HAZARD VULNERABILITY IN SOCIO-ECONOMIC CONTEXT:
AN EXAMPLE FROM ECUADOR

by

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A thesis submitted in partial fulfillment of the requirements for the degree of
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Date of Approval:
March 14, 2003

Keywords: Risk perception, evacuations, volcanic eruptions, emergency management, Tungurahua Volcano

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For Jennifer and Evelyn
ACKNOWLEDGEMENTS

No research is accomplished without assistance, and many people shared knowledge and information that contributed significantly to this thesis. Among these, a special debt is owed to Annette Doying, Ethela Falconi Astudillo, Patricia Guevara, Carmen Laspina Arellano, Luis Rodriguez Morales and Hugo Yépes.

I am particularly indebted to Dr. Graham Tobin for the opportunity to work with him and Dr. Linda Whiteford as a member of their research team on two grants funded by The Center for Disaster Management and Humanitarian Assistance. Without that opportunity, this thesis would not have been possible. Dr. Tobin encouraged me to pursue the particular line of investigation that led to the research hypotheses, oversaw my work, and was supportive throughout the lengthy research process. Dr. Whiteford enriched my understanding of Ecuador and its peoples and, together with Dr. Martin Bosman, provided a critical reading of the thesis that helped clarify many points.

While this research has benefited from the contributions of those named above, and of many others whose input enhanced the work in diverse ways, any inaccuracies, errors, or omissions are mine alone.
TABLE OF CONTENTS

LIST OF TABLES iv
LIST OF FIGURES v
LIST OF MAPS vi
LIST OF ILLUSTRATIONS vii
ABSTRACT viii

CHAPTER 1: INTRODUCTION 1
   Natural Hazards and Developing Countries 1
   Baños and Tungurahua Volcano 4
   Organization of the Chapters 5

CHAPTER 2: LITERATURE REVIEW 7
   Introduction 7
   Individual Perception of Natural Hazards 9
   Response to Evacuation 11
      Behavioral Aspects 11
      Emergency Management Aspects 14
   Tourist Industry and Disasters 16
   Vulnerability and Marginalization 17
   Theoretical Framework 19
   Research Hypotheses 21
   Research Questions 22

CHAPTER 3: METHODOLOGY 23
   Level of Analysis 23
   Consolidation and Synthesis 29
   Notes on the Sources 30

CHAPTER 4: STUDY SITE: PHYSICAL AND HUMAN GEOGRAPHY 31
   Introduction 31
   Physical Geography of the Hazard Zone 33
      Rivers and Relief 33
      Climate and Soils 39
   Baños 40
      Demographics 42
LIST OF TABLES

Table 1  Population growth in the Canton of Baños  43
Table 2  Tungurahua Volcano: Lahars (October 1999 – July 2002)  58
Table 3  Tourist establishments in Baños (1997-2002)  81
Table 4  Reasons for leaving Baños  96
Table 5  Did you leave voluntarily?  96
Table 6  Reasons for returning to Baños – June 2000  108
Table 7  Reasons for returning to Baños – January 2001  111
Table 8  Degree of worry about volcano – June 2000  114
Table 9  Worry about volcano among shelter residents  114
Table 10 Perceptions of risk among shelter residents  115
Table 11 Worry about volcano among Baños returnees  115
Table 12 Perceptions of risk among Baños returnees  116
Table 13 Ranking of crises  119
Table 14 Remittances from expatriates: 1999-2001  127
Table 15 Price increases in basic services in Ambato  133
**LIST OF FIGURES**

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Model showing the relationship between hazard vulnerability, and its root causes, in the causation of disasters</td>
<td>21</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Distribution of population in Baños Canton</td>
<td>43</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Growth in accommodations</td>
<td>82</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Occupation of Baños evacuees</td>
<td>99</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Ecuador crude petroleum prices: 1997-2001</td>
<td>120</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Growth in food production: 1995-2000</td>
<td>121</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Public expenditures on health: 1995-2000</td>
<td>123</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Gross domestic product: 1995-2000</td>
<td>123</td>
</tr>
<tr>
<td>Figure 9</td>
<td>Inflation: 1999</td>
<td>124</td>
</tr>
<tr>
<td>Figure 10</td>
<td>Real wages: 1999</td>
<td>124</td>
</tr>
<tr>
<td>Figure 11</td>
<td>Gross domestic product per capita: 1995-2001</td>
<td>128</td>
</tr>
<tr>
<td>Figure 12</td>
<td>Unemployment and underemployment</td>
<td>129</td>
</tr>
<tr>
<td>Figure 13</td>
<td>Changes in the CPI – Ambato, 1999</td>
<td>131</td>
</tr>
<tr>
<td>Figure 14</td>
<td>Changes in the CPI – Ambato, 2000</td>
<td>132</td>
</tr>
<tr>
<td>Figure 15</td>
<td>Changes in the CPI – Ambato, 2001</td>
<td>133</td>
</tr>
<tr>
<td>Figure 16</td>
<td>Consumer price index Ambato</td>
<td>134</td>
</tr>
<tr>
<td>Figure 17</td>
<td>Consumer price index Ambato: 1999-2001</td>
<td>135</td>
</tr>
<tr>
<td>Figure 18</td>
<td>Social and political conflict: 1999-2001</td>
<td>141</td>
</tr>
<tr>
<td>Figure 19</td>
<td>Public sector conflicts: 1999-2002</td>
<td>142</td>
</tr>
</tbody>
</table>
# List of Maps

<table>
<thead>
<tr>
<th>Map</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map 1</td>
<td>Ecuador: Provinces</td>
<td>32</td>
</tr>
<tr>
<td>Map 2</td>
<td>Communities, rivers and ravines on the flanks of Tungurahua Volcano</td>
<td>36</td>
</tr>
<tr>
<td>Map 3</td>
<td>Topography of Baños and surroundings</td>
<td>37</td>
</tr>
<tr>
<td>Map 4</td>
<td>Topographic profile: Valley of Pastaza River</td>
<td>38</td>
</tr>
<tr>
<td>Map 5</td>
<td>Canton of Baños: Parishes</td>
<td>41</td>
</tr>
<tr>
<td>Map 6</td>
<td>Baños and neighboring communities</td>
<td>45</td>
</tr>
<tr>
<td>Map 7</td>
<td>Cantons of Tungurahua Province</td>
<td>55</td>
</tr>
<tr>
<td>Map 8</td>
<td>Cantons of Chimborazo Province</td>
<td>55</td>
</tr>
<tr>
<td>Map 9</td>
<td>Principal urban destinations of 1999 evacuees</td>
<td>98</td>
</tr>
<tr>
<td>Illustration</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>1</td>
<td>Valley of the Pastaza River</td>
<td>34</td>
</tr>
<tr>
<td>2</td>
<td>Valley of the Chambo River</td>
<td>34</td>
</tr>
<tr>
<td>3</td>
<td>High plains in Tungurahua Province</td>
<td>39</td>
</tr>
<tr>
<td>4</td>
<td>Pastaza River gorge at Baños</td>
<td>42</td>
</tr>
<tr>
<td>5</td>
<td>Farm in Ulba River valley</td>
<td>47</td>
</tr>
<tr>
<td>6</td>
<td>Tungurahua Volcano</td>
<td>54</td>
</tr>
<tr>
<td>7</td>
<td>Destruction caused by lahars</td>
<td>59</td>
</tr>
<tr>
<td>8</td>
<td>Ravine cut by lahar near Baños-Ambato road</td>
<td>61</td>
</tr>
<tr>
<td>9</td>
<td>Ash fall in Chimborazo Province</td>
<td>63</td>
</tr>
<tr>
<td>10</td>
<td>Ash plume from Tungurahua seen from Riobamba</td>
<td>66</td>
</tr>
<tr>
<td>11</td>
<td>Street in front of Basilica</td>
<td>78</td>
</tr>
<tr>
<td>12</td>
<td>Street vendor in Baños</td>
<td>79</td>
</tr>
<tr>
<td>13</td>
<td>Religious procession commemorating evacuation</td>
<td>85</td>
</tr>
<tr>
<td>14</td>
<td>Hazard sign in Baños</td>
<td>89</td>
</tr>
<tr>
<td>15</td>
<td>Evacuation route marking</td>
<td>90</td>
</tr>
</tbody>
</table>
Hazard Vulnerability in Socio-economic Context: An Example from Ecuador

Lucille Richards Lane

ABSTRACT

How people perceive the risks associated with natural hazards contributes to their willingness to take protective action. Such action may be constrained by prevailing socio-economic and place-specific conditions that restrict or inform the choice of protective measures available to the individual. Vulnerability to the impacts of extreme geophysical events increases when the range of alternatives is limited or misinformed.

Many evacuees from a potentially violent volcanic eruption in Ecuador returned to their home town of Baños while it was still under an evacuation order in 2000 and considered to be a high risk area by officials. The research examined four main questions: (1) What economic conditions confronted Baños evacuees? (2) What political or other social events occurred while they were evacuated that limited their perceived range of options? (3) What information was available about prior eruptions of the volcano and other local natural hazards? and (4) What were the characteristics of the economic base of Baños? These questions were investigated using data from interviews with evacuees,
government and non-governmental officials, census and other statistical information, scholarly texts and newspaper reports.

The research suggests that economic conditions made it extremely difficult for people to relocate to other communities. When a violent eruption did not occur immediately, and few direct impacts of the eruptions were experienced in Baños, many people chose to return home in an effort to reestablish themselves economically. These people perceived the volcano hazard in Baños to be far less threatening than the economic destitution associated with evacuation. This perception may have been influenced by factors other than the socio-economic context, including efforts of political leaders and tourist business owners to effect the town’s economic recovery. These efforts included an aggressive publicity campaign that minimized the risk posed by the volcano. Besides encouraging tourists to return, the campaign also encouraged evacuees to do so. Finally, among some residents, religious beliefs may have contributed to perceptions that they would not be harmed in the event of an explosive eruption.
CHAPTER I
INTRODUCTION

Natural Hazards and Developing Countries

Economic losses from natural disasters are greatest in the world’s more prosperous nations but these events kill more people and have more long-term economic consequences for people living in countries of medium and low human development (IFRC, 2001; Smith, 1996). This is not attributable to a higher incidence of disasters in these countries. It is due in great part to the socio-economic context in which the physical hazard occurs (Hewitt, 1997; Smith, 1996). This context can make populations more vulnerable to the effects of disaster.

According to the International Federation of Red Cross and Red Crescent Societies (IFRC, 2002), the root causes of disasters are frequently poverty and development that is not sustainable. The Secretary General of the United Nations noted in 1999: “Ninety per cent of disaster victims worldwide live in developing countries, where poverty and population pressures force growing numbers of poor people to live in harm’s way…” (Annan, 1999). The most recent data from the IFRC (2002) continue to support this statement.

The problems identified by the IFRC are generally the result of the political, economic, and social conditions that exist in a particular country.
These conditions may also reflect the nation’s relationships with other countries (Susman et al., 1983). Ecuador is a country of medium human development with an economy that has depended for about three decades on price-volatile petroleum exports as its main source of revenue. Ecuador is also a relatively small country, with an area of $283,560 \text{ km}^2$, about the size of the state of Nevada, and subject to many natural hazards, some of them catastrophic in human and economic terms. For example, an El Niño event in 1997-1998 caused damages estimated at 14.5 percent of 1998 GDP (World Bank, 2001). The weather disturbance killed about 200 people, damaged approximately 15,000 homes, many of them in low-income neighborhoods, and resulted in widespread loss of jobs. The initial disaster was compounded by a dramatic decrease in food production due to the havoc caused by flooding in agricultural areas (World Bank, 2001).

The number of hazards studies undertaken in developing countries is growing rapidly, but the socio-economic context in which these events occur is still under-researched. Geographers were among the first to examine hazards across a variety of cultures. Gilbert White and other researchers in the 1960s and 70s were pioneers in the field. White and his colleagues were mostly interested in examining hazard perception and the choices that individuals and communities made in order to manage or adjust to the hazard. The research was conducted in several different countries (White, 1974). Geographers have also been in the forefront of studies that emphasized the importance of the socio-economic context in which hazards occur (Alexander, 2000; Burton, Kates and
White, 1993; Cutter, 1994; Hewitt, 1983 and 1997). At least two multidisciplinary teams that included a geographer have made a study of the vulnerability of communities to volcanic hazards: Dibben and Chester (1999) studied the evolution of the economy of Furnas on the volcanic island of São Miguel in the Azores, and Tobin and Whiteford (2001, 2002) and Whiteford et al. (2002) have been studying hazard vulnerability within a health context in Ecuador. Such studies, however, are still uncommon. In the case of Ecuador, there is ample space for more geographical studies on the subject of vulnerability to natural hazards.

This thesis is an attempt to examine, within a geographical framework, aspects of the socio-economic context that prevailed in Ecuador when a volcano in the central highlands became active after many years of quiescence. It is theorized that context helped to shape hazard perceptions and contributed to the vulnerability of individuals displaced by the eruptions. The research concentrates primarily on the people and conditions in one community, Baños, and relates the physical hazard event and local socio-economic context to socio-economic events at the national level. Most of the events or conditions researched were identified as important crises in their lives by individuals who had been evacuated from areas around Tungurahua Volcano when it seemed likely that it would erupt violently. Other topics were suggested because of the economic dependence of Baños on tourism, and aspects of its history and geographical location.
Baños and Tungurahua Volcano

Baños, along with other communities at risk, was evacuated on October 16, 1999. The Ecuadorian government and local and international NGOs had potentially between 20,000 and 24,000 evacuees to house, feed and assist in finding employment. Only a fraction of the total, however, sought assistance in the government shelters. Most people tried to survive in whatever manner they could: living temporarily with relatives or friends, renting living space, or simply making a home for themselves on the streets of nearby towns. It was a harsh world to have to try to survive in because economic conditions in Ecuador were dire for all but the wealthiest. For the evacuees, displaced and dispossessed, the economic challenges must have seemed insurmountable. The government was in no position to be of any great assistance because it was essentially bankrupt and three months after the evacuation, the president was deposed in a coup d’état.

Economic conditions for the country at large continued to deteriorate dramatically in the weeks following the evacuation. When the volcano did not erupt explosively as expected, and government assistance faltered, a movement developed to return to Baños. In January 2000, the town was reoccupied by several thousand people. Business and political leaders then embarked on a campaign to reactivate tourism, the town’s economic base. Although officially Baños remained under the evacuation order until the end of August 2000, the effort to attract tourists gained momentum. By January 2001 there were signs
that the effort was beginning to pay off and eventually, by early 2002, Baños appeared to have regained much of its pre-evacuation activity.

Mount Tungurahua, however, continued its eruptive cycle and to present a high risk to the community located at its base. Due in great part to the physical characteristics of its location, Baños would be difficult, if not impossible to evacuate successfully on short notice, the kind of notice the volcano had given in prior historical eruptions. Regardless, for many reasons, some of which are suggested in this research, some ten thousand people returned to live in this hazardous environment.

Organization of the Chapters

This thesis, therefore, examines the effects of the volcanic hazard on the town of Baños, how people in the community perceived the hazard, and some factors, including socio-economic events and historical occurrences, which might have contributed to shaping perception.

- Chapter 2 reviews the hazards literature on individual perception of volcanic hazards, evacuation, tourism, vulnerability and marginalization, and states the hypotheses and research questions;
- Chapter 3 outlines the methodology, which included analysis at three levels: that of the individual, of the community, and of the nation;
- Chapter 4 covers the physical and human geography of the study site. Topography, principal rivers, climate and soils of the area around Tungurahua Volcano are described. Selected demographics of the
Canton of Baños are presented, and the political and economic geography of the town of Baños is summarized.

- Chapter 5 describes the current spatial and temporal distribution of hazards from Tungurahua Volcano, and the historical record is summarized. The chapter also provides a brief history of major natural hazards in the general area of the volcano and a list of significant hazards that occurred in Ecuador between September 1999 and December 2001.

- Chapter 6 recounts the mandatory evacuation and dispersal of the inhabitants of Baños, the return of many people before the evacuation order was lifted and how they and their leaders effected the economic recovery of the town.

- Chapter 7 shows the economic dependence of Baños on tourism and traces the development of religious and secular tourism to the area.

- Chapter 8 focuses on the socio-economic context in which the hazard and evacuation occurred. The country’s general economic situation is described and selected economic indicators are presented. Data are also provided on the extent of social unrest that accompanied the economic crisis.

- Chapter 9 provides conclusions and a timeline showing the concurrence of volcanic and other hazards, and of political, economic and social events. Month-by-month data on inflation and cost of living are included in the economic section.
CHAPTER 2
LITERATURE REVIEW

Introduction

There is an extensive body of knowledge on individual perception and its effects on response to hazards. This research has contributed to our understanding of how people at risk behave under conditions of uncertainty (Burton, Kates and White, 1993; Lindell and Perry, 1992; Mileti, Drabek and Haas, 1975; Palm, 1990). The subset of perception and response to volcanic hazards is necessarily more limited but this area also has received considerable research attention and has contributed to how emergency agencies manage human response to volcanic hazards (Blong, 1984; Crandell, Mullineaux and Miller, 1979; Greene, Perry and Lindell, 1981; Mileti et al., 1991; Newhall and Punongbayan, 1996; Perry and Lindell, 1990).

Much of the early research on perception, however, paid comparatively little attention to the social, political or economic context in which hazards occur, and how these factors might influence the manner in which hazardous space is perceived and therefore, how individuals or communities respond to the risk posed by hazards. That context matters greatly to hazard studies, however, is increasingly recognized by researchers seeking to explain why the number of people affected by disasters is increasing in spite of technological advances and
improved prediction capabilities (Blaikie et al., 1994; Cannon, 1994; Gregory et al., 1997; Hewitt, 1983, 1997; and Maskrey, 1994).

Hazardous events take their greatest toll on human lives and create the greatest human suffering in the less developed countries. More than half of all natural disasters reported between 1991 and 2000 occurred in countries ranked by the United National Development Program (UNDP) as being of medium human development (MHD), while two-thirds of all deaths occurred in countries of low human development (LHD) (IFRC, 2001 162). These are the nations where hazard studies placing perception in context are most needed. The need is especially great in the case of volcanic hazards because there have been tremendous population increases in LHDs and MHDs over the past decades. In many countries with active volcanoes more people are living in areas that could be affected by the effects of eruptions. Due to the long return period of eruptions these are also places where no recent eruptions have occurred (Simkin et al., 2001).

The literature review examines four aspects of the overall body of hazards literature: (1) individual perception of volcanic hazards; (2) response to evacuation; (3) the role of the tourist industry in preparedness, response and recovery; and (4) vulnerability and marginalization. It should be noted that there is considerable cross-over and interconnectedness among the research areas.
Individual Perception of Natural Hazards

Perception contributes to how humans understand the world. The “range of judgments, beliefs and attitudes” (Taylor, Stewart and Downton, 1988) that is formed in turn influences how individuals respond to hazards and hazard warnings.

Volcanic hazards present special challenges to perception because eruptions produce a variety of different hazards that have different spatial dimensions and impacts. Additionally, explosive eruptions generally have long return periods. The range of eruption hazards includes lava flows, pyroclastic surges and flows, tephra, gases, lateral blasts, debris avalanches, debris flows (also called lahars) and floods (FEMA, 1997). All of these hazards create diverse geographic areas of risk, and different degrees of risk, and all have somewhat different effects on those in danger. These factors can make hazard perception complex. Shield volcanoes are characterized by non-explosive eruptions and lava flows are regular but rarely fast-moving. The perceptions of people living near this type of volcano, with constant but relatively predictable and non-violent activity, will be very different from those living on the flanks of volcanoes subject to sudden, explosive eruptions. In the case of the latter, long periods of quiescence, from decades to centuries, many encourage dense settlements in areas that are in fact extremely hazardous (Blong, 1984). When this type of volcano does begin an eruptive phase, those living in the area may perceive risk quite differently from the scientists studying the hazard (Crandell, Mullineaux and Miller, 1979; Mileti et al., 1991; Perry and Lindell, 1990), and some people may
even deny that there is any significant risk (Newhall and Punongbayan, 1996). Furthermore, some volcanoes may initiate an eruptive period that is characterized by non-catastrophic hazards. During this period, populations living in the hazard zone may be lulled into a false sense of security and discount the possibility of a major eruption. As people continue with their daily routines they may come to ignore warnings issued by authorities (Simkin et al., 2001).

In addition to the characteristics of the hazard itself, a range of cognitive and situational factors contribute to shaping individual perception (for a review see Tobin and Montz, 1997). Systems of belief sometimes contribute to acceptance of the hazard as an event ordained by a god or gods, impossible to evade. Such beliefs may also affect willingness to take protective action (Blong, 1984; Dibben and Chester, 1999; Murton and Shimabukuro, 1974). Systems of belief may also determine what protective action is taken (Chester, 1993; Chester et al., 1985; Lindell and Perry, 1992). Some researchers have found that gender and ethnicity may influence hazard perception but exactly how this occurs, if it does, is still not understood. Researchers in the 1970s found that various ethnic groups in Hawaii had different attitudes toward volcanic hazards and females generally perceived the hazard to be more threatening than did males (Hodge, Sharp and Marts, 1979). On the other hand, the role of experience in perception is much better understood and is related to the recency, frequency and intensity of the hazard (Tobin and Montz, 1997).

