52	0.29	0.593	nsd
Park Obligated to Help Comm	3.93	3.68	0.54	0.47	nsd
Park Managed Well Crisis	3.44	3.48	0.01	0.91	nsd
Meetings with Community	4.4	4.5	0.18	0.67	nsd
Create Park/Comm Committee	4.55	4.59	0.04	0.85	nsd
Provide Clear Information	4.59	4.67	0.2	0.65	nsd
Secure Help for Community	4.65	4.73	0.25	0.62	nsd
Community Dependant Tourism	3.8	3.6	0.35	0.56	nsd

Table 1. ANOVA Comparison for Community and Businesses.

Variable Compare	Mean Towns	Mean Businesses	F Value	P probability	Tukey Family Error Test
Age	38.36	41.54	0.97	0.32	nsd
Sex	0.64	0.19	19.78	0.00	<b>sd</b>
Education	0.66	0.61	0.06	0.81	nsd
Family Income	154	309	38.11	0.00	<b>sd</b>
Years in Community	23	18	1.7	1.19	nsd
Involved with Park	1.05	0.91	17	0.68	nsd
Knowledge of Volcanic Activity	2.05	2.15	0.05	0.85	nsd
Feel Well Informed	2.13	0.8	9.49	0.00	<b>sd</b>
Park mean of information	1.25	1.11	0.69	0.40	nsd
Agree with Restrictions	3.44	1.26	25.91	0.00	<b>sd</b>
Feel Prepared for Eruption	1.6	1.23	0.81	0.37	nsd
Park Obligated to Help Comm	3.7	2.7	5.81	0.02	<b>sd</b>
Park Managed Well Crisis	3.4	1.5	19.95	0.00	<b>sd</b>
Meetings with Community	4.42	4.24	0.4	0.52	nsd
Create Park/Comm Committee	4.57	4.38	0.58	0.44	nsd
Provide Clear Information	4.64	4.76	0.41	0.52	nsd
Secure Help for Community	3.88	3.92	0.41	0.53	nsd
Community Dependant Tourism	3.88	3.92	0.01	0.92	nsd

nsd= not significantly different at 95% and sd= significantly different at the 95% probability

Table 2 presents the ANOVA results of the community and businesses comparison. The variables that presented significant differences at the 95% probability level were sex, monthly family income, how well informed they felt, their level of agreement with restrictions, opinion the park’s obligation to help communities in the crisis, and opinion on how well the park managed the crisis. Once this first stage of the analysis was completed, the estimation of the individual rank ordered models using a stepwise regression procedure was conducted. The results of the models are presented below:

The standardized regression models for the communities is:

$$PMWSTD = - 0.0000 + 0.388 FWISTD + 0.195 AWRSTD - 0.212 KVASTD - 0.164 EDUCSTD + 0.181 MOISTD$$

The resulting model included the standardized transform variables, PMW as a dependent variable (Park managed the crisis well), FWI (feels well informed), AWR (agrees with the restrictions), KVA (knowledges volcanic activity), EDUC (equivalent level of education) and MOI (Park mean of information).

Predictor	Coef	StDev	T	P
Constant	-0.00000	0.07840	-0.00	1.000
		FWISTD	0.38845	0.08299
			4.68	0.000
AWRSTD	0.19500	0.08063	2.42	0.017
		KVASTD	-0.21176	0.08308
			-2.55	0.012
EDUCSTD	-0.16428	0.07926	-2.07	0.040
PMOISTD	0.18118	0.07919	2.29	0.024

R-Sq = 47.5% R-Sq(adj)= 44.4% Analysis of Variance F= 8.87 , p= 0.000 and n= 123

The resulting model included the standardized transform variables, PMW as a dependent variable (Park managed the crisis well), FWI (feels well informed), AWR (agrees with the restrictions), KVA (knowledges volcanic activity), EDUC

(equivalent level of education) and MOI (Park mean of information).

The standardized regression models for the businesses is:

$$PMWSTD = - 0.000 + 0.565 FWISTD + 0.412 AMISTD$$

The resulting model included the standardized transform variables, PMW as a dependent variable (Park managed the crisis well), FWI (feels well informed)

and AWI (Average monthly income of the family).

Predictor	Coef	StDev	T	P		
Constant	-0.0000	0.1185	-0.00	1.000		
FWISTD			0.5648		0.1305	4.33
AMISTD			0.4116		0.1306	3.15

R-Sq = 66.4% R-Sq(adj) = 63.5% Analysis of Variance F = 22.76 ,p = 0.000 n= 26

The previous material clearly indicates that the perception about how well informed the persons being interviewed felt was determinant of how that individual evaluated the park handling of the situation.

The ANOVA analysis conducted among the four options included in the survey as potential actions in case of new emergency indicated that there were no significant differences between the four options. The Tukey family error test confirmed the results and indicated that there were no significant differences among the four options, as indicated with F= 2.24 and p = 0.083. Clear and precise information and securing help for the community with mean values rating of 4.66 and 4.68 respectively seemed to be slightly preferred over the meetings and committees, with meetings been the less preferable of the four, although no statistical difference was detected.

#### **Lessons Learned: Information and Team work, Essential Elements of Crisis Management: A well known conclusion.**

Costa Rica has a number of national parks that contain active volcanoes; with different degrees of volcanic activity, including the internationally famous Poas,

Irazu, and Arenal. The first two represent over 40% of the income in entrances perceived by SINAC on a yearly basis, and are located in the country central valley where over 65% of the country population lives today. Parks therefore are high risk areas and it is essential that each of the communities located in the immediate vicinity have a specialized plan and that parks communicate the necessary information to the surrounding communities on a regular basis. This is essential to deal effectively with crises like that which Volcan Poas National Park faced between Marc 24, and April 10, 2006. No plan existed, and perhaps the absence of such plan was the root of all the problems.

The crater of Volcan Poas, where the majority of activity took place, is just 350 meters below the main lookout point, causing the park administration to close the park for three days and restrict visitor access for the remaining 16 days until eruptions subsided.

The crisis generated by these eruptions and the management measures undertaken by the park made evident a series of issues, including the lack of communication between the affected communities and the park, discrepancies between vulcanological organizations and other scientific experts before and during



the event, and inaccurate reporting of information by the media. Community perceptions relied heavily on what the media reported, which could have been guided more by sensationalism than by "true" events.

In 2001 studies conducted in both communities found that they did not acknowledge their dependency on tourist expenditures brought to the area by the park. (Sedlacek, 2006). However in 2006, during the interviews 74% of the 123 homes surveyed indicated that the two communities were heavily economically dependent on tourists and their expenditures in the area. The problem is not only that this dependency is growing, but that the two communities are becoming more vulnerable to this kind of crisis. Considering that economically diverse tourism communities are more resilient because they are not solely dependent on one industry that could easily be destroyed by disaster, heavy dependency on VPNP could in itself be called dangerous (Kariel and Kariel, 1979; and Rose, 2004).

The community/businesses variables where significant differences were detected between the two groups indicated that: in the businesses, the persons interviewed were 81% males; the average family income of the business owners was twice the community members; the volume of sales suffered a reduction of 56%; businesses did not agree with the visitor restrictions; the rating given to the idea of feeling well informed was 0.8 on a scale of 0-5; and the rating given to how well the park has managed the situation was 1.5. The results also made clear that the general community has been substantially less critical and even supportive of the park's decisions, based on their perception that the park administrators knew what they was doing. The business owners were more concerned with their income reduction and how this affected their own personal income. This may be due to the fact that small business failure rates increase dramatically after natural disasters due to the interruption of commerce and lack of access to sufficient funding to plan for or take action against disaster or recover afterwards, which has been pointed out by many studies (Blair,

2001; Damaso, 2002; Ham *et al.*, 2004 and McClure, 2000). The bottom line for the park administrators seems to be how well the park administration is perceived as having managed the crisis.

The fact that businesses demonstrated little care towards the park's management strategy and tourist safety may be explained by the fact that only 30% of the businesses are owned and operated by people from Poasito and Fraijanes. This is not unusual; in a 2001 study of the area surrounding Manuel Antonio National Park, it was found that 76% of the businesses were owned and operated by foreigners (Aguirre, 2001). The businesses' concern for income and information was ratified by the model derived for the businesses, where how well the businesses owners perceived the park administration's handling of the crisis depended basically on their monthly income and how well informed about the crisis they felt. The relation between businesses income and family income became very evident. If sales go down, family income goes down along with profits; therefore it follows that 90% of all the vociferous complaints to the media during the crisis period came from the business owners.