Lack of recent experience with volcanic eruptions results in unfamiliarity with the consequences of the associated hazards and people may be reluctant to
take protective action. Ongoing eruptions on the other hand, may make the
hazard salient and people become more aware of potential impacts (Cola, 1996;
Dibben and Chester, 1999; Hodge, Sharp and Marts, 1979; Perry and Lindell,
1990; Punongbayan et al., 1996). In the case of frequent but low-impact events,
experience may translate into a false sense of security creating a potentially
high-risk situation for the individual who bases future response on past
experience (Johnston et al., 1999; Warrick, 1979).

**Response to Evacuation**

An evacuation is the removal of oneself or others from harm’s way and
there is an extensive literature on the management and effects of evacuation as
a protective measure (for a review see Perry, 1985). There is an equally
voluminous body of work on behavior in response to evacuation warnings (for a
review see Drabek, 1986). The review in this thesis considers only limited
aspects of the behavioral foundation on which human response to evacuation
warnings and orders is based, and some of the applications of these studies to
the discipline of emergency management.

**Behavioral Aspects**

Some of the early models to explain how people respond to evacuations
used rational choice and utility theories as the basis for explanation (see review
by Tobin and Montz, 1997). Since complete information rarely, if ever, exists and
studies showed that individuals do not always act in what appears to be their own
best self-interest, much subsequent research used emergent norm theory to
explain how individuals determine whether or not to respond to evacuation warnings (Perry, 1979, 1985 and 1994; Perry, Lindell and Greene, 1982; Quarantelli, 1980). Although there are variations in the basic model, emergent norm theory suggests that under conditions of uncertainty, when presented with a warning to evacuate, individuals first determine whether or not the threat is real. If the threat is accepted as real, the next question is whether it affects the individual and/or the individual’s family. Finally, a decision is made as to whether evacuation, or a different protective measure, will reduce risk. Whether or not the family is together or whether missing members are known to be in a safe place are almost always factors in the decision-making process (Lindell and Perry, 1992; Smith, 1996).

Each of the three steps in the decision-making process may be influenced by a host of variables that circumscribe rational choice. Among other factors, researchers have examined the roles played by age, gender and ethnicity; family traits; hazard experience and perceived locus of control; a variety of community and structural constraints; and prevailing health conditions (Tobin and Montz, 1997). Several of these variables are discussed in the above literature review of perception. This approach has generated a bounded-rationality model to explain behavior.

More recently, Gladwin et al., (2001) have used an ethnographic decision tree model to determine evacuation decisions. These researchers argue that decision-making is more complex than some models suggest and that an ethnographic approach can capture “the richness of the decision process as well
as its messiness” (Gladwin et al., 2001 118), and thus provide a sounder basis for emergency management. This approach includes criteria such as safety features of the home and discussions among family members as to the appropriate course of action, factors overlooked in existing studies.

Many behavioral studies have focused on the reasons people do not evacuate. Early research by Zeigler et al., (1981), as well as by Perry (1985), showed that people frequently wait for an official order to evacuate before doing so. This finding emphasizes the important role that the source issuing the warning plays in ensuring the safety of populations at risk. Reluctance to evacuate has also been attributed to fear that abandoned property will be looted. Although some researchers conclude such fears are mostly unfounded (Fischer, 1994), looting is commonly thought to accompany most evacuations and this perception is especially prevalent in the case of evacuations in response to volcanic eruptions (Lindell and Perry, 1992).

Additional research has focused on what has come to be known as the “crying wolf syndrome” (Breznitz, 1984). If there is no disaster after a warning has been issued, people tend to ignore subsequent warnings, which can have serious consequences. The management of evacuations in response to volcanic hazards poses special challenges in this regard. Violent eruptions are devastating but scientists are still not able to forecast exactly when, or even if, they will occur (Chester, 1993). This makes it difficult for authorities to decide when to issue an evacuation order or even whether it is advisable to do so.
Emergency Management Aspects

In emergency management, evacuation is considered a generic protective mechanism, one that can be applied to a variety of hazardous situations (FEMA, n.d.). Depending on the characteristics of the hazard, evacuation may entail the removal from harm’s way of only a few individuals, a limited evacuation, or the mass movement of thousands of people. Mass evacuations are generally disruptive (Rasid et al., 2000). In addition to the logistical considerations involved in providing safe exit for those displaced, the livelihoods of people are interrupted, and when an entire community is uprooted, its economic base may be destroyed.

Some evacuations are spontaneous. People anticipate the impact of an event, rising floodwaters, for example, and voluntarily move to an area they consider safe. In other instances, people must be urged or required to leave an area. The early studies by Zeigler et al. (1981) and Perry (1979, 1985) cited above were confirmed recently by Fisher and his colleagues (1995). These researchers studied evacuation response to a major toxic fire emergency that occurred in Ephrata, Pennsylvania in 1990. The study showed that people at risk were much more likely to leave if they were ordered to do so, even though the fire was an obvious threat. However, while people ordered to evacuate an area will generally do so, compliance is not always prompt (Quarantelli and Dynes, 1972).

Another factor in whether or how quickly people respond is the credibility of the source issuing the evacuation order. The more credible the source the
more likely it is that people will comply (Janda et al., 1996; Lindell and Perry, 1992; Perry, 1985). Compliance with an evacuation order is also much more likely if there is a safe place to go to (Drabek and Hoetmer, 1991), and assistance to leave the threatened area can affect evacuation rates in areas where few individuals or families have their own means of transportation.

Evacuation may be an appropriate solution to saving lives, depending on the circumstances and nature of the hazard, either before an event or subsequent to its occurrence (Lindell and Perry, 1991). To illustrate: hurricane evacuations generally take place before the storm makes landfall, but in the case of earthquakes, evacuations generally occur post-impact, and involve getting people away from areas where buildings or other structures have been weakened by the shock and might collapse. In the case of preventive evacuations, the timing of the evacuation is critical because when a population has been removed from a potentially hazardous area, especially in the case of mass evacuations, the people who have been evacuated generally have lost their ability to earn a living. This situation requires, among other actions, the provision of shelter, food, medical assistance, teaching for school-aged children and, frequently, the retaining of adults so they can survive economically in what may be a very different economic environment (Blong, 1984). These services may have to be provided for a long time (Blong, 1984).

Under certain circumstances, rather than reduced exposure by removing those at risk, authorities may opt for sheltering-in-place. The degree of risk to which people are exposed if sheltering-in-place is the option may be very high,
but this risk may be accepted so as to avoid the social and economic disruption of an evacuation (Lindell and Perry, 1992). Even in small-scale evacuations authorities must provide sheltering for the affected population.

Most evacuations involve coordination by authorities in one or two localities only; others require a regional response; very large scale emergencies, such as some types of volcanic eruptions, may require concerted action among states/provinces or nations (FEMA, n.d.).

**Tourist Industry and Disasters**

Many tourist destinations are located in hazardous locations and the number of tourists visiting these areas in recent years has been increasing. Consequently, the number of people in potentially hazardous places has also been on the rise (Drabek, 1995). The role of the tourist industry in hazard prevention, response and recovery, however, is still under-researched (Drabek, 1995; Faulkner, 2001).

Tourists may be particularly vulnerable to the effects of hazards because they are generally in unfamiliar surroundings and they depend greatly on the availability and smooth functioning of local services, such as hotels or motels, restaurants, transportation – even hospitals. Lack of fluency in the local language may make it difficult to understand hazard warnings or other emergency communications or result in misunderstanding of these messages. It would seem then, that the level of preparedness, ability and willingness of local tourist establishments to assist travelers during periods of crisis is crucial to
prevent or minimize injury or loss of life. This aspect of hazard emergency management was studied in the United States by Drabek (1995, 1992) who concluded that only larger companies had emergency plans and that “the overall record is very spotty” (1995 7), even in communities with relatively recent hazard experience.

The economies of smaller communities that attract tourists may also be highly or exclusively dependent on a steady influx of people. When the flow is interrupted, almost everyone in these communities can be adversely affected. The tourist industry frequently minimized the hazardousness of a particular location (Cammisa, 1993 in Faulkner, 2001; Murphy and Bayley, 1989). Efforts to preserve the economy intact may partially explain such denial. Minimizing perceived risk may also be a factor in the ability of a tourist destination to recover after a disaster (Murphy and Bayley, 1989), although recovery may be protracted and the site may never return to its former level of activity, as occurred with the hot-spring resort of Toyako-Onsen, located at the foot of the volcano, Mt. Usu, Japan, in the late 1970s (Hirose, 1982).

**Vulnerability and Marginalization**

Tobin and Montz (1997) have pointed out that so-called “rational” behavior designed to reduce exposure to a potential hazard does not always follow from individual or community perception of the event because a host of other factors, both internal and external, intervene to modify the expected response. With respect particularly to external factors, these two researchers write that “the
individual may feel relatively powerless...when confronted with the realities of major political, social, and economic structures that serve to constrain individual activity” (Tobin and Montz, 1997 133).

Such constraints or limitations obviously make the individual more vulnerable because appropriate behavioral choices that lead to preventing, avoiding or recovering from the disaster may not be available options.

This particular aspect of disaster studies has been researched by a number of investigators including Blaikie et al. (1994), Cannon (1994), Hewitt (1983, 1997), and Wisner (2001). Hewitt (1997) argued that vulnerability “depends, in large measure, upon ongoing conditions of material and social life, or their transformation” (167). These “ongoing conditions” create circumstances in which risk is not shared equally by all people or groups in society and where the ability of some to recover when disaster does strike is greater because they have access to more resources (Cannon, 1994). For disadvantaged or marginalized groups, particularly, the effort required to survive day-to-day is all-consuming, and people may live in hazard-prone areas because it is, or appears to be, their only viable option (Blaikie et al., 1994). The challenges that people routinely face on a daily basis may not allow them to worry about whether the river they live next to or the flanks of the volcano they live on are hazardous places (Maskrey, 1994). Research in New Zealand, which included consideration of cultural and social factors, confirmed earlier studies that, among the less affluent, present problems outweighed consideration of possible future disaster (Gregory et al., 1997).
Vulnerability, however, does not affect only the poor. Affluent people may also live in hazardous environments and may be very reluctant to abandon their possessions when disaster threatens. They know that it could be difficult and perhaps take years to reestablish themselves in other locations (Dibben and Chester, 1999).

Individual vulnerability to disaster is only one aspect of risk analysis. On a much larger scale, the effects of natural disasters seem to affect some countries or regions more than others (Hewitt, 1997; Tobin and Montz, 1997). These countries are generally countries of low- and medium-human-development (El Masri and Tipple, 1997; IFRC, 2001) or, as Wisner (2001) points out, they are nations with a "long history of political and economic marginalization" (2). In these countries there is still ample room for research into the causes of human vulnerability. To be successful, such studies must pay attention to what Maskrey (1994) refers to as "local specificities" including "local historical and geographical variations" (122).

Theoretical Framework

Two frameworks guided this research: individual decision-making was examined according to emergent norm theory and a bounded rationality model; vulnerability was examined in terms of a model showing the relationship between a hazard and the social, political and economic context in which it occurs.

While emergent norm theory seeks to explain how individuals make decisions under conditions of uncertainty by progressing through a three-stage
decision-making process (Lindell and Perry, 1992; Perry, 1985; Smith, 1996; Tobin and Montz, 1997), the bounded rationality model suggests that a host of cognitive and structural variables affect the manner in which individuals progress through this process (see review in Tobin and Montz, 1997).

As relates to vulnerability, Cannon (1994 21) identified three aspects that are important: livelihood vulnerability, self-protection vulnerability, and social protection vulnerability. All three types of vulnerability are defined by income opportunities, livelihood type, entry qualifications, assets and savings, and health status. Self-protection is additionally influenced by such environmental conditions as building quality, hazard protection and location of home or work. Social protection, besides all of the forgoing elements, includes such considerations as building regulations and technical interventions.

The determinants of each type of vulnerability include class position, gender, ethnicity, age, the action of the state, technical ability or availability, and the characteristics of the hazard itself, along with the level of scientific knowledge and technical practices, and the science and engineering used by the state and dominant groups. Cannon (1994) built these types of vulnerability and determinants into a model, elements of which were used to guide this research (Figure 1). The model suggests that self-protection (willingness to take action, such as compliance with an evacuation order) might be contingent upon other aspects of vulnerability determined by the social, political and economic context in which the individual must make a decision when confronted with a potential hazard.
Figure 1. Model showing the relationship between hazard vulnerability, and its root causes, in the causation of disasters

<table>
<thead>
<tr>
<th>Hazard (natural)</th>
<th>Vulnerability</th>
<th>Socio-economic &amp; Political Factors</th>
<th>National and International Political Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>a measure of the person’s or group’s level of PREPAREDNES: Self-protection + Social protection</td>
<td>• CLASS: income distribution; asset holding; livelihood qualifications &amp; opportunity</td>
<td>• The manner in which surplus is generated and allocated; social power and control</td>
</tr>
<tr>
<td>Cyclone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earthquake</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drought</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volcanic eruptions</td>
<td>In conjunction with RESILIENCE: strength of livelihood (income &amp; assets); recoverability of livelihood; and HEALTH: Social precautions; Individual robustness</td>
<td>• GENDER: household security; nutrition; health</td>
<td>• Civil security (war)</td>
</tr>
<tr>
<td>Biological Etc.</td>
<td></td>
<td></td>
<td>• ETHNICITY: income; assets; livelihood; discrimination</td>
</tr>
<tr>
<td>Human Modification</td>
<td>May reduce or increase impact of hazards</td>
<td>• STATE: institutional support; training; regional bias</td>
<td>• Debt crises</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Environmental degradation</td>
</tr>
</tbody>
</table>


Research Hypotheses

The literature review and the theoretical frameworks suggested two areas for investigation, therefore two hypotheses were advanced:

1. It was hypothesized that the socio-economic context in which the hazard occurred contributed to the vulnerability of people who were evacuated because this context limited the economic options available to them. Research
was therefore conducted to examine the contextual conditions of the people who were evacuated from Baños, looking specifically at social, economic and political factors.

(2) It was hypothesized that perception of the volcano hazard was influenced by specific geographic, economic and historical characteristics of Baños. Research was therefore conducted into the spatial characteristics of the town and its development.

**Research Questions**

Several research questions develop from these hypotheses:

1. How did evacuees and people who returned to the hazard zone in Baños rank the volcano hazard in relation to the economic, political or social context in which the hazard occurred?
2. What were the economic conditions of life for people in Baños before, during and after the evacuation?
3. What political events were occurring during and after the evacuation?
4. What was the spatial distribution of hazards from the volcano?
5. What other natural hazards occurred in Ecuador that may have provided a comparison of relative risk?
6. What other local “historical and geographical specificities” (Maskrey, 1994 122), if any, may have influenced hazard perception?
7. Was the tourist industry a prominent actor during the return and recovery phases? If it was, what was its role?
The methodology consisted of analysis conducted at the level of the individual, and at the local and national levels. This was achieved through personal interviews, a review of academic and other publications, and compilation and analysis of data from several statistical databases. All data were subsequently consolidated and synthesized and placed on a timeline to show what economic conditions and political developments were occurring just prior to, during and subsequent to the evacuation of Baños.

**Level of Analysis**

Analysis was conducted at three levels: individual, local and national. At the level of the individual, perceptions of the hazard, response to the evacuation of Baños and surrounding communities, and ranking of crises were analyzed. Local level analysis consisted of reviewing the physical, economic and historical geographies of the town of Baños and adjacent areas affected by the volcanic hazard. National level analysis consisted of examination of the socio-economic context in which the hazard, the evacuation and the return to Baños occurred.
First level of analysis: review of individual perceptions of the hazard, response to the evacuation, reasons for returning to the hazard zone, and ranking of crises experienced.

Data for this level of analysis were extracted from a study conducted by Graham Tobin, Ph.D. and Linda Whiteford, Ph.D., MPH, in which the researcher participated as an assistant. The study examined the role of women in post-disaster environments and consisted principally of the application of two structured questionnaire surveys.

The surveys were applied on-site in Ecuador, in Spanish, in June 2000 and January 2001, to individuals who had different evacuation experiences: people who had evacuated to a shelter in a metropolitan area; individuals who had evacuated and were working in a resettlement center in a small agricultural community; people who had been evacuated but had returned and were living in the town of Baños before the evacuation order issued by the authorities was lifted; and a control group consisting of individuals living outside the hazard zone and who had not experienced the disruption of an evacuation. The June 2000 survey consisted of 54 questions and was applied to 131 individuals; the January 2001 survey consisted of 70 questions and was applied to 171 individuals. Both closed and open-ended questions were included in the questionnaires.

The steps taken with this first level of analysis were:

Step 1: Both surveys were reviewed for questions that related to hazard perception, evacuation experience, perceptions of government assistance, identification of events or occurrences that respondents classified as
crises in their lives and reasons for returning to Baños. Twenty-three questions considered relevant to the research for this thesis were abstracted from the 2000 questionnaire and 16 from the 2001 questionnaire. The questions, in English translation, are included as Appendix I and Appendix II respectively.

Step 2: Frequency tables of descriptive statistics relating to the selected questions were generated using the software package, Statistical Program for the Social Sciences (SPSS). On questions where there were insufficient data in one or more of the possible responses, and where grouping was appropriate, data were aggregated. For example, the responses “high risk” and “very high risk” were grouped as “high risk,” and the responses “low risk” and “moderate risk” were grouped as “moderate risk.” On open-ended questions which resulted in a multitude of different responses, these were grouped into broad categories. For example, “Loss of Bank Funds,” “Loss/Lack of money” and “[Currency] Devaluation” were grouped as “Economic Problems.” The data were further analyzed by selecting certain variables for cross-tabulation.

Step 3: From the data analysis several themes were identified that suggested research topics that would help to understand aspects of the socio-economic context of the hazard that respondents said were significant. These themes included principally political upheaval/change, currency devaluation, and the nation’s bank crisis, conversion from a national currency to the dollar, inflation, unemployment and underemployment.
Second level of analysis: review of the physical, economic and historical geographies of the town of Baños and adjacent areas affected by the volcanic hazard and of materials relating to the actual evacuation of Baños, dispersal of the population and return to the town.

The steps taken within the second level of analysis were:

Step 1: A site description that included elements of the physical geography of the area, including rivers, topography, climate and soils. The spatial and temporal distribution of major natural hazards was generally described with more detailed attention given to the volcanic hazards of Tungurahua Volcano. The site description was developed from scholarly geographical and historical texts, a study of topographic maps, and from field observations made by the researcher during four trips to the hazard zone (in June 2000, January 2001, March 2002 and May 2002). The main sources for data on Tungurahua Volcano were Ecuador’s Geophysics Institute (Instituto Geofísico) and the Global Volcanism Program of the Smithsonian Institution. Description of damages from the current eruptive cycle came from field observations made during trips to communities on the flanks of the volcano and to the west of the volcano in the Provinces of Tungurahua and Chimborazo, discussions with representatives of local emergency management and humanitarian organizations, informal interviews with local inhabitants and monitoring over a three-year period of print media reporting of the hazard. Some of the principal physical characteristics of Baños and surrounding areas and of the volcanic hazard
were photographed to aid in understanding and illustrating hazard effects and the threat posed to Baños by the spatial characteristics of its location.

Step 2: A survey of the historical geography of Baños to help in understanding some of the principal socio-economic characteristics of the area today that appeared, from field observations and preliminary readings, to influence vulnerability. These present-day characteristics included the town’s dependence on tourism for its economic survival, the position taken by some members of the clergy in regards to the evacuation, and the town’s historical ties with the Ecuadorian Amazon.

Step 3: A brief study of the current importance of tourism to the town of Baños and, by extension, of the importance of Baños to national tourism. The study was conducted using local and national statistics provided by the national Ministry of Tourism in Quito, the Provincial Ministry of Tourism in Ambato and by the local tourism authority in Baños as well as an interview with its director, a review of the tourism development plans of the municipality of Baños, newspaper reports, and informal interviews with local artisans, tour and hotel/motel operators. Basic demographic information on Baños and surrounding areas, culled from 1990, 1995 and 2001 census data were included in this study.

Step 4: Description of the evacuation of the town of Baños in October 1999, dispersal of the population, and the reoccupation of the town in January 2000 while the evacuation order was still in effect, focusing particularly on those aspects that might contribute to understanding individual perception
of the hazard and response to the evacuation as identified in the Level 1 analysis of questionnaire survey data. Source materials for this description included newspaper reports, TV news clips, video footage taken by participants in the return, official documents relating to the evacuation and to sheltering of the population, published reports by local and international NGOs, fields notes taken by the researcher during administration of the questionnaire surveys for the Tobin and Whiteford (2001) study, and informal interviews with local residents and representatives of local and national agencies involved in disaster response during research visits in March and May 2002.

Third level of analysis: review of the national socio-economic context in which the volcanic hazard, the evacuation and the return to Baños occurred.

The steps taken within the third level of analysis were:

Step 1: Collection, analysis and, where appropriate, graphing of statistical data on each of the topics identified as significant by individuals (from Level 1 analysis). Data were obtained primarily from the websites of the Instituto Nacional de Estadística y Censos (Census Bureau), the Banco Central del Ecuador (Central Bank of Ecuador), the Ministerio de Agricultura (Ministry of Agriculture), the Sistema Integrado de Indicadores Sociales del Ecuador (Integrated Social Indicators System of Ecuador) and the Economic Commission for Latin America and the Caribbean (ECLAC).

Step 2: Identification and analysis of additional events occurring in the general hazard area and in Ecuador at the time that might have contributed to
perceptions of relative risk. The on-line versions of the national daily newspapers were the main sources for these topics.

Step 3: Identification and listing of significant natural hazards that occurred in other parts of Ecuador while Mount Tungurahua was erupting. The main sources were the national newspapers and the website of the International Federation of Red Cross and Red Crescent Societies. One or more of the following were criteria for inclusion on the list:

- one or more fatalities
- 20 or more people reported injured
- significant damage to property or infrastructure
- livelihoods endangered

Whenever possible newspaper reports were checked against other sources or one newspaper’s report compared against another’s. Verification of many of the reports was not possible.

**Consolidation and Synthesis**

The final step in the methodology consisted of combining level 2 (local) and level 3 (national) data in a timeline to assist in understanding the concurrent nature of the several crises to which the people of Baños and surrounding areas were exposed from the time they were evacuated in October 1999 through December 2001 when the town was well on the way to recovery. For completeness, major political events and economic data starting in January 1999
were included in the timeline, although these predate the evacuation by several months.

Notes on the Sources

Two main challenges were encountered with source materials. First, the available number of academic texts on Baños and surrounding areas was limited. The history of Baños, for example, was culled primarily from one text, written by an academic in 1954 and not published during his lifetime. The text is unabashedly enthusiastic about the town and its inhabitants, and was published by the Ministry of Culture for the Province of Tungurahua in 2001 – subsequent to the evacuation of Baños.

The second challenge was that statistical data were not as accessible in Ecuador as is generally the case in the United States. This may be due in part to the fact that data are not always maintained or are not maintained in easily retrievable formats. For example, details of crop production in Baños and peripheral communities at the time of the evacuation were provided by an official from hand-written notes. It could also be due to the belief that statistical data might be used for political purpose. Most data from the 2001 census, for example, were only available in mid-2002 as preliminary data. The data had become a political issue and the Director of the Instituto Nacional de Estadística y Censos (INEC), the Ecuadorian Census Bureau, resigned in early 2002 claiming that the national government was requiring that cost-of-living data be manipulated for political purpose due to upcoming elections.
CHAPTER 4
STUDY SITE: PHYSICAL AND HUMAN GEOGRAPHY

Introduction

Tungurahua Volcano (5,023 meters) is located in the Eastern Cordillera of the Ecuadorian Andes at $1^0 28'$ S, $78^0 27'$ W (Hall et al., 1999) on the border between the provinces of Tungurahua and Chimborazo (Map 1).

The research concentrated on the town of Baños, in Tungurahua Province. Baños is the largest community in the volcano’s high risk zone. In the event of a major eruption, this town and peripheral communities could be subject to pyroclastic flows and lahars. For these reasons, the area was evacuated in October 1999. When the hazards resulting from the volcano’s ongoing eruptions did not cause major damage in Baños many people soon returned to live there.

Baños is located at an altitude of 1,800 meters, so the climate is mild and relatively humid, compared with the harsh conditions that characterize most of the surrounding villages. Built at the northern base of Mount Tungurahua, Baños is a popular tourist destination, due in part to thermal springs heated by the volcano. The town has also benefited from its location in one of the few passes in the Andes between highland Ecuador and the Amazon basin.
This chapter describes the physical geography of the area in the vicinity of and immediately to the north and west of Mount Tungurahua. The eastern and southeastern flanks of the volcano are sparsely populated and had experienced few effects from the eruptions, so are not included in this site description. The section on the area’s physical geography is followed by a section on the general
physical and demographic characteristics of the town of Baños. This is followed by an outline of the principal economic activities in the town and surrounding rural communities. Finally, the historical importance of the location of Baños on a route between highland Ecuador and the Amazon is described.

**Physical Geography of the Hazard Zone**

**Rivers and Relief**

Mount Tungurahua is drained by several rivers. The most important are the Chambo and the Pastaza. The Pastaza River is formed by the confluence of the Chambo and the Patate at a location known as Las Juntas (“The Juncture”). This point, northwest of the volcano, is approximately 6 kilometers west of the town of Baños, which is located at the volcano’s northern base on a narrow terrace between the gorge cut by the Pastaza River and the steep, exposed remnants of an earlier Tungurahua (Hall et al., 1999). The Pastaza flows toward the east, bordering the volcano on the north before proceeding through a narrow pass in the Eastern Cordillera to the Amazon (Illustration 1). In the study area, peaks in the mountain range to the north of the Pastaza attain heights of between 3,100 meters and 3,700 meters, forming an almost unbroken northern wall to the valley.

The Chambo River flows roughly southeast to northwest, through the valley bordering the lower western flanks of the volcano (Illustration 2). None of the mountains on the west bank of the Chambo is as high as Mount Tungurahua, but these mountains too form a virtually unbroken range with elevations from
approximately 2,900 meters (Chingazo II) in the south, to 3,800 meters (Cerro Mulmul), located near the confluence of the Chambo and the Patate rivers.

Illustration 1. Valley of the Pastaza River

Looking east along the valley of the Pastaza toward the town of Baños (left of center).

Illustration 2. Valley of the Chambo River

Looking south along the valley of the Chambo, with the lower flanks of Mount Tungurahua on the left.
Both the Pastaza and the Chambo have been dammed by lava flows from the volcano during geologic and historic times (Hall et al., 1999). The danger of such natural dams is that lakes form behind the dam. When these fail, torrents of water descend the river valleys destroying everything in their path. There are historical accounts of at least one such event.

In addition to the regionally important rivers described above, Mount Tungurahua is drained by many smaller streams. Of particular importance are the rivers Puela (a tributary of the Chambo), Vazcún and Ulba (tributaries of the Pastaza). Numerous *quebradas* (ravines) form a radial pattern outward from the summit of the volcano (Map 2). Lahars and other volcanic hazards have descended the three rivers and the many *quebradas* in prehistoric and historic eruptions. The town of Baños is located between the valleys of the Vazcún and Ulba rivers (Map 3).

The Rio Blanco, which joins the Chambo in the southern section of the study area, does not drain the volcano directly, but is an important physical feature because it has been associated with two non-volcanic natural disasters that severely impacted people, infrastructure and agriculture in the area during the study period.

Portions of the local relief are extreme. The flanks of Mount Tungurahua have a grade of 30° to 35° (Hall et al., 1999) (Map 4), and some of the ravines draining the volcano have slopes approaching 70° (Kirkby, 1981). Parts of the valley of the Vazcún River have slopes nearing 60°.
Map 2. Communities, rivers and ravines on the flanks of Tungurahua Volcano

Communities, rivers and ravines on the flanks of Tungurahua Volcano

Scale (approximate) Lane, 2002

The map shows the precarious location of Baños on a shelf in the narrow valley of the Pastaza and between the Vazcún and Ulba Rivers that drain Tungurahua. The contour lines south of Baños indicate the steep rise of the Runtún, an outcropping many people believe would protect the town in the event of a major explosive eruption.
Map 4. Topographic profile: Valley of Pastaza River

Topographic profile: Valley of Pastaza River

Based on Baños quadrangle (Sheet 3989 IV, Series J721) produced by the Instituto Geográfico Militar, Quito, 2000. Lane, 2002
The highlands to the west of the Chambo River, where there has been significant ash fall, are characterized by broad, undulating plains. Despite the altitude, many of these areas support intensive agriculture. This is typical of parts of Quero Canton in Tungurahua Province (Illustration 3).

**Illustration 3. High plains in Tungurahua Province**

These farms, west of Mount Tungurahua, are directly in the path of ash emissions from the volcano, which is partly visible in the background.

**Climate and Soils**

Climate in the area varies greatly. Because the study area is located near the Equator, temperature is determined by elevation more than by any other factor. Additionally, there can be large variances between nighttime and daytime temperatures. The period from April/May through July/August is considered
winter. The prevailing winds blow from east to west and bring moisture-laden clouds from the Amazon basin. A rain shadow effect is noticeable on many slopes. In general, lower elevations are drier than higher ones (Kirby, 1981).

It may take thousands of years for soils that develop near volcanoes to acquire enough organic matter so they have good capacity for water retention (Huttel et al., 1999). The soils closest to Mount Tungurahua contain more ash than those farther to the south along the valley of the Chambo River (Kirby, 1981). Where the grade is steep (between 25° and 70°), which is the case of much of the land on the flanks of Tungurahua, the upper, fertile layers of soil have been eroded, exposing the underlying hardpan, known locally as cangaua (CEPEIGE, 1997). This applies to many of the lands in the valley of the Pastaza River, near the town of Baños, where the development of large-scale, intensive agriculture has not been possible for the most part, and where existing agricultural activities are further eroding the soil (CEPEIGE, 1997).

**Baños**

The town of Baños is the seat of the Canton of Baños, which occupies an area of 1,056.0 km² and is divided administratively into one urban and four rural parishes: Baños (urban) and Lligua, Ulba, Rio Verde and Rio Negro (Map 5). In 1995, the urban area of Baños occupied one square kilometer and population density in the downtown area was approximately 180 people per hectare (Asociación de Municipalidades del Ecuador – Municipio Baños de Agua Santa, 1996).
Baños, Lligua and Ulba were the parishes most directly affected by the volcano and the evacuation, but the entire canton suffered economically as a result of closure of the highway between Ambato and the Oriente which passes through the town of Baños and neighboring communities.

The Pastaza River runs through the canton from west to east, and most of the population is concentrated in the narrow valley formed by the river. Baños is located at an altitude of 1,800 meters, on a narrow shelf between the gorge of the Pastaza River (Illustration 4), and the valleys of the Vazcún River to the west and the Ulba River to the east.
The narrow suspension bridge was the only way to exit directly from downtown Baños over the Pastaza River during the time research was conducted. A dirt path, used for pedestrian and animal traffic, zigzagged down from the level of the town to the bridge, a difference in elevation of about 100 meters. A new bridge was planned for the same location but built higher up the canyon walls, nearly at street level in Baños, to enable faster evacuation. In August 2002 construction had not been completed.

The valleys of the Vazcún and Ulba rivers were conduits for lahars during historical eruptions in 1773, 1886, 1916 and 1918, and a large pyroclastic flow descended the valley of the Vazcún in 1918 (Instituto Geofísico, 2002).

**Demographics**

In 2001, 73 percent of the cantonal population of 16,136 was concentrated in the parish of Baños. Eighty-eight percent of parish inhabitants were in the
cantonal seat, the town of Baños (Figure 2). This population made Baños the largest community in the high risk zone.

**Figure 2. Distribution of population in Baños Canton**

![Distribution of population in Baños Canton](image)

Data obtained from INEC statistics, 2001 Census

According to Ecuadorian Red Cross data, approximately 17,000 people were evacuated in October 1999 from the hazardous areas in and around Baños (Ecuadorian Red Cross, 1999), somewhat more than the total cantonal population registered in the 2001 Census. Local officials estimated in March 2002 that only 60 percent of evacuees had returned to the hazardous areas.

Since the 1990 census, the cantonal seat, Baños, and its urban periphery have grown at the expense of the rural parishes, but the overall population of the canton has changed by only 4.7 percent (Table 1).

**Table 1. Population growth in the Canton of Baños**

<table>
<thead>
<tr>
<th>Census year</th>
<th>Baños</th>
<th>Lligua</th>
<th>Rio Negro</th>
<th>Rio Verde</th>
<th>Ulba</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>10,991</td>
<td>431</td>
<td>1,047</td>
<td>1,040</td>
<td>1,907</td>
<td>15,416</td>
</tr>
<tr>
<td>2001</td>
<td>11,828</td>
<td>311</td>
<td>1,086</td>
<td>1,056</td>
<td>1,855</td>
<td>16,136</td>
</tr>
</tbody>
</table>

Data obtained from INEC 1990 and 2001 Censuses
No data were available for the town exclusively but, given the skewed distribution of population, data for the canton are taken as representative of the town. Based on the 1990 Census, literacy rates were high: 19.4 percent of the population had completed secondary school. This was higher than in any other canton in Tungurahua Province with the exception of Ambato, which includes the provincial capital and where literacy rates were 24.8 percent. The incidence of illiteracy was second to lowest in the province: only 8.7 percent of the population of Baños could not read or write, which compared with 12.6 percent in Ambato Canton, and an overall average of 14.0 percent for the province. Baños also had a high percentage of college-educated people (9.1 percent), exceeded only by the percentage in Ambato (14.8 percent) (SIISE, n.d.).

The level of education may possibly be reflected in the poverty rates which, based on 1995 data, showed a similar pattern of relative wellbeing: Baños, at 63.0 percent, had the lowest rate of poverty of consumption in Tungurahua Province, where the average rate was 74.1 percent (SIISE, n.d.). Separate data indicated that the Canton of Baños also had the lowest percentage of population with basic needs unmet (Guzmán, 2001).

**Economic Bases of the Town of Baños and Peripheral Communities**

The principal economic activity in Baños was tourism. Because of its importance, this activity is described separately in Chapter 6. The most important industrial feature of the canton was the hydroelectric dam across the Pastaza at Agoyán, a few kilometers east of Baños. The facility generated approximately 15 percent of Ecuador’s electricity (Kielmas, 1999) (Map 6).
Map 6. Baños and neighboring communities

Baños and neighboring communities

To Ambato
To Puyo
Patate River
Pastaza River
La Ciénega
PAßNOS
Santa Rosa de Runtún
Tomas Harolds
La Palma
Iluchi Bajo
Las Juntas
Ligua
Juive Chico
Juive Grande
Cusua
Ulba R.
Vazcún R.
San Vicente
San Anna
Ulba
La Clénega
Agoyan Dam
Illuchi Bajo
La Palma
Iluchi Bajo
Las Juntas
Ligua
Juive Chico
Juive Grande
Cusua
Ulba R.
Vazcún R.
San Vicente
San Anna
Ulba
La Clénega
Agoyan Dam

Scale (approximate)
0 km 3 km

Legend
Main road
Secondary road
River/Stream
Rural community
Spot elevation in meters

Lane, 2002
The most important commercial agricultural activity was aviculture. In late 1999 local ranches had a population of more than 250,000 chickens, of which 200,000 were on farms in Agoyán, east of the town of Baños. Subsistence farming, on minifundios of mostly between ¼ and ½ hectare, was important for families in the communities of Cusúa, Juive Grande, Pondoa, Juive Chico, Pititig, Ligua, Illuchi, Lligua, El Recreo, San Vicente, Santa Ana, Ulba, Agoyán, Santa Rosa de Runtún and Bellavista (Illustration 5). With the exception of Cusúa, all of these communities are in the Canton of Baños. Cusúa is in Pelileo Canton but because of its proximity to the town of Baños, for planning and evacuation purposes, it was included with Baños by Civil Defense authorities. Small farms in, and near these communities produced surplus that helped supply local markets, principally in Baños. Corn was important locally, as were crops of beans and tree tomatoes. At the higher elevations there were plantings of crops such as onions and potatoes; at the lower elevations, farming activity included small orchards of tropical or subtropical fruits. Much of the area in the parish of Baños was in pasture. Farm families typically owned two or three cows and pigs, in addition to a few chickens. Equines, mostly asses, were used primarily for farm work and transportation (Ministerio de Agricultura, 1999).

No data on the actual populations of these rural communities were available but Ministry of Agriculture data listed approximately 750 rural homes scattered throughout the area. Rural families generally consisted of at least five to six people so there were possibly between 3,700 and 4,500 people living on
area small farms at the time of the evacuation in October 1999 (Ministerio de Agricultura, 1999).

**Illustration 5. Farm in Ulba River valley**

Small farms, like the one in the foreground, are located throughout the valley of the Ulba and in the valleys of other rivers in the hazard area. Lahars descended the Ulba valley in 1886, 1916 and 1918. In some areas the slopes angle as much as 60 to 70 degrees.
Gateway Between East and West

The town of Baños is located in one of less than a handful of passes in the Ecuadorian Andes between the high intermontane central valley and the Amazon basin. The town’s development has been closely associated with its geographical location.

The narrow passageway created by the Pastaza River through the Eastern Cordillera of the Andes was the conduit for successive movements of people between the regions east and west of the mountain chain. Small bands of pre-Colombian tribes may have moved up the Pastaza from the Amazon and established temporary communities in the area where Baños was subsequently founded (Reyes, 2001), although most authorities maintain that among these peoples, the Puruhá entered the high inter-Andean valley from points north and south of Tungurahua. Regardless, once established in the central Andean region, the Puruhá kept in contact with the Amazon region by using the valley of the Pastaza (Gomez, 1999), and shortly after the Spanish arrived in Ecuador in the 1530s, this was the route these indigenous people used to withdraw to the safety of the Amazon (Reyes, 2001).

The Spaniards came to the area in 1541 looking for silver mines that, according to legend, were at the base of Tungurahua. The Spanish Crown consolidated its sovereignty over the area by granting land and mining rights. This firmly established the Spanish presence in the valley of the Pastaza and along the Chambo and Patate rivers.
It was left to the Dominicans though to establish a permanent settlement, which they did in 1553, and which they named Pueblo del Espíritu Santo, later to become Baños (“Baths” in English). From Baños the religious order extended the Catholic religion and the domain of Spain into the Oriente, or Amazon. By 1583, the place that started as a simple shrine had become an important center for pilgrims who may have come from as far away as Lima in Peru (Reyes, 2001).

By 1628, the path through Baños had become the main route between Riobamba and the Amazon region. In the early 1600s the Jesuits, like the Dominicans, were also advancing along the Pastaza, but in the opposite direction, from east to west, having come up the Amazon and its tributary the Bobonaza (Zúñiga, 1977). The Jesuits finally made it all the way through in 1655 and established themselves in the valley of the Patate (Reyes, 2001), to the northwest of Baños. In 1743, an Ecuadorian scientist, Pedro Vicente Maldonado, who was also a former governor of Esmeraldas Province and the owner of property that extended from Cusúa near Baños all the way to Canelos in the Amazon, followed the same route that the Jesuits had used but in the opposite direction. He proceeded from west to east, in order to meet up with a French scientific expedition (Zúñiga, 1977).

In the 1750s, the Spanish government realized that the valley of the Pastaza was a more convenient and accessible means of reaching the Tierra de la Canela (Land of Cinnamon) than the more northerly route taken earlier by Gonzalo Pizarro and Francisco de Orellana in their search for the land of spices
(Rudolph, 1991). From this time on, Baños became an important point for exploration of the Amazon region and of Spanish efforts to halt the westward advance of Portuguese and Brazilians (Reyes, 2001). After the independence movements in Spanish-America in the early 1800s, Ecuadorian incursions into the Amazon region came into direct conflict with Peruvian interests in the area. Baños, because of its strategic location in the east-west pass, was the “jumping off” point for many expeditions into the contested territory (Reyes, 2001).

The pass in the Eastern Cordillera carved by the Pastaza River continues to be strategically important today. Among other efforts to further develop its economic base, the town of Baños was positioning itself as the launching point for ecotourism to the Amazon (Municipalidad Baños de Agua Santa – Ministerio de Turismo, 2002), the fastest-growing segment of the tourist industry in Ecuador.

Prior to the eruption and evacuation of Baños in 1999, the Ecuadorian government signed an agreement with an Argentinian firm for a multimillion-dollar highway construction project to improve the existing narrow, mostly unpaved road between Baños and Puyo in the southern portion of Pastaza Province where oil exploration activities are underway. Subsequently, two Ecuadorian presidents, Alvaro Noboa and Lúcio Gutierrez, placed funding and completion of the road on their agendas when meeting with their Argentinian counterparts (La Hora, March 5, 2000; El Comercio, December 5, 2002), highlighting the importance of this east-west route.
Conclusions

The area around Mount Tungurahua is physically rugged, with highly eroded soils in many areas, and unreliable sources of water for irrigation. Deep valleys with fast-flowing rivers make communication difficult and sometimes hazardous. For inhabitants of rural communities, even under normal circumstances, life in this environment is harsh and economic survival precarious. The town of Baños, on the other hand, with its amenable climate, and non-agriculture-based economy, has become a center of relatively prosperity and wellbeing.

The physical space that Baños occupies offers both advantages and drawbacks. The thermal waters that are heated by the volcanic activity that threatens the town with destruction have been successfully merchandized, first by religious and later by secular entrepreneurs. The steeply-angled slopes and outcroppings of ancient lava flows that make the area inappropriate for large-scale agriculture provide the dramatic scenery that attracts visitors from Ecuador and from throughout the world. The Pastaza River, with its deep gorge that prevents fast exit from town in the event of a major eruption of Mount Tungurahua, also made is possible for Baños to become a gateway between east and west.
CHAPTER 5

NATURAL HAZARDS

Introduction

In addition to the volcanic activity of Mount Tungurahua, other geologic and meteorological hazards frequently afflict areas currently affected by the volcano. Earthquakes are a major and widespread hazard and even relatively small events can trigger massive landslides. Prolonged or heavy rainfall is often followed by flash floods and slope failure due to the steepness of the terrain. Droughts, windstorms and ice storms are not uncommon.