On the other hand, the community model identifies a broader array of issues in the variables that it included. The perception of how well the park administration handled the crisis depended on how well informed he or she felt, level of agreement with the restrictions, level of knowledge of volcanic activity, level of education, and whether or not the park was a source of information (the vast majority of respondents, both residents and business owners, reported that none of the information they received came from the park). Even absolute values are most important for examining the rankings given, the signs are indicative of the behavior of the relations. For example, education and knowledge of volcanic activity had negative signs, indicating that the higher the education and the knowledge of previous volcanic activity, probably due having lived through previous eruptions, make the interviewee more critical of the park's handling of the crisis. The variables of how feel informed the respon-

dants felt, their level of agreement with the restrictions, and whether the park was a source of information had positive signs, indicating that information coming from the park was very important in forming the opinion of the community members on how well the park handle the crisis.

When asked what they preferred that the park do in times of crisis, the reaction was basically that they wished the park would provide clear and precise information and help the community to get help, two things they can not do for themselves. One comment made during the interviews to the authors by one lady probably is the best summary; "Sir, if the volcano blows up, we as a community are going to be the first to feel the eruption impact; therefore we have the right to be informed in a precise and clear way. If my life is in danger, the park people have the responsibility to inform me."

Information and the team approach are the bottom line. The need for an integrated approach to disaster analysis in volcanic eruptions involving a multidisciplinary team of volcanologists, social scientists, and the media is essential in order to guarantee that clear, concise, coordinated and reliable information reaches the public, which in turn will help avoid creating "massive negative reactions." Clear responsibility for coordination and adequate communication and information dissemination are essential, as are detailed analyses of community needs and resources sources. Clear and participatory risk management plans are essential in times of crisis, something that today does not seem to be present in many communities surrounding the main volcanic national parks in Costa Rica. The need for crisis management plans has been more than demonstrated in many studies around the world (Paton *et al.*, 2001; Kariel and Kariel, 1979; Ronan *et al.*, 2000; Perry and Godchaux, 2005; and Miller *et al.*, 1999 and Finnis *et al.*, 2004).

After talking to many community members, businesses owners and park officials, it became obvious to the authors that the vulcanological concerns overshadowed human considerations; this may

also be due to the absence of social scientists in the discussions. The media was not directly involved in this study beyond the fact that is cited as the main source of information for the nervous and unhappy residents and business owners. Information is vital for appropriate disaster management, and it has to come from the park. The media is a good source but in critical times competition among media outlets may make it less reliable.

The final question is: Will VPNP make the same mistakes again? Only time will answer this question. Above all, the final and perhaps most important purpose of this study is to serve as a permanent remainder of the need for information and community participation in disaster management in Costa Rica. Citizens are always the ones affected; therefore they have the right to know what is occurring in order to be prepared.

## Conclusions

1. The study provides SINAC and VPNP with timely information on the perception issues related to the March-April 2006 crisis created by the eruptions of Volcan Poas.
2. The negative economic and social impacts of the recent eruption seem to be greater in the local businesses than in the communities of Poasito and Fraijanes gateway communities to Volcan Poas National Park
3. The communities appear to support the way the crisis was handled by the park administration more than the businesses because of the economic impact on their sales as results of the disaster management measures taken by the park.
4. Providing information and helping the community to get help appear to be the preferred actions to be taken by the park if similar crises occur in the future.
5. It is felt that the hypothesis that guided the study was proven based on the results of the study.

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### Business Survey (Translation of the original Spanish surveys)

<b>PRELIMINARY ECONOMIC IMPACT ASSESTEMENT SURVEY VOLCAN POAS</b>						
<b>Please mark or fill out in the proper places. THANK YOU FOR THE SUPPORT.</b>						
Age						
Education	Primary	Secondary	University	Post Grad	Other	
Type of Business	Hotel or Lodge		Restaurant	Souvenir	Other	
Family Monthly Income						
Nationality	Costa Rica	From Where		Foreign	From Where	
Sex	Male	Female				
<b>Income and Purchases Data on the Business Activity</b>						
How long have the business been operating?						years
How long have you lived in the Community?						years
How much have you invested in this business?						colones
How much do you sell...						colones
On a good day						colones
On an average day						
On a poor day						colones
What percentage of your sales are to tourists visiting the park?						
What percentage of your sales are to the local community?						
What is the average spending per tourist in your business?						
On a good day						colones
On an average day						colones
On a poor day						colones
How much do you normally spend on supplies for your business every month?						colones
What percentage of that amount is purchased in the local community ?						
What percentage of that amount is purchased outside the local community ?						
What is the average number of tourist your business receives on:						
On a good day						number
On an average day						number
On a poor day						number
<b>Employment</b>						
What is the number of employees in your business?						
What is the weekly payroll?						colones
How many of your employees come from the community?						
How many of your employees come from outside the community?						
When the business was started, how many employees did you have?						
How many employees do you have at the present time?						
What is your profit margin?						%
<b>Direct Impact</b>						
Since the activity of the Volcano started, in what percentage has your normal business activity been reduced?						
	no impact	5	10	20		
	30	40	50	60	70	80
	90					
	100	No reduction				