During historic times, earthquakes have claimed more lives in the provinces of Chimborazo and Tungurahua, and caused greater damage to property and infrastructure than have the infrequent eruptions of Mount Tungurahua. Furthermore, given the current prevalence of landslides, it is likely that these hazards also have taken a great toll on the people living in the area. In order to understand perception and response to Tungurahua’s current eruptions and associated hazards, it is helpful to consider them in relation to concurrent hazards and to the historical records of natural hazards that are known to have caused great numbers of fatalities as well as social and economic disruption.
The chapter compares the effects of the current volcano hazard in Chimborazo Province and in other parts of Tungurahua Province with effects on the town of Baños and its satellite communities; reviews the impacts of previous historical eruptions on Baños; describes the effects of major area earthquakes; and lists non-volcanic natural hazards that resulted in loss of life, damage to property or infrastructure, or that in some fashion may have diverted local or national resources from the volcanic emergency during the research period.

Tungurahua Volcano

Mount Tungurahua is one of a number of active volcanoes in the Eastern Cordillera, one of two parallel ranges of the Andes that traverse Ecuador from north to south. The volcano’s summit (5,023 meters) towers over the surrounding countryside, where elevations are approximately in the 2,000- to 2,200-meter range (Illustration 6). Tungurahua is a relatively young stratovolcano (Hall et al, 1999; GVP, 1999) that is actively building and helping to shape the landscape around it. Locally it is also known as Mama Tungurahua.

The most extensive damage from the volcano’s current cycle has been from ash fall which has repeatedly affected populations and agriculture in rural areas. Two populous provincial capitals (Ambato and Riobamba) and several medium-sized towns have also been affected but to lesser degrees. Lahars have been frequent but affect a much more restricted area in the immediate vicinity of the volcano.
A column of steam and gasses rises from the symmetrical cone of Mount Tungurahua on March 19, 2002. The volcano is often shrouded in clouds.

The volcano straddles the border between Tungurahua and Chimborazo Provinces and the impacts of eruptions have been felt primarily in Baños, Pelileo, Quero, Mocha and Tisaleo Cantons in Tungurahua Province (Map 7), and in Guano and Penipe Cantons in Chimborazo Province (Map 8).
Map 7. Cantons of Tungurahua Province

Map 8. Cantons of Chimborazo Province
Current Eruptive Cycle: 1999-?

Tungurahua has been monitored scientifically since 1989 (Instituto Geofísico, n.d.). In September 1999 the volcano gave serious indications that it was awakening from an 80-year sleep: seismic activity and gas emissions were on the increase. On September 15, following continuous tremors and the emission of a vapor column that extended to 2 kilometers above the crater, Civil Defense authorities issued a yellow alert level on the volcano (GVP, 1999). This meant that a major eruption was possible within weeks (see below for explanation of alert levels). Three explosions on October 5, increasing gas emissions and finally, incandescence at the crater on October 13, convinced authorities that an explosive eruption was imminent, and the alert level was raised to orange on October 16 (GVP, 1999). This action resulted in a mandatory evacuation order for the town of Baños and for the smaller rural communities in similar high-risk areas in the vicinity of the volcano. Inhabitants of some villages, particularly those located at higher elevations, who had been experiencing ash fall regularly, seen the incandescence, felt the tremors, or heard the loud rumblings and roaring emanating from the volcano, had voluntarily started to leave the area before the official order was issued.

Ecuador’s Civil Defense System recognizes four levels of alert: (1) WHITE alerts authorities that they must start preparing or updating mitigation plans in anticipation of the occurrence of an adverse event; (2) YELLOW, which may last weeks or months, requires verification that personnel and means are available to manage probable emergency situations and the execution of exercises and
simulated evacuations; (3) ORANGE may last days or weeks. It requires notification of the public that an emergency is possible and of any preparatory measures that should be taken; as well as the mobilization of personnel and equipment for a possible evacuation and intensification of community self-protection measures; (4) RED is the actual occurrence of the hazard. Duration may be hours or days. Emergency plans are implemented or executed (Defensa Civil, 2001; researcher’s translation).

The major explosive eruption anticipated in mid-October 1999 had not occurred as of December 2002, but Tungurahua had engaged in an almost continuous display of activity, sometimes intense. This included at least one pyroclastic flow that extended out 1,000 meters (GVP, 1999), the ejection of incandescent material to heights sometimes several hundreds of meters above the summit, numerous lahars, frequent ash fall, tremors and loud explosions, one of which was heard 75 kilometers away in Quito, the capital of Ecuador (GVP, 2000).

Two Principal Current Hazards: Lahars and Ash Fall

Lahars

Starting in October 1999 numerous lahars or mudflows descended the steep flanks of Tungurahua, following the natural route afforded by the quebradas, and cutting across roads vital for communication and economic activity (Table 2). The compilation in Table 2 is not complete as not all lahars may be noted in available official records but does convey a sense of the frequency of events.
Table 2. Tungurahua Volcano: Lahars (October 1999 – July 2002)

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 18-24</td>
<td>Chontapamba and Rea ravines</td>
<td>Deposits on road between Penipe and Baños</td>
</tr>
<tr>
<td>November 20</td>
<td>Baños area – 2 events</td>
<td>Both cut across highways; one was 20 meters wide</td>
</tr>
<tr>
<td>December 10</td>
<td>Mudflows – no details</td>
<td>Cut across three segments of Baños-Penipe road</td>
</tr>
<tr>
<td>January 21</td>
<td>Several mudflows – no details</td>
<td></td>
</tr>
<tr>
<td>January 29</td>
<td>2 mudflows</td>
<td>Roads affected</td>
</tr>
<tr>
<td>February 5-6</td>
<td>Mudflows – no details</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>Frequent mudflows</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>Frequent mudflows</td>
<td></td>
</tr>
<tr>
<td>February 19</td>
<td>Cusúa ravine</td>
<td></td>
</tr>
<tr>
<td>March 16</td>
<td>Vazcún, Los Pájaros, Las Pampas</td>
<td>Generated by heavy rainfall</td>
</tr>
<tr>
<td>April 29-30</td>
<td>Las Pampas, Cusúa, Hacienda and Achupashal sectors</td>
<td>Lahars in Las Pampas area; blocked Pelileo-Baños road on April 29</td>
</tr>
<tr>
<td>May 3</td>
<td>Possible lahar recorded by monitors</td>
<td></td>
</tr>
<tr>
<td>May 9-15</td>
<td>Cusúa, Basural, Mandur, Vazcún and Ulba valleys</td>
<td>Baños-Riobamba highway blocked</td>
</tr>
<tr>
<td>June 11</td>
<td>Achupashal ravine</td>
<td></td>
</tr>
<tr>
<td>July 18-24</td>
<td>Western flank</td>
<td>July 19 lahars reached Baños-Riobamba highway</td>
</tr>
<tr>
<td>September 11-12</td>
<td>Path followed not given</td>
<td>Affected Penipe</td>
</tr>
<tr>
<td>December 14-16</td>
<td>Lahars</td>
<td></td>
</tr>
<tr>
<td>December 29</td>
<td>Juive Grande ravine</td>
<td>Las Pampas and Los Pájaros sectors affected</td>
</tr>
<tr>
<td>January 9</td>
<td>Western flank</td>
<td></td>
</tr>
<tr>
<td>February 5 or 6</td>
<td>Path followed not given</td>
<td>Affected Las Pampas</td>
</tr>
<tr>
<td>February 11-18</td>
<td>Juive and Cusúa</td>
<td>Pyroclastic flows traveled part way down these ravines</td>
</tr>
<tr>
<td>February 19</td>
<td>Chontapamba sector</td>
<td></td>
</tr>
<tr>
<td>April 7</td>
<td>North flank</td>
<td>Blocked Ambato-Baños road</td>
</tr>
<tr>
<td>April 21</td>
<td>Path followed not given</td>
<td>Blocked Ambato- Baños road at Las Pampas</td>
</tr>
<tr>
<td>April 28</td>
<td>3 lahars – Descended Juive and Cusúa ravines</td>
<td>Blocked Ambato- Baños road at Las Pampas and Los Pájaros</td>
</tr>
<tr>
<td>May 1</td>
<td>Path followed not given</td>
<td>Las Pampas</td>
</tr>
<tr>
<td>June 3</td>
<td>Traveled northwest</td>
<td></td>
</tr>
</tbody>
</table>

Compiled from GVP monthly and weekly reports for 1999 - 2002 and newspaper reports over the same period.
Besides being triggered by earthquakes, lahars also occur frequently during the local rainy season. Most of the lahars have occurred on the northwestern and western flanks, where ash has accumulated in larger quantities (Illustration 7). These slopes remained on orange alert even after the alert level for the Canton of Baños was downgraded to yellow on September 5, 2000 (Instituto Geofisico, n.d.).

Illustration 7. Destruction caused by lahars

In May 2002 residents of the dangerous western and northwestern flanks were using a primitive bypass road to access their farms. The main road, bordering the valley of the Chambo River, was destroyed by lahars early in the eruptive cycle. Two of the many ravines that drain the volcano are shown here. They are near the flank community of Bilbao.

Many people returned to the dangerous areas and by May 2002 about 200 families were living on the volcano’s flanks in Tungurahua Province. In August 2001, emergency management personnel in Chimborazo Province estimated that
Lahars can travel quickly down steep slopes. Monitoring by the Instituto Geofísico gives authorities some warning of when these events are occurring and most people living on the flanks have learned to avoid the ravines where lahars commonly occur. Some people, however, still do not stay away from these hazardous places, particularly if there have been no recent events (Rodriguez, 2002) (Illustration 8).

Ash Fall

Ash from Tungurahua is fine-grained (GVP, 2000) and is sometimes carried great distances. Starting in 1999, ash fall became a common occurrence in communities located approximately to the west and southwest of the volcano, mainly in Riobamba, Penipe and Guano cantons in Chimborazo Province, and in parts of Ambato, Baños, Pelileo, Quero, Mocha and Tisaleo cantons in Tungurahua Province. Communities in other cantons and provinces were also affected but to a much lesser extent. Even so, on February 14 and 15, 2000, for example, ash was reported to the north-northwest of the volcano, in the towns of Pillaro, Latacunga and Salcedo, with up to one millimeter deposited on that occasion as far as 10 kilometers from Mount Tungurahua (GVP, 2000).
The remains of a campfire and other signs of occupancy in this ravine in March 2002 show that some people still had not learned to avoid these areas at all times. Following the course of ravines, fast-moving lahars can reach areas near the base of the volcano like this one, right off the Baños-Ambato road, in a few minutes.
Besides showering down on the neighboring countryside, ash was occasionally carried by prevailing, higher altitude winds hundreds of miles away, towards the Ecuadorian coastline and out over the Pacific. Communities to the north of the volcano, such as Baños, experienced ash fall only infrequently due to the prevailing winds that generally push the ash plume toward the west and southwest.

During the first weeks of intense activity in late 1999, up to one centimeter of accumulated ash was reported to have fallen (GVP, 1999). Frequent emissions continued throughout 2000, 2001 and 2002, with ash plumes or steam-and-ash plumes becoming a familiar part of the local landscape. An eruption in early February 2000 produced a high-altitude cloud consisting of a 12-kilometer wide band of thick ash, a 27-kilometer wide band of finer ash and an additional 26-kilometer band suspected to contain ash (Washington VAAC, 2000). On several occasions ash columns towered to 12 kilometers above sea level and one reached to 13 kilometers (GVP, 2001). Throughout the eruptive period several centimeters of ash would be deposited on the lower west flank of the cone; farther west thicknesses would be millimeters deep. When ash deposit thicknesses are mentioned in the reports of the Global Volcanism Program they generally range from 0.5- to 2.0-millimeters.

In August 2001 there was a marked increase in activity. On August 5 a strong eruption sent a massive ash column approximately 7.5 kilometers above the crater (GVP, 2001). According to Instituto Geofisico estimates, this and subsequent emissions through August 26, generated between 10 and 15 million
metric tons of ash spread over parts of Chimborazo, Tungurahua and Bolívar provinces (GVP, 2001) (Illustration 9).

Illustration 9. Ash fall in Chimborazo Province

A farmer in San José de Sabañag in Chimborazo Province shakes ash from a fruit tree during eruptions in August 2001. Recurrent ash fall has caused serious problems for agriculture.

In some places depths of ash between 1.6 and 2.0 centimeters were recorded (La Hora, August 19, 2001). An estimated 39,000 people (8,000 families) were affected. The ash blanketed 53,597 hectares of farmland and pastures, destroying or endangering crops and livestock and damaging more than 3,100 houses (OCHA, 2001). Because crop yields were so low, many small farmers had to use the portion of the harvest normally reserved for seed as food instead (WFP, 2001 – September 21).

Tungurahua engaged in another episode from September 12 through 25, 2001, depositing ash to the north in Pondoa, Runtún and Baños; to the southwest in Quero, Penipe and Riobamba; and to the west in Pillate, Juive,
Cotaló, and Bilbao, before settling into its usual pattern of small but regular emissions (GVP, 2001).

Almost exactly one year to the day after the August/September 2001 eruptions, another cycle of intense emissions was underway: during the first weeks of August 2002 a similar pattern of heavy ash fall occurred to the west and southwest of the volcano, affecting 40 communities in Quero canton as well as other portions of southern Tungurahua Province, parts of northern Chimborazo, and portions of Bolívar Province (El Universo, August 15, 2002). Five thousand acres of food crops and 10,000 acres of pastures were damaged (WFP, 2002 – August 30). Farmers able to do so started evacuating their herds (El Universo, August 19, 2002). The deepest ash fall recorded during that cycle was measured at 2.5 centimeters. Agricultural production was forecast to decline by five to ten percent (WFP 2002 – August 30).

Although the August 2001 and 2002 ash emission events were the most spectacular, the volcano had been emitting ash clouds intermittently but consistently since late 1999.

Hazard Experience in Baños During the Current Cycle

Although located in an area at high risk from pyroclastic flows, lahars and potential flash flooding in the event a dam formed on the Pastaza River, by December 2002, the town of Baños had escaped the worst of the direct impacts of Mount Tungurahua’s current eruptive phase: ash fall and lahars. Since ash fall had been directed generally to the west and southwest of the volcano by the prevailing winds it was infrequent and light in Baños. Similarly, the town had
been spared the effects of most of the lahars which had descended primarily the western and north-northwestern flanks, a few kilometers west of Baños, although the course of one *quebrada* had brought a few large lahars to a point just to the west of town. In November 1999, while Baños was evacuated, a lahar had descended the valley of the Vazcún destroying part of one of the main tourist attractions, *El Salado* thermal baths.

Lahar activity through 1999 and 2000 destroyed the road that winds along the western flanks of the volcano in Chimborazo Province but the road along the volcano's northern flanks, leading from Ambato to Baños and on to the Oriente, was quickly cleared and repaired following any lahar events. Consequently, transportation to and from Baños was not disrupted except for brief periods of time. Most of the time, Baños was also spared other direct reminders of the hazard such as roaring and the continual sight of the eruption column which was not visible from the center of town because of the intervening outcropping called Runtún. The lack of visibility of the hazard was atypical as the column was clearly visible from many other communities in the broader hazard zone (Illustration 10).

**Effects of Previous Historical Eruptions**

The historical record indicates that during active cycles Tungurahua alternates periods of quiet with periods of intense activity. The onset of the latter is sudden (Mothes et al., 2001) leaving little or no time for warning and evacuation. There are three eruptions of Mount Tungurahua for which there is both historical and geologic evidence. These are the events of 1773, 1886, and
1916-18. The historical record also reports activity from 1641 through 1646, but the evidence is scant and scientists have yet to confirm these events (Hall et al., 1999).

Illustration 10. Ash plume from Tungurahua seen from Riobamba

The ash plume from Tungurahua was clearly visible from this location in Riobamba, Chimborazo Province, in March 2002, and has become a common sight in many communities. In Baños, at the foot of the volcano, the plume is not usually seen and the town rarely receives ash fall.

Geologic studies by Minard Hall and other scientists with the Instituto Geofisico and members the French Institut de Recherche et Développement (Hall et al., 1999), confirmed the following: during the 1773 event there was
widespread tephra fall and the Pastaza River was blocked by a massive lava flow that descended the volcano’s north-northwest flank; the 1886 eruption was marked by “numerous pyroclastic flows that descended different routes on the western flank” (Hall et al., 1999 14), and a lava flow created a dam across the Chambo; the period from 1916 through 1918 was also characterized by pyroclastic flows.

Lahars occurred frequently during all three of the historic eruptions. Towns like Baños, on the north, and the villages of Puela and Penipe to the southwest, as well as smaller communities along the western flanks were at great risk. Heavy ash fall also occurred on occasion during all three historic eruptions (Hall et al., 1999).

The historical record indicates that several people died in an April 1773 eruption when what was described at the time as a hot mudflow descended the valley of the Vazcún and entered part of Baños (Reyes, 2001; Martínez, 1932). Some of the residents of Baños were able to escape across the Pastaza River. The 1773 eruption caused the dispersal of the town’s inhabitants to other communities and it was several years before Baños fully recovered from the 1773 event (Reyes, 2001).

Two brothers, Augusto and Nicholás Martinez wrote eyewitness accounts of the 1886 and 1916-18 eruptions. The following details were abstracted from excerpts from their writings, published in 1904 and 1932 respectively, and compiled recently by Manuel Espinosa Apolo (2000).
During the 1886 eruption Augusto Martínez noted pyroclastic flows that descended ravines on the volcano. The first of these flowed down the north-northwest flank in the area of Juive Grande and Juive Chico and dammed the Pastaza for 15 days, forming a lake that inundated lands along the Patate River. Huge lahars descended the courses of the Puela, Ulba and Vazcún Rivers. A river of lava descended the northwest flank in the area where present-day Cusúa is located. Ash fall was extensive, reaching thicknesses of 20 centimeters in parts of the highlands of Chimborazo Province. In Ambato, ash fell for 18 hours. Tungurahua’s last 1886 eruptive display was on November 16. The volcano produced a pyroclastic flow and an eruption column heavily laden with tephra that deposited ash as far north as Quito (Apolo, 2000).

The 1916-1918 eruptions reached a climax toward the end of 1918. Nicolás Martínez, in a study published in 1932, reported seven great eruptions between January and November 1918, all of them “extremely violent but short-lived” (Apolo, 2000 144; researcher’s translation). The worst eruption occurred on April 5 without warning and it caused widespread destruction. The largest pyroclastic flows “descended the valley of the Vadcún [sic.], at the entrance to Baños, which was not at all surprising since many ravines that originate at the crater feed this valley” (in Apolo, 2000 150; researcher’s translation). The flow stopped 100 meters short of the town proper. Describing the devastation wrought in the valley of the Ulba, Martínez noted that it was in many ways worse even than that in the Vazcún,

because the pyroclastic flow…melted the ice fields that cover the eastern summit of Tungurahua, melting them instantly…and
generating a formidable lahar that covered or carried before it houses, animals and plants, without, fortunately, causing one single human victim. When this lahar arrived at the Pastaza, because of its momentum it crossed [the river], dashing against the opposite bank and causing a great landslide that formed a dam that contained the waters of the river and formed a beautiful lake, more than one kilometer long, which lasted for several months (in Apolo, 2000 152; researcher’s translation).

**Other Significant Natural Hazards**

**Earthquakes: Historical Accounts**

One of the earliest accounts of the vulnerability of humans to the area’s natural hazards dates from 1640 when an entire indigenous village near Riobamba in Chimborazo Province was destroyed (Wolf, 1904). Subsequent earthquakes that caused significant death and destruction in Chimborazo and Tungurahua provinces in the general vicinity of the study area, and which are well-documented, occurred in 1645, 1698, 1797, 1840 and 1949 (Apolo, 2000). Official reports to the Spanish Crown listed 6,500 dead in the 1698 event. The 1797 earthquake is considered to be the worst in Ecuador’s history (Egred, 2000). Riobamba, near the epicenter, was destroyed, prompting relocation of the town – a fact that current residents almost invariably refer to when talking with visitors. Estimates of the number of dead vary greatly. The official count was 13,533, but conservative historians calculate that approximately 20,000 perished (Egred, 2000). In Baños 432 people died and the town’s development came to a halt temporarily. The earthquake disrupted the terrain so greatly that a natural dam was formed on the Patate River. After three months, the dam broke and a huge wall of water descended the Pastaza, again causing destruction in Baños
Finally, an earthquake in 1949 completely destroyed the old town of Pelileo, located between Ambato and Baños. The earthquake also razed entire sections of Ambato, damaged 32 other communities in Tungurahua Province, ten in Cotopaxi and several in Chimborazo. The initial death toll in the Pelileo earthquake was estimated at 6,000 but the final number was probably much higher (Eichler, 1952). Perhaps the worst effect of the 1949 earthquake on Baños was that the town’s transportation lifeline to the west was cut off (Reyes, 2001).

**Natural Hazards Concurrent with the Eruptions of Tungurahua**

Since Mount Tungurahua started erupting in late 1999, other natural hazard events in the study area took lives and damaged property, and several major natural disasters occurred in Ecuador. The following lists are by no means complete but they do give a sense of the prevalence of these events during the study period.

**Concurrent Local Hazards**

May 2000: Ice storms caused crop damage.

October 2000: A summit bloc failure on El Altar, a nearby inactive volcano, resulted in a flash flood and the deaths of 13 people in Penipe and Guano cantons in the vicinity of Mount Tungurahua. Several homes and business structures were destroyed, and there was extensive loss of livestock and crops (Defensa Civil, 2000; Hall et al., 2000).
October/November 2000: A drought, followed by a series of freezes, caused the loss of 15,000 acres of crops in Tungurahua Province (La Hora, November 18, 2000).

June 2001: Exceptionally heavy rainfall caused several landslides along the road between Baños and Puyo in the Amazon region. Two people died in Rio Verde, just east of Baños (El Universo, June 15, 2001; GVP, 2001). The same storm system resulted in flooding along the Chambo, Blanco and other rivers and the road between Penipe and Riobamba was partially destroyed (Jordan, 2001) In the vicinity of Baños people living along the Pastaza, Vazcún and Ulba Rivers had to move to higher ground. In Ambato, the heavy rains caused flooding of the Ambato River, at least one bridge was destroyed and the city’s potable water supply was compromised (La Hora, June 12 and 13, 2001; Jordan, 2001).

August 2001: In Ambato, Tungurahua Province, local flooding resulted in one death.

August/November 2001: Drought throughout the Sierra. Toward the end of the period the low level of water in the Pastaza River threatened to compromise generating capacity at Agoyan Hydroelectric plant (El Comercio, 13 and 18 November, 2001).

Concurrent Hazards in Other Parts of Ecuador

Late 1999: At about the same time that Mount Tungurahua started erupting, Guagua Pichincha, a volcano that overlooks Quito, the capital of Ecuador, also renewed its activity. The greatest threat to Quito was from ash fall
which, had it continued for any length of time, could have seriously disrupted activities in the city of 1.2 million. Some small villages closer to the volcano were evacuated (GVP, 1999).

April 2000: Heavy rains throughout Ecuador caused extensive flooding and numerous landslides resulting in 14 fatalities.

May 2000: Ice storms affected agriculture in the Central Sierra while heavy rains throughout Ecuador resulted in 34 deaths from flooding. Twelve people were killed in landslides in Imbabura and Carchi provinces.

July 2000: Activity at Guagua Pichincha volcano increased again and Quito received light ash fall.

September 2000: Earthquakes in Guayas Province and in Quito caused property damage.

October 2000: An earthquake centered near Ibarra in Imbabura Province caused one fatality, injured several people and caused widespread damage to homes partly due to local construction practices.


March 2001: Heavy rains in many areas caused widespread flooding. Thirty-nine people died in Sucumbíos and Orellana provinces. A landslide in Alausí, Chimborazo Province, killed three people; in the province of Azuay eight villages were isolated by a series of landslides (El Universo, March 13, 2001; La Hora, March 13, 2001).
June 2001: Torrential rains caused flooding and landslides resulting in 41 fatalities and the loss of 4,000 livestock. Most fatalities were on the Papallacta – Baeza road, about 70 kilometers east of Quito (OCHA, 2001 – June 20), where 14 landslides occurred in one 47-kilometer stretch. One of the landslides damaged the trans-Ecuadorian oil pipeline (La Hora, June 12, 2001). The same weather system caused extensive flooding in four provinces in the Amazon region, destroying crops and disrupting transportation systems. International food assistance was necessary to feed people in isolated communities (WFP, 2001 – November 14).

July 2001: A landslide on the road between Loja and Zamorra killed two people; a third was missing and presumed dead.

August 2001: Record snowfall in parts of the northern Sierra left 200 travelers stranded.

August-November 2001: The lowest precipitations recorded in the Sierra of Ecuador in 20 years. Province of Cotopaxi, adjacent to Tungurahua Province, was among those most affected by the drought.

Conclusions

As of December 2002, there was no record available that showed a fatality as a direct result of hazards from Mount Tungurahua, although the long-term effects of poor nutrition and compromised health remained to be known. Widespread ash fall from the volcano had caused many hardships for thousands of rural people dependent on agriculture for their survival. Lahars had disrupted
communications along the western and northwestern flanks particularly, causing further economic distress for isolated communities. For townspeople in Baños, however, once they returned to the homes they were forced to evacuate, the rhythm of life eventually resumed, with scant experience with or evidence of the potentially devastating hazard right on their doorstep. The impacts of Tungurahua’s activity were almost always somewhere else.

Historically too, past eruptions were beyond the memory of most residents. More recent cataclysms, such as the 1949 earthquake that destroyed the nearby town of Old Pelileo and razed half the provincial capital, were still within the lifespan of many local people. The horrendous flash-flood disaster in October 2000 that killed 13 people in Penipe and Guano cantons, virtually right next door to Baños, was factual, an actual occurrence. The possibility of a major explosive eruption of Tungurahua, on the other hand, remained an uncertainty, even for the scientists monitoring the volcano.

The normal progression of the seasons of the year regularly brought with it its own set of hazards: flooding and landslides were certain to occur. Friends and neighbors died in these events, only one or two at a time perhaps, but they were actual happenings. For those who read newspapers or watched television, even events farther away, in other parts of Ecuador, may at times have seemed more threatening: certainly 30 or 40 people buried in a landslide or drowned in rising floodwaters might be reminders of the instability of local slopes or of the swift flow of the Pastaza, but not of the potential hazards from an explosive eruption of Mount Tungurahua.
CHAPTER 6
BAÑOS AND TOURISM

Introduction

Tourism is vital to the economy of Baños and the growth of international travel tourism has made Baños an important contributor to the economy of Ecuador. Visitors have been coming to Baños for several centuries, first as religious pilgrims and later as secular tourists. In recent years, the number of foreign visitors has edged ahead of the number of Ecuadorians visiting the town. The latter still converge on Baños in the thousands especially on religious holidays and during school vacation time.

The usual influx of tourists came to a halt during the weeks following the October 1999 evacuation, although adventure-seekers continued to be attracted to the area by the eruptions of Mount Tungurahua. The tourist industry was devastated by the evacuation and members of the industry were prominent in the movement to return to the town. Business owners and the Municipality, working closely together, embarked on an aggressive campaign to counteract the negative publicity that resulted from the eruptions and the evacuation. By January 2001 local businesses appeared to be on the road to recovery and by May 2002, Baños seemed to have reestablished itself as a prime tourist center in spite of its hazardous location.
Tourism and the Ecuadorian Economy

Tourism provides hard currency for Ecuador and its role in the economy has been growing in importance for several years. In 2000, despite the fact that the country was experiencing economic and political turmoil, approximately 615 thousand foreign tourists visited there and contributed US$402 million to the economy (Ministerio de Turismo, 2002). This made tourism, with 7 percent of the total, the country’s third-ranked source of foreign revenue from the sale of goods and services. Sales of petroleum contributed 41 percent, and the export of bananas about 14 percent. According to available data, tourism was expected to rank third again in importance in 2001. By mid-year tourist revenues were about US$213 million and were projected to reach US$441 million by yearend. Tourism provided direct jobs for approximately 53,000 people and the data suggested that as many as 160,000 people depended directly or indirectly on tourist-related activities (Ministerio de Turismo, 2002).

Tourism and the Economy of Baños

Baños is one of the most popular tourist destinations in Ecuador. During 2000, the town was under an official evacuation order for the first eight months of the year. Even so, according to Ministry of Tourism data, Baños ranked as the country’s fifth most popular destination, with 140,000 foreign visitors, or 23 percent of all foreign tourists to Ecuador. Only Quito, Guayaquil, Cuenca and Otavalo drew more visitors (Ministerio de Turismo, 2002). Quito is the capital; Guayaquil is the largest city and most important commercial center; Otavalo is
famous for its Indian market and handicrafts; and Cuenca is a provincial capital with a long history in the arts. According to the Director of the Baños Municipal Tourism Department (Rios, 2002), the rankings for 1999 were similar, with 117,070 tourists visiting Baños out of a total of 509,000, also 23 percent of all foreign visitors to Ecuador.

The peak months for tourism in Baños are June, July and August. These are the most popular months for visits by foreign tourists and they are also summer vacation months in the Sierra. Religious holidays, such as Carnaval (the period preceding Lent), Easter and All Saints, attract large crowds from throughout Ecuador. On the weekends, Baños is visited by many people from the surrounding countryside and from the neighboring provincial capitals of Ambato and Riobamba.

According to a survey conducted in November 2001 by the town’s Tourism Department, 56 percent of all tourists visiting Baños were foreigners. Among the 44 percent of visitors who were Ecuadorians, 18 percent visited the town for religious reasons (Municipalidad Baños de Agua Santa – Ministerio de Turismo, 2002).

Directly and indirectly, tourism contributes to approximately 95 percent of the town’s economic base (Rios, 2002). Local economic activities that benefit from tourism include transportation, lodging, food and beverage, entertainment, ecotourism and handicrafts.

The economic importance of tourism was emphasized in the Municipality’s 2002 development plan in which the industry was identified as the dominant
factor in the local economy. In Baños, “all objectives, policies, strategies and actions of all programs; all intents, resources and actions of public and private agencies” (Municipalidad Baños de Agua Santa – Ministerio de Turismo, 2002 2; researcher’s translation) were based on the economic importance of tourism.

During research visits in 2000, 2001 and 2002, the extent to which Baños was geared to tourists was obvious. The streets in the center of town were lined with stores and restaurants catering to tourists. There were numerous photo supply stores, internet cafés and bars. Travel/tour operators advertised outdoor activities including kayaking, horseback riding, mountain climbing and sightseeing. Street vendors catered principally to the many local visitors who flocked to town on special holidays. Much of the informal commerce was concentrated in an area to the east of downtown, and on the streets in the vicinity of the basilica (Illustration 11).

Illustration 11. Street in front of Basilica

[Baños appeared to have regained much of its pre-evacuation tourist activity by March 2002.](Image)
The economic reliance of many of the inhabitants of Baños on tourism can be surmised from the fact that entire families were engaged in the tourist trade. For example, a husband might operate a taxi while the wife managed a food or trinket booth on the street (Illustration 12). After school, even the children sometimes contributed their labor to the family effort by helping to prepare food for the following day’s sales or by working on handicrafts.

Illustration 12. Street vendor in Baños

The livelihoods of some families were entirely dependent on tourism.

The small mom-and-pop operations were not the only ones where most family members depended on the tourist trade for family income. A similar dependence was noted among more prosperous segments of the population, such as hotel/motel owners. Some motel owners were also tour operators, and
owned restaurants and other related businesses. No data were available on exactly how concentrated ownership of major tourist businesses was but it is likely that it was highly concentrated.

In addition to tourism locally and in the immediate environs, ecotourism to the Oriente was becoming increasingly important economically. Baños had something of an advantage because of its location on a road through one of the few passes over the Andes.

The Tourist Cadastre

Until tourism was decentralized early in 2001, the national Ministry of Tourism, operating through the Provincial Ministries, was responsible for maintaining a “Quality Control Cadastre” of establishments catering to tourists. The cadastre was the basis for regulation and taxation of registered establishments by the central government. In an effort to estimate what the economic effects of the evacuation and eruptive activity of Mount Tungurahua had been on the tourist industry in Baños, this cadastre was reviewed for available years (Table 3).

The cadastre data show that although Baños was under an official evacuation order for ten months (October 1999 through the end of August 2000), there were more tourist establishments in 2001 than there had been in 1998. Additionally, between 1997 and May 2002 room offerings increased by 42 percent (from 923 to 1311) and beds by 57 percent (from 1808 to 2818) (Figure 3).
Table 3. Tourist establishments in Baños (1997-2002)

<table>
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<td>-</td>
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</table>

Notes:

(a) Data provided by the national Ministry of Tourism in Quito.
(b) No data for 1999 available from the local, provincial or national agencies responsible for record-keeping.
(c) No data for 2000 available from any agency possibly due to the fact that companies listed on the cadastre were exempted from taxation by special ministerial decree.
(d) Data provided by the provincial Ministry of Tourism in Ambato.
(e) Data provided by the Municipality of Baños Tourism Department in May 2002.
(f) Data accessed on the Municipality of Baños public website in August 2002; may reflect establishments that were not registered with the Ministry of Tourism when this entity was responsible for the cadastre, or some other cause.
The Municipal Tourism Department estimated that occupancy rates in 2002 were approximately 40 percent. This was considered an average occupancy rate for Baños (Rios, 2002).

Room rates were very inexpensive for visitors with hard currency. Because of the opportunities for outdoor activities, Baños attracted many backpackers, mountain climbers and similar active sports enthusiasts. Modest but clean rooms were available in 2002 at daily rates as low as US$4.00. A comfortable private room, within a few blocks of the main tourist area, could be had for US$6.00 or US$7.00. A private room in a more upscale hostal, or in one of the larger hotels in town, might go for US$12.00 to US$20.00 – expensive by Ecuadorian standards. At the high-end, the single-occupancy rate on a well-appointed room at a resort hotel was $56.00 in 2002. This was well beyond what
most visitors were able to or wanted to spend. The more upscale hotels appeared be having the most difficulty in recovering financially. No data were available from owners or managers of these establishments but personal observations in 2002 suggested that this was the case. Also no data were available to compare the rate structure pre-evacuation with that in effect in 2002. Such comparisons might be difficult to make because of currency fluctuations and inflation, but are essential for any detailed assessment of the economic repercussions of the evacuation and eruptions on the hotel/motel industry in Baños.

Meal prices were similarly attractive, but not noticeably more so than in comparable restaurants in Ambato, Riobamba or Quito. A light lunch in Baños, with a non-alcoholic beverage might cost in the neighborhood of $2.00 to $3.00. A dinner entrée, accompanied by a glass of wine, could run from about $7.00 up.

The Baños Tourism Department was new, established in May 2001. Under the national government’s modernization program, tourism was one of the first activities to be decentralized, and Baños was one of the first municipalities to assume responsibility for this activity (Municipalidad Baños de Agua Santa – Ministerio de Turismo, 2002). Decentralization was the reason cadastres for the various years could only be obtained from three separate entities: the Municipality of Baños, the Provincial Ministry of Tourism for Tungurahua, and the Ministry of Tourism in Quito.
Continuing Investment in Tourism

In 2002, the Baños Municipality planned to invest $150,000 in infrastructure enhancements of tourist facilities and services (Rios, 2002). Improvements to basic public services for the community-at-large, such as the provision of safe drinking water, appropriate management of solid waste disposal and sewage treatment – which was non-existent at the time since all effluents were dumped directly into the Pastaza River – were listed in the Municipality’s planning document with references to the benefits such improvements would have on the growth of tourism (Asociación de Municipalidades del Ecuador – Municipio Baños de Agua Santa, 1996).

The Municipality of Baños had a direct financial interest in the tourist industry, receiving revenues from the operation of several thermal baths. The municipality planned to expand its revenues from the thermal baths by branching out into specialty spas and increasing “health tourism” (Municipalidad Baños de Agua Santa – Ministerio de Turismo, 2002).

Origins of Tourism to Baños

Religious Tourism

In 1553, Dominican missionaries established a small shrine in honor of the Virgin Mary near one of the thermal springs emanating near the base of Mount Tungurahua. Word of the miracles performed by the Virgin of Baños de Agua Santa (Our Lady of the Holy Water Baths) and of the healing powers of her thermal waters quickly spread throughout Ecuador (Reyes, 2001). Ever since,
Baños has been a site for religious pilgrimages and there is a body of myths about the Virgin that many people still believe and which appeared to have had some influence on response to the hazard and the evacuation (See Appendix III for highlights of four of the myths).

The Dominican order was still prominent in Baños and played an important role during the evacuation of the town and the return of its people in 2000. In Baños the month of October is dedicated to celebrations honoring the Virgen del Rosario de Agua Santa (Reyes, 2001) and since the evacuation thousands of people have participated in religious processions (Illustration 13).

**Illustration 13. Religious procession commemorating evacuation**

Thousands of people participated in a religious procession in October 2001, commemorating the second anniversary of the evacuation of Baños.

Many devotees were from communities in the rural areas around Baños.

Since the evacuation of the town in October 1999 and its reoccupation starting in January 2000, the number of pilgrims making the trip to the basilica in the center
of town increased tremendously (Guevara, 2002). The church was said by some to be “the big winner” as a result of the evacuation. While the evacuation order was in effect and prior to the mass movement to return in January 2000, the resident Dominican priests were urging people to come to Baños for Sunday mass in the Basilica (Mothes, 2000). On the first anniversary of the evacuation, in October 2000, 15,000 people participated in a 5-hour procession from Los Pájaros to the main sports stadium in downtown Baños to attend an open-air mass (La Hora, October 22, 2000). Members of the clergy claimed that the Virgin protected Baños from the volcano and from corrupt politicians (La Hora, October 22, 2000).

In 2001, when local leaders successfully lobbied the central government for the emission of a new set of postage stamps for the purpose of promoting tourism to Baños, two of the five commemoratives were religious in nature, one honoring the Virgen del Rosario de Agua Santa, described in the article as the “eternal guardian of the town and its inhabitants,” the other depicting the basilica in which the statue of the Virgin is housed. Tungurahua volcano and two local waterfalls were depicted on the other three stamps. The newspaper report described the volcano as “currently erupting and providing tourists with a unique opportunity to admire this spectacle of nature, filled with magic and color” (La Hora, July 26, 2001).

**Secular Tourism**

Organized secular tourism dated at least from the early part of the 20th century. In the late 1920s, not too many years after Mount Tungurahua...
concluded its 1916-18 cycle of eruptions, the central government provided for the construction of thermal baths, a road capable of carrying vehicular traffic, and several reinforced concrete bridges. The improvement in access and facilities must have had the desired effect of increasing the influx of tourists because by 1937 Baños had an electric power plant (Reyes, 2001) which was likely a luxury for rural Ecuador at the time. By the 1950s, the population of the canton had grown to 9,921 (CEPEIGE, 1997) and the town of Baños itself had about 3,000 inhabitants. Even in those days, the town’s population increased two- or threefold on holidays (Reyes, 2001).

Tourism and Disaster Management

In a 2002 planning document, the Municipality of Baños recognized that the attitude of the residents of Baños was to minimize risk: “There is no culture of disaster management, and the local population, upon returning from the evacuation, has minimized the problem. The slogan of Baneños is that ‘nothing is happening’ and therefore few protective measures are taken” (Municipalidad de Baños de Agua Santa – Ministerio de Turismo, 2002 10). The municipality’s plan proposed, among several initiatives, that construction in high risk areas be prohibited and called upon religious and educational leaders to support emergency preparedness training.

During research visits to Baños in June 2000, January 2001, and March and May 2002, it seemed there was no concerted, proactive effort to ensure that hazard information was readily available to tourists. Instructions on what to do in
the event of a major eruption were not prominently displayed. Only a few establishments had posted the evacuation plan developed by Civil Defense. In March 2002, a small sign posted in one of the main squares was smashed and the wording unreadable, and appeared to have been that way for some time. The sign was still broken in May 2002. Signs in other parts of town were also defaced (Illustration 14). The bus terminal was not checked for hazard notices on the first research trip, but on the three subsequent visits, no hazard notices or evacuation plans were posted. The terminal is probably one of the most important locations to alert and educate less affluent visitors to Baños. Broad yellow stripes, painted on the surface of certain streets, which were designed to direct inhabitants to less hazardous areas, mainly at the base of the Runtún outcropping, were confusing to an outsider unfamiliar with any evacuation procedures. At first inspection the stripes simply appeared to be directional traffic signs (Illustration 15). Fortunately, this situation may have changed because in a 2002 document, the Municipality itself recognized that the lack of differentiation between regular traffic signs and evacuation signage was a serious problem (Municipio de Baños de Agua Santa – Ministerio de Turismo, 2002). The same document expressed the intention of authorities to improve emergency preparedness, including providing tourists with adequate evacuation information.

An evacuation exercise in August 2002 was an indication that emergency preparedness was on the municipality’s agenda. Based on subsequent press reports it appeared that other risk-reduction activities were underway. In the
case of the August 2002 exercise, however, apparently only about 30 percent of the population participated. Municipal facilities, including the thermal baths, were closed but most private businesses stayed open after the warning sirens were activated. One official estimated that it took people far too long to reach designated shelter areas. Had the emergency been real, many might have perished (La Hora, August 3, 2002).

Illustration 14. Hazard sign in Baños

In March 2002, this sign indicating an area for temporary shelter had been defaced, as were several other emergency signs in town.
Illustration 15. Evacuation route marking

The yellow arrow indicates an evacuation route. In some places these arrows are easily confused with traffic signs. The building in the background is one of the many smaller residential hotels or pensions in Baños. Note the mural of Tungurahua Volcano on one wall.

Conclusions

The development of Baños has been associated historically with tourism: first religious and later secular. During the past several decades, as agricultural activity became less significant and rural areas lost population to the cities, Baños came to depend more on tourism, to the degree that when Tungurahua became active in 1999, this activity accounted for 95 percent of the town’s economy.

Reliance on a single economic activity left local authorities and business owners with no practical, short-term solution for recovery, other than an
aggressive campaign to get tourists back to the town. Considering the economic crisis in Ecuador, it may have been fortunate that the economy of Baños depended on tourism rather than some other activity, because of the high percentage of foreign tourists from hard-currency countries.

By mid-2002, it appeared that town leaders had accomplished their goal of getting tourists back. Measuring the degree to which this had been achieved is difficult. The accuracy of the data from the Ministry of Tourism (2002), which estimates 140,000 foreign visitors to Baños during 2000, is questionable. From personal observation, there were very few foreign tourists in Baños in June of 2000 and it is highly unlikely that there were any great numbers prior to that since this would correspond to the first months following the “retaking” of the town. The data in the Municipality of Baños’ tourism cadastre show a dramatic increase in the number of business in several categories of tourist establishment. The increase requires further investigation and explanation. Although several explanations suggest themselves, no verifiable explanation of the growth was available for this research.