If the volcano erupts, do you have any other source of income besides this business						
Yes		No			No answer	
If your business has to close due to the eruptions of Poas how long can you hold out before you have to totally close the business.						
Will not have to close	one week	two weeks	three weeks	one month	three months six months	
other						
						No comment

<b>Information about Park Emergency Activities</b>						
<b>How many times have you visited the park in the last 5 years?</b>						
<b>How involved are you in park activities?</b>						
Never 0	1	2	3	4	Very 5	
<b>How much do you know about the activity of the Volcano?</b>						
No Inf 0	1	2	3	4	Full Info 5	
<b>Do you feel you have been adequately inform about what is happening in the park?</b>						
Not Adeq 0	1	2	3	4	Full Info 5	
Where did you get this infromation?						
Park Service	Media	Neighbors	Other			
<b>Do you agree with the restrictions on visitors in the park?</b>						
Not In Agre 0	1	2	3	4	Full Agre 5	
<b>In case the Volcano erupts, do you feel prepared to handle the emergency?</b>						
Not Prep 0	1	2	3	4	Pully Pre 5	
<b>In the case of an eruption, do you feel the park would be responsible for helping</b>						
No 0						Yes 5
<b>Do you feel the park is handling the current situation as it should be?</b>						
No 0	1	2	3	4	Yes 5	
<b>Comments</b>						
<b>How important are the following things that the park could do to help the community?</b>						
<b>Meet with the community regularly?</b>						
Not important 0	1	2	3	4	very 5	
<b>Help create an emergency committee?</b>						
No 0	1	2	3	4	very 5	
<b>Provide clear and precise information?</b>						
No 0	1	2	3	4	very 5	
<b>Help community to get government support</b>						
No 0	1	2	3	4	very 5	
<b>If you have any additional suggestions please list them below:</b>						

## Community Survey

<b>PRELIMINARY ECONOMIC IMPACT ASSESTEMENT SURVEY volcán POAS</b>						
<b>Please mark or fill out in the porper places. THANK YOU FOR THE SUPPORT.</b>						
Age					Sex	Male Female
Educación	Primary	Secondary	University	Post Grad	Other	
Family Monthly Income						
Is your job related to tourism in any way? 0 1 2 3 4 4						Members in the Family
<b>Residence in the Community</b>						
How long have you lived in the community?						
Did you live in this community the last time the volcáno erupted?						Yes No
<b>Información about Park Emergency Activities?</b>						
On a scale of 0 to 5, rank your agreement or disagreeemnt with 0 means lowest value and 5 highest value.						
<b>How involved are you in park activities?</b>						
Never 0	1	2	3	4	Very	5
<b>How much do you know about the activity of the volcáno?</b>						
No Infmormación 0	1	2	3	4	A lot	5
<b>Do you feel you have been adequately informed about the activity of the volcáno</b>						
No 0	1	2	3	4	Full Info	5
<b>Where did you get this información?</b>						
park Service	News	Neighbors	Other			
<b>Do you agree with the restriction of visitors placed by the Park</b>						
Not In Agre 0	1	2	3	4	Full	Agre 5
<b>In case the volcáno Erupts, do you feel prepare to handle the emergency?</b>						
Not Prepared 0	1	2	3	4	Fully Prepared	5
<b>Do you feel the park is responsible to help the community in case of an erupción?</b>						
No 0	1	2	3	4	Yes	5
<b>Do you feel the park is handling the current situación as it should be?</b>						
No 0	1	2	3	4	Yes	5
<b>Comments</b>						
<b>How important are the following things that the park could do to help the community?</b>						
<b>Meet with the community regularly?</b>						
No 0	1	2	3	4	Very	5
<b>Help create an emergency committee?</b>						
No 0	1	2	3	4	Very	5
<b>Provide clear and precise información?</b>						
No 0	1	2	3	4	Yes	5



<b>Help community to get government support</b>						
No	0	1	2	3	4	Yes 5
<b>If you have any additional suggestions please list them below:</b>						
On a scale from 0 to 5, How do you rate the economic dependency of the community on tourism?						
0 means no dependency and 5 totally dependent.						
0	1	2	3	4	5	No comment

**NOTA**

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