The best evidence of the success of the effort to bring tourists back to the town comes from comparing conditions during the research visits in June 2000 and May 2002. On the first visit the streets downtown were almost empty; many restaurants were open but few patrons were in evidence. In May 2002, the streets were filled with moving, ebullient crowds, and at some restaurants all tables were filled at the height of the lunch or dinner hour.
The dark side of the economic recovery of Baños was that Mount Tungurahua continued to present a significant threat to residents and visitors. For local inhabitants, risk denial may have made living in a hazardous environment possible but it may also have compromised their ability to respond effectively to an eventual, explosive eruption. For out-of-town visitors, so long as Tungurahua is a probable risk, lack of access to information about how to respond in the event of an emergency could have catastrophic consequences.
CHAPTER 7
RETURN AND ECONOMIC RECOVERY

Introduction

Volcanic eruptions are difficult for scientists to forecast with certainty and therefore organizations responsible for public safety are presented with special challenges when timing evacuations. In the case of volcanoes with a history of explosive eruptions, given the characteristics of a particular location, or the degree to which the community has anticipated an event and prepared for it, sheltering-in-place may not be a viable option. On the other hand, if people are forced to leave their homes, there must be some way of providing them with adequate food and shelter. If the high level of risk persists, then the people who have been displaced need assistance with training and jobs.

In the case of Tungurahua Volcano, thousands of people were displaced from at-risk communities for weeks and in some cases for months. Most people stayed nearby, in the provincial capitals of Ambato or Riobamba. Others traveled to distant cities, like Guayaquil or even Quito. For many reasons, government programs were unable to care for all of the people who needed assistance, and because the country’s economy was in a shambles, it was very difficult for evacuees to find jobs or reestablish their businesses. Owners of motels, restaurants and similar businesses that were virtually tied to a particular location
could not easily or quickly reestablish themselves somewhere else unless they had the financial resources to do so. The mandatory evacuation implied that an eruption was imminent, something that would happen within days. When it did not, many people returned to Baños and other hazardous areas where they believed, rightly or wrongly, that they had a better chance of economic survival than if they continued to live as exiles.

**Exodus: The Evacuation**

When activity at Tungurahua increased rapidly in late 1999, authorities started planning for a possible emergency. In the town of Baños preparedness activities started in late August. On September 8, the day the volcano was placed on alert by scientists, Civil Defense authorities started a public awareness campaign, which included showing a video of the effects of volcanic eruptions. A week later, when the alert level was raised to yellow, official emergency management response was activated. On September 28, an evacuation exercise was held in Baños. On October 5, Mount Tungurahua erupted.

Although the October 5 event was a small one, authorities were faced with the possibility that, similar to prior historical events, a sudden and unpredictable major eruption might follow. Given the virtual impossibility of getting people in Baños to safety in time if such an event were to occur, authorities raised the alert level to orange, triggering a mandatory evacuation of the town and neighboring communities in the hazardous zones. Residents had approximately 48 hours in which to prepare and leave their homes by the deadline of 6:00 pm on October
16. The vast majority of people needed transportation to leave the area and this was provided principally by local bus companies and military trucks. There were no arrangements for the evacuation of farm or domestic animals and many farmers either abandoned their animals or sold them to speculators at cut-rate prices.

Some wealthier residents of Baños, and others with moveable assets or a place to go, had already started leaving the town well in advance of the mandatory evacuation. Residents in some of the rural communities located higher up the flanks of the volcano had also started to evacuate voluntarily. The vast majority, however, did not leave until required to do so. During the final hours before the deadline, this reluctance was probably not helped by the refusal of three Dominican priests to leave Baños. The priests claimed that according to their calculations it was impossible for the volcano to damage the town and they demanded that the authorities provide a notary to make a complete inventory of the contents of the basilica’s museum (interview with Father Julio Estileno broadcast on Chile TV, 1999).

Data from a study by Tobin and Whiteford (2001) supported the idea that it took a mandatory evacuation order for most people to leave. Among former Baños residents living in a shelter in Ambato, 57.6 percent listed the evacuation order as the reason for deciding to leave their hometown, compared with only 30.0 percent who listed fear of the volcano as their reason. The mandated departure was also the primary reason listed by 81.8 percent of residents who had returned to Baños while the evacuation order was still in effect (Table 4).
Table 4. Reasons for leaving Baños

<table>
<thead>
<tr>
<th>Reason for leaving Baños</th>
<th>Colégio Bolivar shelter (n=33)</th>
<th>Returned Baños residents (n=11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fear of volcano hazard</td>
<td>30.0%</td>
<td>18.2%</td>
</tr>
<tr>
<td>Saw volcano erupting</td>
<td>3.1%</td>
<td>-</td>
</tr>
<tr>
<td>Safety of children</td>
<td>3.1%</td>
<td>-</td>
</tr>
<tr>
<td>Government/military intervention – Warning</td>
<td>57.6%</td>
<td>81.8%</td>
</tr>
<tr>
<td>For a better life</td>
<td>3.1%</td>
<td>-</td>
</tr>
<tr>
<td>Everyone else leaving</td>
<td>3.1%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.

The same study suggested that the evacuation order provided the impetus that people needed to make them leave (Table 5). Approximately 60 percent of respondents in both groups said they had left voluntarily but for at least half of the respondents, “voluntary” meant in response to the military intervention.

Table 5. Did you leave voluntarily?

<table>
<thead>
<tr>
<th>Interview area</th>
<th>Did you leave voluntarily?</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>Yes – evacuation order</td>
</tr>
<tr>
<td>Living in shelter in Ambato (n=36)</td>
<td>30.6%</td>
<td>30.6%</td>
</tr>
<tr>
<td>Returned to live in Baños (n=30)</td>
<td>23.3%</td>
<td>40.0%</td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.

Diaspora: Destinations of Evacuees

Approximately 17,000 people were evacuated from Baños and its peripheral communities; another 2,000 left the communities of Pillate, San Juan, Mucubi and Cusúa in neighboring Pelileo Canton, also in Tungurahua Province.
An additional 4,000 people were evacuated from communities on the western flanks of the volcano, in Chimborazo Province (Ecuadorean Red Cross, 1999). It was impossible to determine exactly where most people went, but Red Cross, Civil Defense, and other officials estimated that the principal destinations for the approximately 23,000 evacuees were Ambato, the provincial capital of Tungurahua; Riobamba, the capital of Chimborazo Province; and Puyo, in Pastaza Province in the Amazon region (Map 9). It is known that approximately 4,000 people sought asylum in the shelters set up in these three towns (Aráuz, 2000). Of the 19,000 people displaced from Tungurahua Province fewer than 2,000 proceeded to the numerous temporary shelters set up by the authorities, considerably less than the 5,000 anticipated in the province’s emergency plan (Herdoiza, 2000).

The temporary shelters were scattered throughout the cantons of Pelileo, Patate and Ambato, in communities near the volcano but beyond the high risk zone. Local school buildings were used for this purpose so classes at these establishments had to be suspended. More than two weeks into the emergency, on November 1, 1999, the national government authorized the establishment of several resettlement centers, called Centros de Reactivación Poblacional (CEREPS). Four of these were set up in Tungurahua Province: two in Ambato and one each in the cantonal capitals of Patate and Pelileo. Religious organizations also provided shelter at various locations for some of the evacuees.
One of the larger resettlement centers in Ambato was at Colégio Bolivar, which housed people mainly from the poorer suburbs and peripheral communities of Baños: La Ciénega, San Vicente, Ulba, Santa Ana, Lligua, Juive...
Chico and La Matriz (Herdoiza, 2000). Data on the number of residents housed here initially were not available but in June 2000, when residents were interviewed for the Tobin and Whiteford (2001) study, there were 208 people in residence. In mid-September 2000, when all resettlement centers were officially closed, there were still 180 evacuees living at Colégio Bolivar, about 86 percent of the June 2000 shelter population.

Although the shelter population originated mostly from the poorer suburbs, many of the people displaced from the town of Baños and its environs were relatively prosperous small business people. Twenty-nine percent of the people from Baños were middle-class small business owners, another 29 percent were owners of tourist businesses (Figure 4). The socio-economic composition of evacuees from the town of Baños was different from that of other displaced groups. The 4,000 people displaced from Chimborazo Province and the 2,000 who left the rural communities in Tungurahua Province west of Baños were all poor agriculturalists (Ecuadorian Red Cross, 1999).

**Figure 4. Occupation of Baños evacuees**

Data obtained from Ecuadorian Red Cross, 1999.
Conditions for Evacuees

The long-term shelters (resettlement centers) set up in Ambato in Tungurahua Province housed mostly evacuees from Baños. The shelters were crowded and people had little privacy. One building used as a shelter had a leaky roof. However, for some residents the biggest problem may have been that these places just were not home and, furthermore, there were few economic opportunities available to them in the communities to which they had evacuated. Eventually, government and NGO assistance to the shelters stopped.

Less is known about conditions for the thousands of displaced people who flooded into Ambato and other communities without going to shelters. Based on data obtained in formal and informal interviews, while some people went to live with relatives or friends, these arrangements often did not last very long; some people rented a room or a small house for as long as their savings held out; some became impoverished. Newspaper reports dating from late 1999 and early 2000 indicate that conditions for these people were extremely difficult. Ambato did not have the resources to accommodate such a large influx of displaced people. The strain on public utilities, including water and trash collection, was too much for the city to manage. Initially, individual residents and private companies helped the evacuees but, as time went by, this assistance diminished too. Neither the city, nor the province, nor the central government, had the money to care for a protracted length of time for so many people.
Return

Several weeks went by after the evacuation and the anticipated violent eruption still did not happen. Anger and resentment at the authorities for their unwillingness or inability to deal effectively with the evacuee problem became organized around a movement to return to Baños. In the print media, the return movement highlighted especially the plight of evacuees in shelters and the hardships experienced by farmers in the vicinity of Baños. Both groups represented a very small percentage of the displaced population. The largest group affected economically were people engaged in tourist and related industries which accounted for 95 percent of the town’s economic base.

The return movement was led principally by an organization called Hermandad Baneña, composed of elements from the tourist industry, including hotel owners/operators, tour guides, artisans’ associations and transportation unions. Additional pressure on the authorities to allow the return of evacuees came from the Province of Pastaza, immediately to the east of Baños Canton. Closing the Ambato-Baños-Puyo road cut the economic lifeline to the southern part of the province. The road was the principal means of accessing or leaving the area. Further support for the movement almost certainly came from some of the Dominican fathers who had stayed in Baños and who, by early November, while the evacuation order was still in effect, were calling on their parishioners to attend Sunday masses in the basilica (Mothes, 2000).

The mayor who held office when Baños was evacuated maintained that townspeople should not return until the alert level was downgraded, but by the
end of December, Hermandad Baneña had become sufficiently well-organized politically to be able to mobilize a return. This they announced on January 4 in a televised meeting with the Governor of Tungurahua Province. In the meeting Hermandad Baneña demanded: (1) the reopening of the road leading to Pastaza Province; (2) demilitarization of the hazard zone; and (3) a return of the displaced population to Baños. The Governor was opposed to allowing people back on the grounds that anyone who returned to the town would be in serious danger. The following day, Baños evacuees marching from Ambato were joined by groups from the town of Puyo in Pastaza Province, including members of the Organization of Indigenous Peoples of Pastaza (OPIP). Between 2,000 and 3,000 people advanced on the military posts set up to prevent access to Baños and the neighboring hazard zone. There was a brief confrontation between the military and the crowd. One civilian was killed and several military personnel were taken hostage by the crowd.

The same day, January 5, 2000, in the town of Pelileo, located between Baños and Ambato, the Hermandad Baneña and leaders from Pastaza Province signed an agreement with the Governor of Tungurahua Province that provided, among other points, for the immediate withdrawal of military forces from the Ambato-Baños-Puyo road, the resumption of traffic on the road and unimpeded reentry to Baños and neighboring communities for anyone who wished to return. The agreement acknowledged that anyone who did return would do so at his or her own risk, and responsibility for citizen safety was assumed by those who had
organized the return. The agreement was endorsed by the Archdiocese of Ambato.

The plight of evacuees from Baños and the hardships being experienced in some of the communities in Pastaza Province were legitimate causes around which to organize a return movement. The tourist industry also may have been pushing for a return when it did rather than wait any longer because of the start of the high tourist season in June/July. A member of the tourist industry, in video footage filmed during the January 5 march, argued for reoccupation of the town with the Colonel in charge of the military contingent on site because “…we’re the ones who are in contact with the international tour operators and we know that if Baños is not reactivated within at the latest… by the end of January that Baños will disappear from the world tourist scene….” (“…nosotros que tenemos contacto con las operadoras internacionales, si Baños no se reactiva como máximo como… hasta el mes de enero, Baños sale del contexto turístico mundial.”) (transcribed from footage in untitled, undated video by PATV Producciones; researcher’s translation). With mayoral elections scheduled for March, it was also an opportune time for possible candidates to ameliorate conditions for evacuees. The leader of the return movement did run for mayor. His candidacy was backed by Hermandad Baneña, Ojos del Volcán (a group affiliated with the tourist industry) and some of the rural communities around Baños. He did not win the election (La Hora, March 14, 2000).
Economic Recovery

For the return movement to be successful, people had to be convinced that the volcano was not a significant danger. Leaders of the movement, taped during the return march, repeatedly emphasized that Baños was not at risk because it was protected by the Runtún outcropping ("...tenemos la protección natural del Runtún"); that the hazard was not affecting the town ("...y en Baños no pasa nada"); and that no one had died as a result of the volcano ("...la naturaleza no nos ha destruido todavía") (transcribed from footage in untitled, undated video by PATV Producciones; researcher's translation). These beliefs were still being expressed by some political leaders two years after the event. On the second anniversary of the return and reoccupation of the town, a member of the city council announced that the inhabitants of Baños decided to return because they had come to the realization that nothing was happening in their town, that the volcano was not a danger, nor had it been a danger to them throughout history ("...al darse cuenta que en su pueblo no pasa nada, que el volcán no les hace daño, ni les ha hecho a través de la historia...deciden volver..." (La Hora, January 5, 2002; researcher’s translation)).

Although two thousand or more people participated in the return march, only a few hundred people actually resettled in town in the weeks following. In addition to the volcano hazard itself, several other reasons may have contributed to this reluctance, including the fact that there were no basic services and that the provincial authorities refused to allow schools to reopen in Baños because of the degree of risk. Even more of a deterrent, the evacuation had effectively kept...
all but the most intrepid tourists away so initially there was little demand for services and therefore few jobs. There is some evidence that suggests that most people who returned early were business owners and the elderly, and that many young families with children stayed away. A former resident of Baños interviewed in Riobamba on television explained her position this way: “I’m not going to return. We have children, and we cannot put their lives at risk” (interview on undated Chile TV news segment; researcher’s translation).

Getting tourists and residents back to town had to become the top priority for community leaders. The tourist industry mounted an effective campaign designed, in the words of one resident, “to convince the rest of the country and the rest of the world that Baños has been reborn.” A tourist pamphlet circulating within weeks of the return read: “Tungurahua Volcano is currently active and offers tourists a unique opportunity to admire, from the very streets of the town, a magical and colorful spectacle, one of nature’s displays that can be experienced only once in a lifetime.” (“El Volcán Tungurahua se encuentra actualmente activo, ofreciendo a los turistas la oportunidad única de admirar a un espectáculo lleno de magia y color desde las mismas calles de la ciudad, uno de los espectáculos naturales que se vive una sola vez en la vida”) (transcript of broadcast on Chile TV; researcher’s translation). The volcano then, which had been the source of the town’s woes, was to become its economic salvation.

In March 2000, a group of journalists was invited by the Municipality to come to Baños so they could verify – and report on – the town’s successful recovery. The municipal authorities, some of whom were owners of tourist
businesses, had accused the press of irresponsible reporting of the hazard and of having been partly to blame for the economic damage inflicted on the entire canton. According to one council member, it was therefore the duty of the press to help the town and its people recover economically (La Hora, March 11, 2000a).

Attempts to show the world that Baños was operating normally were not restricted to the activities of the Chamber of Tourism. A representative of a local union claimed in a press interview in March 2000 that about 90 percent of the economy of Baños had recovered and that “as of this moment about 10,000 Baneños are living in town” (La Hora, March 11, 2000b). The 10,000 number was picked up and repeated by another national newspaper (El Universo, April 25 and 29, 2000).

In truth, the town was far from “reactivated” and in March there were probably fewer than 4,000 people in town (Mothes, 2000), some of whom were not actually living there but were commuting to work in Baños from temporary living quarters in Ambato and other nearby communities. While no reliable official numbers were available it was obvious even three months later, during a research visit to Baños in June 2000, that the town was suffering economically, with many businesses still closed.

At the time, the town was still under orange alert and the ability to provide for sheltering-in-place (as an alternative to or in combination with partial evacuation) was minimal. Apart from the main highway, which almost certainly would be destroyed by a major eruption, the only other way to exit the downtown
area in 2000 was via an old suspension bridge over the Pastaza. A new bridge (estimated to cost US$ 460,000) that would enable faster egress from the downtown area was only contracted for in the fall of 2001, so it had yet to be built. Even by July 2002, excavation and construction of a foundation for the bridge had only been completed on one side of the river (La Hora, July 1, 2002), and the connecting road, leading away from the area, still was not complete in January 2003 (La Hora, January 17, 2003). How effective the new bridge might prove in the event of a sudden, violent eruption is questionable, since even though it is at street level it would be difficult for many people to reach it and cross it in less than the estimated seven minutes available.

The data suggest that among people who returned to Baños while the evacuation order was still in effect some did so in the expectation of improving their economic situation. The Tobin and Whiteford (2001) study shows that among a group of people who returned early, 77.7 percent did so because of a combination of lack of employment and economic hardship experienced in the place they had evacuated to, and 22.2 percent returned because of employment or business opportunities available in Baños (Table 6).

The authorities were being petitioned by groups in Baños to downgrade the alert level, but the governor of Tungurahua Province refused. However, in March 2000 he did authorize the reopening of the town’s hospital, resumption of some public works activities relating to bridge and road maintenance, resumption of telephone and police service, opening of the property registry and of the courts.
Table 6: Reasons for returning to Baños – June 2000

<table>
<thead>
<tr>
<th>Push factors for return</th>
<th>N (%)</th>
<th>Pull factors for return</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suffered in shelters</td>
<td>2 (11.1)</td>
<td>Military had left</td>
<td>3 (16.7)</td>
</tr>
<tr>
<td>Lack of employment</td>
<td>8 (44.4)</td>
<td>Home and possessions</td>
<td>4 (22.2)</td>
</tr>
<tr>
<td>Economic hardship</td>
<td>6 (33.3)</td>
<td>Return to own land</td>
<td>1 (5.6)</td>
</tr>
<tr>
<td>Uncomfortable situations</td>
<td>1 (5.6)</td>
<td>Rebuild community</td>
<td>1 (5.6)</td>
</tr>
<tr>
<td>Volcano not a threat</td>
<td>1 (5.6)</td>
<td>Belong in Baños</td>
<td>2 (11.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others had returned</td>
<td>3 (16.7)</td>
</tr>
<tr>
<td>Employment (business, farm, etc.)</td>
<td></td>
<td></td>
<td>4 (22.2)</td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.

The Governor’s action was taken with the proviso that the town authorities agree to allow Civil Defense to train the community in emergency response and preparedness activities (La Hora, March 2, 2000) rather than letting the local groups continue to do so as had been agreed to by the government under the January “peace agreement” with Hermandad Baneña. The Governor’s action was taken apparently in conjunction with lobbying of the national government in Quito by groups in Baños (La Hora, March 6, 2000). The opening of the various offices and agencies required, of course, that employees return to Baños. Informal interviews in June 2000 with workers at the town’s hospital suggest that some of them believed they could have lost their job had they not returned to staff the unit. For these individuals, fear of the economic consequences of becoming unemployed seemed to outweigh fear of the hazard.

Scientists at the Geophysics Institute, responsible for monitoring the volcano, continued to recommend that the alert level not be downgraded from orange (El Universo, April 25, 2000).
In addition to the lack of work in Baños, another factor that may have contributed to keeping people away from the hazard zone initially was that the provincial government would not authorize a general reopening of the schools in Baños while the town was on orange alert status. The Provincial Ministry of Education for Tungurahua Province did, however, allow a limited number of classes to be held so that students from poor families working in Baños and who had no means of getting their children to school outside of the hazard area could be accommodated. By early March 2000, there were an estimated 337 children in school in Baños, 300 of them with the authorization of the ministry (La Hora, March 11, 2000b). Toward the end of April, the administrator of a school in Baños opened his facility for classes in an effort to get more people to return, a move that met with open criticism from the governor of the province. A number of parents also objected, and they petitioned the Education Ministry to allow their children to complete the school year, which runs through August, in Ambato, regardless of whether or not schools were open in Baños (La Hora, April 25, 2000).

The difficulties encountered in getting the town back on its feet did not deter local leaders, and the campaign to get tourists and residents back continued. At his inauguration in August 2000, a new mayor, elected earlier in the year, called for all of the residents who had evacuated the canton to return. According to a press report, the mayor also announced that the town’s tourism campaign would be a means of “getting the truth out about Baños and its [natural] beauty” (La Hora, August 11, 2000). The pertinent paragraph reads:
[The Mayor] said that he would make a coordinated effort so that all residents would come back to their birthplace. ‘The recovery of tourism, with publicity campaigns carried in the various media, will make the truth about Baños and its beauty known…. In Baños, everything is peaceful because the volcano, with all its power, has made a new source of revenue available to all families from Baños, he said.’ (Dijo que a través de un trabajo coordinado tratará que todos los pobladores vuelvan a su tierra natal. ‘La reactivación del turismo con campañas en los diferentes medios de comunicación permitirá conocer la verdad y la belleza de Baños. ….. En Baños todo se encuentra en tranquilidad, pues el volcán con todo su poder ha abierto otra fuente de ingresos para todas las familias baneñas, afirmó.’) (researcher’s translation).

New infrastructure would be built and existing facilities improved to encourage more tourists (La Hora, August 10, 2000). The announcement was part of a lobbying effort that succeeded in getting the authorities to step down the alert level. Faced perhaps with a fait accompli, on September 5, 2000, the National Civil Defense authority finally lowered the alert level to yellow, but for Baños only. All other hazardous areas around the volcano remained on orange alert. This was still the status in December 2002.

The step-down in alert status for Baños came just two weeks before Holy Friday and tourists flocked to the town (El Comercio, September 24, 2000).

Former evacuees were interviewed in January 2001 for the Tobin and Whiteford study. Asked why they had returned to Baños, 12.5 percent said it was because of the availability of work; another 25.0 percent returned because of adverse economic conditions in the communities they were living in; 7.5 percent listed the opening of the schools in Baños and only 2.5 percent said it was
because the alert level had been lowered and/or Baños was no longer at risk (Table 7).

Table 7. Reasons for returning to Baños – January 2001
(first reason cited by respondents)

<table>
<thead>
<tr>
<th>Push factors for return</th>
<th>Pull factors for return</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Economic reasons</td>
<td>Community and property</td>
</tr>
<tr>
<td>20 (25.0)</td>
<td>25 (31.3)</td>
</tr>
<tr>
<td>Uncomfortable situations</td>
<td>Work availability</td>
</tr>
<tr>
<td>10 (12.5)</td>
<td>10 (12.5)</td>
</tr>
<tr>
<td>Forced to return</td>
<td>Others had returned</td>
</tr>
<tr>
<td>2 (2.5)</td>
<td>5 (6.2)</td>
</tr>
<tr>
<td></td>
<td>School availability</td>
</tr>
<tr>
<td></td>
<td>6 (7.5)</td>
</tr>
<tr>
<td></td>
<td>Alert level lowered/Baños no longer dangerous</td>
</tr>
<tr>
<td></td>
<td>2 (2.5)</td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.

Efforts by town leaders to get their community reactivated brought them into conflict with the scientists responsible for monitoring the volcano and providing risk assessments, and with the Civil Defense authorities responsible for emergency management. Scientists at the Geophysics Institute were accused of exaggerating the degree of risk posed by the volcano to Baños. Individuals connected with the tourist industry threatened to bring suit against the Institute’s director (La Hora, July 8, 2001). In August 2001, when ash fall from Tungurahua was intense and was causing serious problems for people and agriculture in neighboring cantons, authorities in Baños, fearful that tourists would be scared away, demanded that information about the volcano be released only through the Province’s Emergency Operations Committee (El Universo, August 27 and 28, 2001). The August 9, 2001 editions of several newspapers show a very different emphasis in coverage of the event. The national editions of El Comercio and El
Universo focus on the damaging effects of the ash fall. The national daily, La Hora, with a local edition in Tungurahua Province, emphasized that the erupting volcano was a tourist attraction (El Comercio, El Universo and La Hora, August 9, 2001).

Efforts to minimize the degree of risk to the community may also be reflected in a lack of enthusiasm to pursue the necessary public awareness campaigns and preparedness programs. The leaders who organized the return to Baños had committed that returned residents and tourists would be provided with full information and training as to what to do in the event of a major emergency. This commitment was not a top priority for community leaders because Civil Defense personnel were not welcome in Baños for several months following the return, and groups within the community insisted that they were capable of handling any emergency that might develop (La Hora, September 18, 2000; El Comercio, September 24, 2000). However, after the intense activity and ash emissions in August 2001, the municipality did announce that its Emergency Operations Committee would be strengthened (La Hora, September 1, 2001; El Comercio, September 1, 2001). Peripheral flank communities may have received less attention. For example there was no road suitable for promptly evacuating the 150 inhabitants of the village of Pondoa (Map 2, page 36), on the flanks of the volcano, above Baños (La Hora, November 10, 2001).

During research visits in June 2000, January 2001, March 2002 and May 2002, personal observations seemed to confirm that the potential hazard posed by Mount Tungurahua was being downplayed by local businesses and
authorities. As detailed in Chapter 6, hazard signage and directions were not prominently displayed in the areas most frequented by tourists, including the bus terminal, hotels/motels and restaurants.

**Ongoing Eruptions**

After authorities downgraded the alert level for Baños to yellow more residents did return and the influx of tourists gradually improved. In March 2002, there were approximately 10,000 people living in Baños, about 70 percent of the original population (INEC, 2001). The intervening months had seen major impacts of Tungurahua’s eruptions in other parts of the province and in the adjoining province of Chimborazo, but Baños remained relatively untouched. Whenever volcanic activity increased significantly, town leaders appear to have gone on a publicity offensive to make it clear that the hazard was not affecting Baños and that the eruptions provided tourists with a great opportunity to see an active volcano.

**Perceptions of the Volcano Hazard**

In June 2000, former residents of Baños living in a shelter in Ambato were interviewed for the Tobin and Whiteford (2001) study about their perceptions of the degree of risk posed by the volcano hazard. Fifty percent of those interviewed said they were very worried about the volcano. Early returnees to Baños were also interviewed, but among this group, fewer than 6 percent said
they were very worried, and 50 percent said they were not at all worried about the volcano (Table 8).

Table 8. Degree of worry about volcano – June 2000

<table>
<thead>
<tr>
<th>Interview area</th>
<th>Are you worried about the volcano?</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>A little</td>
</tr>
<tr>
<td>Living in shelter in Ambato (n=36)</td>
<td>-</td>
<td>22.2%</td>
</tr>
<tr>
<td>Returned to live in Baños (n=34)</td>
<td>50.0%</td>
<td>20.6%</td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.

The same study found that among evacuees from Baños living in shelters in June 2000, many people were still “very to extremely” worried about the volcano and believed it represented a “high to very high” degree of personal risk. The same group of evacuees, but not necessarily the same individuals in the group, was interviewed again in January 2001, approximately four months after the shelter they had been living in was closed and one year after the town of Baños had been reoccupied. Many of them were still very worried about the volcano (40.8 percent) and 45.8 percent believed it presented a high degree of personal risk (Tables 9 and 10). At the time of the January 2001 interviews some of these people were living in Baños but working in Ambato and vice-versa.

Table 9. Worry about volcano among shelter residents

<table>
<thead>
<tr>
<th></th>
<th>June 2000 (n=42)</th>
<th>January 2001(n=27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little or no worry</td>
<td>21.4%</td>
<td>48.1%</td>
</tr>
<tr>
<td>Somewhat worried</td>
<td>14.3%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Very to extremely worried</td>
<td>64.3%</td>
<td>40.8%</td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.
Table 10. Perceptions of risk among shelter residents

<table>
<thead>
<tr>
<th></th>
<th>June 2000 (n=42)</th>
<th>January 2001 (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little or no risk</td>
<td>16.7%</td>
<td>41.7%</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>16.7%</td>
<td>12.5%</td>
</tr>
<tr>
<td>High to very high risk</td>
<td>66.6%</td>
<td>45.8%</td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.

Perceptions of risk among people who were actually living in Baños in June 2000, January 2001 and May 2002 were strikingly dissimilar. Approximately 60 percent or more in each of the interviews were not worried about the volcano and believed it presented little or no personal risk (Tables 11 and 12). Since these were people who were living in Baños, their responses are not surprising, as it would seem logical that they would not have returned had they believed the volcano presented a significant threat. It is, however, interesting to note that by May of 2002, the percentage of people in Baños who indicated they were "somewhat worried" about the volcano had increased to 32.1 percent, versus 14.7 percent in June 2000 and 7.1 percent in January 2001 (Table 11), possibly reflecting, among other hypotheses, the inclusion of people in the sample who had been forced to return because the shelters were closed, or a growing realization among residents that the volcano was indeed a risk. Unfortunately it was not possible to verify either of these hypotheses.

Table 11. Worry about volcano among Baños returnees

<table>
<thead>
<tr>
<th></th>
<th>June 2000 (n=34)</th>
<th>January 2001 (n=82)</th>
<th>May 2002 (n=106)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little or no worry</td>
<td>70.6%</td>
<td>79.8%</td>
<td>59.4%</td>
</tr>
<tr>
<td>Somewhat worried</td>
<td>14.7%</td>
<td>7.1%</td>
<td>32.1%</td>
</tr>
<tr>
<td>Very to extremely worried</td>
<td>14.7%</td>
<td>13.1%</td>
<td>8.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.
Table 12. Perceptions of risk among Baños returnees

<table>
<thead>
<tr>
<th></th>
<th>January 2001 (n=80)</th>
<th>May 2002 (n=105)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little or no risk</td>
<td>62.4%</td>
<td>64.8%</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>18.8%</td>
<td>25.7%</td>
</tr>
<tr>
<td>High risk</td>
<td>18.8%</td>
<td>9.5%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.

Conclusions

The economic recovery of Baños required a conscious effort on the part of community leaders to change perceptions of risk among tourists and evacuated residents. The initial eruptions and the evacuation stemmed the flow of visitors to Baños. Without tourists there could be no economic recovery for the community. Community leaders realized this and started an aggressive campaign to get positive views of the situation in Baños out in the marketplace. Even after the reoccupation of the town some evacuees, however, believed the volcano did indeed present a high degree of risk. It is not possible to determine how widespread this belief was because so few evacuees went to shelters and there are no data on risk perception among the non-sheltered population. Although newspaper articles cannot be taken as completely factual reports of statements by leaders in Baños, the reporting throughout 2000 is consistent, and suggests that residents, like tourists, had to be convinced that the volcano was not an imminent threat.
CHAPTER 8
SOCIO-ECONOMIC CONTEXT OF THE HAZARD

Introduction

When high-risk areas around Tungurahua Volcano were evacuated in 1999, Ecuador was in the midst of a severe economic crisis that was causing tremendous social and political turmoil. The ongoing eruptions of a volcano in a relatively unpopulated part of the country appear on the national scene as an event of minor significance. One way in which to understand the vulnerability of the people exposed to the hazard is to view their response to the evacuation and their attempts to reestablish the economic viability of their community in terms of the major socio-economic developments occurring at the time. These events may have affected individual or community perceptions of the importance of the volcanic hazard when compared with the socio-economic turmoil that had engulfed all of Ecuador, may have decreased the range of recovery options available to evacuees, and certainly inhibited the state’s ability to manage the crisis adequately.

Macro-economic conditions in Ecuador correlated closely with local conditions because of the country’s relatively small size and because historically Ecuador has been governed on a centrist model. Until recently, practically all decision-making was done by government agencies in the capital.
The relationship between events at the national and local levels was
drawn from an analysis of data excerpted from research conducted by Tobin and
Whiteford (2001) in which evacuees ranked the various crises or problems they
were experiencing. Except among a group of rural people, who had abandoned
their lands because of the direct impact of the hazard, more people perceived the
economic situation and the evacuation itself as greater crises in their lives than
the potential danger from the volcano. The data from the Tobin and Whiteford
(2001) study are presented in the first section of the chapter and are followed by
research on each of the major socio-economic events that respondents had
ranked as crises in their lives.

**Crises Experienced by Evacuees**

Questionnaire surveys for the Tobin and Whiteford (2001) study that were
administered in June 2000 and January 2001 to evacuees showed that economic
problems almost always outranked other crises, including the volcano hazard.
The exceptions were: (1) economic problems were ranked equally with the evacuation as the worst crisis by people who had returned to live in Baños in early 2000 before the evacuation order was lifted; and (2) agricultural problems slightly outranked economic problems in 2000 among rural peoples who were living in a resettlement center. Among people affected by the volcano, more respondents ranked economic problems as the worst crisis in 2001 than did in 2000. In a control community, that had experienced neither the evacuation nor the volcanic hazard, the percentage decreased significantly (Table 13).
Table 13. Ranking of crises

<table>
<thead>
<tr>
<th></th>
<th>Returned to Baños</th>
<th>City shelter residents (current)(former)</th>
<th>Rural Resettlement Center</th>
<th>Rural Control Community (not evacuated)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Worst Crisis</strong></td>
<td>N=33</td>
<td>N=77</td>
<td>N=40</td>
<td>N=24</td>
</tr>
<tr>
<td>Agricultural problems</td>
<td>6.1</td>
<td>9.1</td>
<td>12.5</td>
<td>4.2</td>
</tr>
<tr>
<td>Economic problems</td>
<td>33.3</td>
<td>40.3</td>
<td>32.5</td>
<td>33.3</td>
</tr>
<tr>
<td>Political turmoil</td>
<td>6.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Volcano/ floods</td>
<td>12.1</td>
<td>7.8</td>
<td>10.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Family illness/death</td>
<td>6.1</td>
<td>10.4</td>
<td>20.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Evacuation</td>
<td>33.3</td>
<td>14.2</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Other family issues</td>
<td>3.0</td>
<td>9.1</td>
<td>5.0</td>
<td>12.5</td>
</tr>
<tr>
<td>Loss of home</td>
<td>-</td>
<td>1.3</td>
<td>5.0</td>
<td>-</td>
</tr>
<tr>
<td>Everything</td>
<td>-</td>
<td>1.3</td>
<td>2.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Other crises</td>
<td>-</td>
<td>6.5</td>
<td>-</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Data obtained from Tobin and Whiteford (2001) statistics.

For statistical reasons, the economic problems identified as crises in 2000 were aggregated. They included the devaluation of the currency, loss of bank funds and lack of money. In 2001, dollarization of the economy was added to the 2000 list. The background of these events is reviewed in the following sections.

**Overview of Socio-economic Developments in Ecuador**

The Ecuadorian economy is highly dependent on revenue from petroleum exports which, in 2001, represented approximately 45 percent of all exports (US Energy Information Administration, 2002). As a result of this dependence, even...
small changes in world prices can have big impacts on government revenues. In the early 1990s, Ecuador had benefited from high oil prices but within a few years the price for Ecuadorian crude began falling, resulting in inflation and fiscal deficits. By 1998, Ecuador was spending more on imports than it was receiving in export revenues. The combination of economic factors and an unstable political situation resulted in less domestic and foreign investment. In 1998 the world price for petroleum dropped dramatically (Figure 5). The change between 1997 and 1999, when the per barrel price reached a low of $8.50, represented a drop of 62.8 percent. Ecuador could not compensate for the decrease in revenues by increasing production (FAO, 2001).

**Figure 5. Ecuador crude petroleum prices: 1997-2001**

![Ecuador crude petroleum prices: 1997-2001](image)

Data obtained from: U.S. Energy Information Administration (2002) statistics. Note: Prices are those in effect at the start of the year.

The Ecuadorian economy was also negatively impacted in 1997-1998 by the effects of a natural hazard. An El Niño episode caused extensive flooding
and destruction of infrastructure and housing in coastal areas. The total cost of the damage was estimated at US$2,869 million (World Bank, 2001), or approximately 14.5 percent of 1998 gross domestic product. For comparison purposes, Hurricane Opal in 1995 in the United States resulted in similar damages: $3,000 million (1995 dollars) (Jarrell et al., 2001). Opal was the fifth most costly hurricane in U.S. history, but the $3,000 million figure represented a mere 0.04 percent of 1995 GDP (GDP data from Bureau of Economic Analysis, 2002). In addition to the widespread infrastructure damage and loss of housing, the 1997-1998 El Niño event caused food production to fall because of extensive damage to crops especially (Figure 6).

Figure 6. Growth in food production: 1995-2000

As the economy worsened, a number of banks failed, due in part to the economic crisis but also because of shaky loans and, in some cases, outright
theft and corruption. In March 1999, in order to stop a run on the banks, the government declared a bank holiday and froze demand and savings deposits for a six-month period and time deposits for one year at all banking institutions (ECLAC, 2000). The move affected all social classes but especially the middle class. The freezing of bank accounts was one of the problems identified by many evacuees as a crisis that had affected them more than the volcano and the evacuation.

Cutting government expenditures and efforts to increase revenues were not enough to stave off the crisis. In September 1999 Ecuador announced it could not make interest payments on part of its international debt (Janes, 2000; Bronstein, 1999).

For several years foreign debt had been taking up about 41 percent of government expenditures, leaving little to spend on education, healthcare or other vital social programs. For example, in 2000 foreign debt service amounted to 33.4 percent of GDP, approximately US$2,124.3 million (Bureau of Economic and Business Affairs, 2001). This was considerably more than government expenditures on social programs that year. Public spending on health, for instance, decreased from 1.8 percent of GDP in 1995 to 0.9 percent in 1998 and while the percentage remained the same in 1999 and 2000, GDP decreased significantly those years resulting in smaller budgets for health expenditures (ECLAC, 2001) (Figures 7 and 8).
A new president, elected in mid-1998, attempted to turn the economy around by further cutting government budgets, by increasing tax revenues and by implementing structural adjustment policies recommended by international lenders, but the economy continued to deteriorate. By October 1999, when the
The town of Baños and other communities were evacuated, the inflation rate was
43.1 percent; by yearend it reached 60.7 percent (Figure 9). Real wages
deprecated by 67.8 basis points, from 108.70 in January 1999 to 40.90 in December
(Figure 10), a decrease of 62.4 percent.

**Figure 9. Inflation: 1999**

![Inflation: 1999](image)

Data obtained from Banco Central del Ecuador (1999) statistics.

**Figure 10. Real wages: 1999**

![Real wages: 1999](image)

Data obtained from Banco Central del Ecuador (1999) statistics.
Life had become economically impossible for most of the population. This was especially so for evacuees, who were separated from their livelihoods and homes at the worst possible time, just as inflation, which had already been eating away at earnings and purchasing power, was rising even more steeply. These conditions undoubtedly aggravated what was already an extremely difficult situation for evacuees and many who might otherwise have been able to cope at some level with the disaster became unable to do so.

Among the population at large, with inflation out of control and the lack of funding of many social programs including pensions, healthcare, food programs and education, social unrest mounted. The announcement on January 9, 1999, that the government intended to convert to the U.S. dollar was widely viewed as a move that would create additional economic hardship, especially for the poor, who constituted the vast majority of the population. Opposition to the government culminated in a coup d’état on January 21, 2000, a little more than two weeks after residents forced the military to relinquish Baños. The national coup was achieved in part by a massive popular uprising backed by a few military officers. The leaders of the coup, however, relinquished power within hours to a constitutional successor government headed by the vice president, Gustavo Noboa (Hoy Digital, January 22, 2000).

The Noboa government continued the previous president’s attempts to effect reforms, including the elimination of subsidies on essential items such as cooking gas, electricity and fuel. A two-billion dollar loan package was negotiated with the International Monetary Fund, the World Bank and the Andean
Development Corporation (IMF, 2000). Ecuador’s international debt with other lenders was rescheduled.

Part of the price for the assistance was the requirement that Ecuador continue structural adjustment programs, including increased participation by the private sector, including international companies, in important segments of the economy. The loan also called for the elimination of subsidies on essential services, the imposition of higher taxes and further curtailment of government spending programs. The Noboa government proceeded with the implementation of dollarization. In March 2000, the Ecuadorian Congress passed a law making the dollar the official currency. September 2000 the former national currency, the sucre, was retired (Bureau of Economic and Business Affairs, 2002).

For many evacuees, the conversion to a dollar standard was another in the series of economic blows they had sustained since the evacuation in October 1999. Besides having to spend money on items they might otherwise not have had to, such as rent, inflation had also been eating away at any savings and then, dollarization resulted in further price hikes on essential items, particularly food, because of lack of familiarity with the currency and rounding-up to a dollar equivalent of the old sucre – a situation that was taken full advantage of by many unscrupulous merchants.

**Some Social Costs of Ecuador’s Economic Crisis**

Throughout 2000, economic conditions for Ecuadorians continued to be extremely difficult. The dramatic increase in the number of Ecuadorians
emigrating provides one measure of how desperate many people had become. By one estimate, between January and March 2000 more than 57,000 Ecuadorians emigrated (Unda, 2001). The exodus was a continuation of a pattern that had started some years earlier and which intensified. Most migrants were middle-class and a high percentage of them were female (Jokisch and Pribilsky, 2002). The money sent home to Ecuador by these expatriates became an important source of financial assistance for family and friends (Table 14).

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount (in billions of US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>1.084</td>
</tr>
<tr>
<td>2000</td>
<td>1.317</td>
</tr>
<tr>
<td>2001</td>
<td>1.415</td>
</tr>
</tbody>
</table>

Source: El Comercio, 2003 (January, n.d.)

Because of the economic polarity of Ecuadorian society, average national figures fail to convey the full impact of the economic crisis. Even so, GDP per capita figures do provide an insight into conditions. From a high of US$1,665 in 1997, GDP per capita decreased to US$1,079 in 2000 (Figure 11), a drop of 34.8 percent (ECLAC, 2001). A per capita GDP of US$1,079 equates to just $2.96 per day as a national average.

At yearend 1999, the official urban unemployment rate was 14.4 percent of the economically active population (the average for 1999 was 15.1 percent). Private consumption had decreased by 14.8 percent compared to 1998 (Banco Central del Ecuador, 2002; ECLAC, 2001).
In January 2000 inflation surged. The rate for December was 8.5 percent. In January it jumped to 14.3 percent. In February 2000, when the Instituto Nacional de Estadística y Censos released the January figures, its data showed that the price of the basic family food basket was $178.75, while typical income for a family of 5 was $74.94, a deficit of 55.8 percent between income and the cost of food (INEC, 2000). But more was still ahead: the increase in February was 11.5 percent; in March 9.5 percent; in April 13.8 percent. It was May before inflation started to abate, but the cumulative rate for the year was 90.6 percent.

It would be near the end of 2000 before the economy started to show some improvement, approximately around the same time that the shelters for evacuees were closed. In 2000, gross domestic product grew by 2.8 percent.
compared to 1999, which had seen a decline of 9.5 percent. Real gross national
disposable income also increased in 2000, by 5.0 percent, compared with a
decline of 6.8 percent in 1999 (ECLAC, 2001). But the unemployment rate
remained high and underemployment continued to rise. By November 2000
underemployment affected 60.5 percent of the labor force (Figure 12).

**Figure 12. Unemployment and underemployment**

Data obtained from Banco Central del Ecuador (1999, 2002).

The evacuation of Baños occurred during a critical period in the economy
of Ecuador. Evacuees, like the rest of the population, had seen their real income
decreasing rapidly throughout 1999 as unemployment and underemployment
rose. Government revenues had been contracting, as shown by the decrease in
the GDP and other indicators, with resulting cuts in the funding of government
programs, such as health, that are important components of recovery from
disaster. The country’s economic condition had destroyed the ability of both the
individual and the state to respond adequately to the emergency.
Local Economic Context

Many of the people who were displaced from Baños and surrounding communities moved to Ambato. Ambato has a population of 154,369 and is the ninth most populous city in Ecuador (INEC, 2001). It is a bustling commercial and industrial town, quite different from Baños with its focus on tourism. Ambato might have offered new economic opportunities for many of the people who sought refuge there, but because the national economy was in disarray, conditions were difficult even for the town’s established residents. It was impossible for the city to provide for such a large number of people seeking refuge and employment. Informal conversations with several residents of Baños indicated that many people did find jobs in Ambato, although some believed that the wages they were being paid were less than locals would have been paid for the same work. The same sources indicated that other people, possibly only a relative few, found better-paying jobs in Ambato than they had held in Baños.

About 2,000 people were housed in shelters in Ambato. An unknown number, but most likely several thousand people, rented living quarters or stayed with family or friends.

According to the consumer price index (CPI) reports issued monthly by the Instituto Nacional de Estadística y Censos (INEC), the increase in the average CPI in Ambato between October 1999, when Baños was evacuated, and the end of December 1999, when the return movement crystallized, was almost 27 percentage points. For the year, the average increase in the CPI was 69.25 percent, higher than the national average of 60.71 percent. Figure 13 shows the
average increase in the CPI and increases in selected individual components of the index during 1999.

Figure 13. Changes in the CPI - Ambato 1999

Data obtained from INEC (1999) statistics.

The period mid-October to end-December then was one of high inflation, at exactly the time that people were first evacuated from Baños and other communities, and when it was realized that the eruption was not a given and that evacuation could be for a prolonged period of time.

The economic situation deteriorated further in 2000. The average increase in the CPI for the year was 90.84 percent, and increases in the food component of the CPI, which consists of foods, non-alcoholic beverages and tobacco products, increased by 107.65 percent, while health costs increased by
102.76 percent (Figure 14). For people who remained evacuated, the general prices increases and the increases in the price of foods particularly, must have accentuated the crisis.

Figure 14. Changes in the CPI – Ambato, 2000

Data obtained from INEC (2000) statistics.

By the end of 2001, about 70 percent of the people from Baños and surrounding communities had returned home. For that year, the average increase in the CPI for Ambato was 20.24 percent. Food prices also leveled off somewhat in 2001, increasing by a relatively moderate 12.7 percent. The leveling off in food costs, however, was partially offset by a 53.0 percent increase in the cost of rent, water, electricity and cooking gas; health costs increased by 34.9 percent (Figure 15). These data suggest that, in addition to the very
effective efforts of the tourist industry in Baños, the recovery of the town was at least partly due to the general improvement in the overall economy of Ecuador.

Figure 15. Changes in the CPI – Ambato, 2001

Table 15 shows the breakdown in the increases in the prices of water, electricity, and cooking gas in Ambato between 2000 and 2001.

Table 15. Price increases in basic services in Ambato (2000 to 2001)

<table>
<thead>
<tr>
<th>Service</th>
<th>Unit of measure</th>
<th>Percent increase 2000-2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>30 m³</td>
<td>148.80%</td>
</tr>
<tr>
<td>Electricity</td>
<td>180 Kw</td>
<td>57.40%</td>
</tr>
<tr>
<td>Cooking gas</td>
<td>15 Kg</td>
<td>56.90%</td>
</tr>
</tbody>
</table>

In summary, between October 1999 when Baños was evacuated, and September 2000, when the shelter in Ambato was closed and most people returned to start the new school year in Baños, the consumer price index rose from 394.12 basis points to 807.37 points, an increase of slightly more than 100 percent (Figure 16), and higher than the national inflation rate of 90.6 percent.

**Figure 16. Consumer price index Ambato**
(October 1999 – September 2000)

Most people were away from their homes in Baños from October 1999 through September 2000. It was during this period that the cost of living was increasing at a faster pace than either before the evacuation or after the shelters were closed (Figure 17) so evacuees were adrift from their normal support systems during the worst of the inflationary period.
Social Conflicts

The period from 1998 through mid-2000 was a tumultuous one on the social front. Government cost-cutting/cost-containment programs generated numerous strikes and street protests. The difficult times continued throughout most of 2001. The following information was compiled from numerous sources, including the daily editions from December 1999 through December 2001 of the national newspapers El Comercio, La Hora and El Universo; the magazine Ecuador Debate (1999-2002), and a review by Unda (2001).
In November and December 1999, while Baños was completely evacuated, there was a growing movement that called for the resignation of President Jamil Mahuad. On January 7, just two days after the “peace agreement” was signed between the leaders of the movement to return to Baños, the Province of Pastaza and the Governor of Tungurahua Province, CONAIE, the politically powerful Confederación de Nacionalidades Indígenas del Ecuador (National Federation of Indigenous Peoples of Ecuador), called for a nationwide strike and demonstration for January 15. The same day this was announced (January 7) some labor unions took to the streets. Two days later, President Mahuad announced that he would proceed with plans to make the U.S. dollar the national currency (“dollarization”), and would proceed with partial privatization of essential services such as the petroleum industry and the telephone companies as well as partial privatization of the social security system.

In the ensuing days, other social and political organizations, including factions within the Roman Catholic Church, started organizing, protesting and blockading the main roads. On January 18, thousands of indigenous people moved into the capital during the night. Two days of massive protests and the union of some military leaders with the indigenous groups culminated in the deposition of Mahuad.

Although the coup brought some political stability, the economic issues were still unresolved. Throughout the year the country would be disrupted by periodic strikes and demonstrations. Social protest centered mostly on wage demands, privatization, dollarization and opposition to scheduled or announced
price increases on essential items such as bus fares, electricity and cooking gas. These were not the only topics however. There were also street demonstrations for the release of the civilian and military participants in the January 21 coup, who had been imprisoned, and against the construction of a new oil pipeline. There were also peaceful protests demanding the “unfreezing” of bank deposits. Some demonstrations drew thousands and involved the entire country; others marshaled a few hundred protesters in one restricted location. All were disruptive though, particularly the actions by public sector workers – although the latter are barred under Ecuadorian law from participating in strikes or work stoppages (Article 3, paragraph 10 of the Constitution of Ecuador).

The sectors most affected appear to have been health care, education and the social security service. One of the longest strikes was by employees at the Instituto Ecuatoriano de Seguro Social (IESS) (the Social Security agency) opposing partial privatization of the social security system. In addition to opposing privatization, public sector workers, including health workers and teachers, engaged in strikes, demonstrations and work stoppages to seek higher wages and/or back pay owed by the government. In April 2000, 40,000 public employees from various agencies went out for several weeks demanding a base monthly wage of $200. The teachers were on strike periodically throughout the year, asking for wage hikes and for back pay owed to them by a government slow in paying wages. One generalized teacher strike lasted from mid-April through mid-May 2000.
The Ministry of Agriculture (MoA), along with the Ministries of Social Welfare, Environment and Public Works, was affected by a work stoppage. The MoA were responsible for managing the resettlement centers for rural peoples, located mainly in Chimborazo Province. They were on strike for three weeks in April.

The protests against price hikes focused on an agreement signed on April 19 after protracted negotiations between the government and the International Monetary Fund. In order to meet the terms of the agreement, among other items the government was committed to raising the price of fuel, cooking gas and electric energy, speeding-up the privatization process, and implementing various changes to the tax laws, including establishing a tax on domestic services (i.e. on household workers/domestic servants), and increasing the value-added tax (VAT) from 12 to 14 percent.

One of the most grievous issues was the conversion from the national currency, the sucre, to the U.S. dollar. This was one of the crises identified by evacuees in the Tobin and Whiteford (2001) study. As the September deadline approached for general adoption of the U.S. dollar, many economic and social groups throughout Ecuador protested. It appeared at one point that there might be massive demonstrations but the government intervened quickly and decisively, threatening to impose martial law. A general strike called by CONAIE did not materialize. On September 9, with relatively little manifest protest, the U.S. dollar became legal tender throughout Ecuador (El Comercio, September 9, 2000).
One of the problems with dollarization was that, in spite of an educational program that the government started in April to acquaint people with the currency, most of the population literally did not understand the value of a dollar. They also were not familiar with the coins that represent fractions of a dollar. People used to dealing in thousands of sucres for the purchase of a small quantity of a staple, such as potatoes for example, had difficulty adjusting to the fact that the many thousands of sucres converted to less than a unit of one. Also, initially, there were not enough coins in circulation and unscrupulous merchants would not give change or would give the wrong change. Further, because of the limited convertibility (100 cents = 25,000 sucres) the price of many items jumped dramatically, as merchants “rounded up” from the old price in sucres to the new dollar amount (La Hora, September 9 and 23, 2000).

The political events of 2000 had a significant effect on the evacuees from Baños. The change in head of state at the beginning of the year had a ripple effect because it resulted in a series of new government appointments, including several to key posts responsible for managing the crisis, such as the Governor of Tungurahua Province and the Minister of Housing and Urban Development. The numerous strikes by public employees, particularly those in the ministries of health, education and agriculture, created an unstable administrative environment and must have adversely affected the ability of these ministries to render assistance. Given the circumstances, then, it is not surprising that rather than wait for the national bureaucracy to manage the situation, political and labor leaders in Baños took matters into their own hands. In the Tobin and Whiteford
percent said that the government had done “little or nothing” to help people affected by the volcano. A survey for the same study, conducted in January 2001, showed that the percentage of people who believed the government had done nothing increased to 94.0 percent (Tobin and Whiteford, 2001).

Toward the end of 2000, the government implemented some of the price hikes announced earlier in the year. On December 27, bus fares increased by up to 75 percent on some routes and the price of premium gasoline increased by 20 percent. The following day, some of the subsidies were removed from the price of cooking gas and early in the new year an increase in the value-added tax went into effect. As a result, the year 2001 started with mass demonstrations against the price increases (BBC News, 2001). In a process similar to that of the year before, which had resulted in a coup, major roads were blocked and thousands of people marched on Quito. According to media reports, 6,000 indigenous peoples occupied the Salesian University in Quito. They camped there for several days. Eventually conflicts developed between the police/security forces and demonstrators in Quito and in other parts of Ecuador. On February 2, the president declared a nationwide state-of-emergency (La Hora, February 3, 2001). Although the protesters’ demands were not entirely met, the government did eventually agree to roll-back the regressive VAT from 14 to 12 percent. The roll-back went into effect in September 2001.

After such an inauspicious start to the year, social unrest diminished gradually throughout the balance of 2001. Figure 18 shows the steep rise in
social and political conflict from October 1999 through the end of January 2000. The period immediately following the coup was calm but unrest gradually increased until the end of May/early June when wage demands by public workers and others reached a peak. The peak around August/September coincides with protests against the introduction of the dollar as the national currency. Protests against price increases are reflected in the unprecedented January peak.

When only public sector conflicts are analyzed the trend is somewhat different. The January 2001 peak is missing. Since the January 2001 protests were not successful, the data suggest that the public sector played a significant role in events during the period analyzed (Figure 19).

Figure 18. Social and political conflict: 1999-2001

Figure 19. Public sector conflicts: 1999-2002

<table>
<thead>
<tr>
<th>Number of events</th>
<th>Public sector conflicts (Nov.1999-Feb.2002)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov-Feb 1998-1999</td>
<td>140</td>
</tr>
<tr>
<td>Mar-Jun 1999</td>
<td>120</td>
</tr>
<tr>
<td>Jul-Oct 1999</td>
<td>100</td>
</tr>
<tr>
<td>Nov-Feb 1999-2000</td>
<td>80</td>
</tr>
<tr>
<td>Mar-Jun 2000</td>
<td>60</td>
</tr>
<tr>
<td>Jul-Oct 2000</td>
<td>40</td>
</tr>
<tr>
<td>Nov-Feb 2000-2001</td>
<td>20</td>
</tr>
<tr>
<td>Mar-Jun 2001</td>
<td>0</td>
</tr>
<tr>
<td>Jul-Oct 2001</td>
<td>0</td>
</tr>
<tr>
<td>Nov-Feb 2001-2002</td>
<td>0</td>
</tr>
</tbody>
</table>


Conclusions

Mount Tungurahua could not have become active at a worse time. Evacuees from the volcano were divorced from their livelihoods and cast out from their homes at a time when the economic and political structures of the nation were disintegrating. The volcanic hazard occurred when inflation – already high – was skyrocketing. People who might have been able to grow part of the family food supply at home, in a kitchen garden for instance, had to buy basic foods at market prices that made many items unattainable. Trying to find work in a new environment, when the unemployment rate was high and underemployment pervasive would have been extremely difficult even for those with the right skills. Moving to a large city, like Ambato, where getting around might require taking a bus, could be a problem. A small town like Baños can be
walked without difficulty from one end to the other, but not a city the size of
Ambato. Looking for work might require spending money on transportation – and
bus fares were rising rapidly, as were the prices of other essentials that
evacuees had to pay for, such as rent and utilities.

The economic hardships were aggravated by the political turmoil and the
constant strikes and protests. Essential public services such as health care,
schools and transportation were frequently shut down, or their regular functioning
was impaired. Agencies that should have been deeply involved in the recovery
process were paralyzed. The evacuees from Mount Tungurahua were not at the
center of public attention. This was directed away, toward events that were
shaping the national political scene.
CHAPTER 9

CONCLUSIONS

Introduction

The case of Baños illustrates the relevance of the socio-economic context when considering vulnerability to disasters. Issues of class and State that Cannon (1994 23) identifies in his model (Figure 1, page 21), including income distribution, assets, livelihood opportunities and institutional support, all affected the response of the evacuees to the risk posed by Mount Tungurahua. The residents of Baños were confronted with a natural hazard that scientists estimated presented a high degree of risk to the community, although the impacts of the ongoing eruptions were hardly experienced in the town of Baños itself. Many of the less affluent evacuees had limited opportunities to earn a living in the communities they evacuated to because of the economic crisis; the owners of tourist-reliant businesses could not move their assets out of Baños; the economic crisis and associated political turmoil diminished the capacity of the State to respond to the disaster. Therefore, many evacuees chose to return to their homes, prepared to risk their lives by living at the base of a continuously erupting volcano rather than live as refugees, in exile, in extremely adverse economic conditions, with no expectation that the State would be able to adequately assist them.
Evacuees who returned to the hazard zone increased their exposure to the potential effects of a sudden-impact, violent eruption of Mount Tungurahua. On the surface, such a decision seems irrational, but people who returned were following reasoning that made sense to them. The research suggests that their decision-making was constrained by a series of factors, mainly economic, which increased livelihood vulnerability. An already disastrous situation – an entire community evacuated for an indeterminate length of time – was exacerbated because there was no “safe” place for most evacuees to go to, safe in the sense of a space where there were sufficient economic opportunities for them to rebuild their lives. Had Ambato and other destination locations been able to provide better economic opportunities for evacuees than was possible under the conditions that prevailed in Ecuador at the time, fewer people might have returned to the hazard zone.

A hostile national economic environment and the expectation of opportunities in Baños were the principal motivators for many of the people who returned, but other factors, specific to the locality, as suggested by Maskrey (1994), also intervened. The absolute dependence of the local economy on tourism made the large-scale relocation of businesses and their associated jobs virtually impossible. For most of these businesses, Baños was the only place where economic recovery could be achieved. Further, the closing of the road running through Baños had serious economic repercussions on communities, transportation services and other businesses in the Oriente, so the spatial dimensions of the disaster extended well beyond the actual hazard zone and the
urban confines of Baños. Additionally, many people held deep-rooted beliefs that helped to shape perceptions of the relative hazardousness of their community. These beliefs appeared to be rooted mainly in the spatial characteristics of the location and in the history of the town, but may also have been influenced by past hazard experience and by the efforts of the business community to secure the return of tourists to the area. Finally, and perhaps most significantly, the volcano hazard barely affected Baños. As the weeks following the evacuation turned into months, the ongoing eruptions caused no physical destruction in the town. The people in Baños had no direct, intense experience with the hazard.

The preceding observations are reviewed in greater detail below. The chapter concludes with a timeline that shows concurrent major events that occurred between September 1999, when Tungurahua’s eruptive activity first became a serious concern, and December 2001. The latter date brings the record up to two complete years of the reoccupation of Baños. The scale of analysis is local and national. Events noted include economic, social and political happenings, and a listing of significant natural hazards, including the progression of the volcano hazard.

Discussion

Endemic joblessness, low wages, rapidly escalating prices, and political uncertainty already had a firm grip on Ecuador well before Baños was evacuated. However, during the weeks and months following the exodus, the adverse economic and political conditions intensified. Apart from the exceedingly wealthy, every socio-economic group in society was suffering the effects of the
economic crisis. In the case of evacuees from Baños, the economic crisis was compounded by the abandonment of established livelihoods and the crisis in the government.

Baños had been a space of economic well-being, with a large middle-class and a high percentage of well-educated people. The hard work of its inhabitants, combined with its propitious location and the many foreign travelers, domestic tourists and religious pilgrims who visited there had made Baños a small but prosperous oasis in the otherwise harsh physical environment of the eastern Sierra. Baños also benefited economically from activities at the Agoyán Hydroelectric Plant located just to the east of town. The main road running through Baños connected the Amazon region, with its growing potential for ecotourism and its important oil fields, with the towns of the high inter-Andean valley, even with the country’s principal commercial city, Guayaquil, on the Pacific Coast.

Throughout its history, Baños had used its physical location to advantage. Mount Tungurahua threatened to make this location untenable. Business owners had to abandon operations that generally take years to bring to profitable levels, leaving their employees out of work. Further, where could the town’s many self-employed artisans, taxi-cab owner/operators, tradesmen, street vendors, or tour guides, whose economic success was due to the status of Baños as a tourist Mecca, find a comparable location to reestablish themselves? Tourist locations take years to develop and require increasingly sophisticated marketing.
At the national level, the political scene was changing rapidly. As Baneños were being forced out of their homes, indigenous, labor and other groups were massing in opposition to the existing political regime. Within two months of the evacuation, one president was deposed and a new one installed. The social and political disruption prior to the coup implied that the economic survival of the vast majority of evacuees from Mount Tungurahua depended not on government intervention or other outside assistance but on the initiative, inventiveness and tenacity of the evacuees themselves.

It is not surprising therefore, that leaders within the displaced community were able to mobilize people to return to Baños in spite of the risk of an eruption. Because Baños depended on a single industry – tourism – it followed almost as a corollary that groups within the tourist industry would be instrumental in the return. Many had fixed assets, impossible to relocate. In addition to the economic distress of the tourist industry, closure of the road to the Oriente through Baños had economic repercussions for communities and business interests far away from the actual hazard zone, many of which had close ties to Baños. The movement of people and goods along the Puyo-Baños-Ambato road had been brought to a halt when Baños was evacuated and the road closed. The cost and time of taking an alternate route, through Quito considerably to the north, for example, made products more expensive, and therefore less competitive. The road could not stay closed indefinitely.

Only a resumption of the tourist trade could help effect economic recovery. It is significant that according to the Municipality of Baños more than half of all
tourists in 2001 were foreigners (Municipalidad Baños de Agua Santa – Ministerio de Turismo, 2002). Foreign tourists, traveling with hard currency, would be unaffected by the rampant local inflation even though they might be perturbed by the political instability attending the economic crisis. If Baños was to recapture its share of this foreign market and also attract domestic tourists during the peak season, the town had to get the recovery effort underway quickly. The eruptions and evacuation in October 1999 had generated negative publicity that discouraged most tourists. The perception that Baños was a dangerous place had to be overcome, particularly in the mind of the traveling public. A number of factors undoubtedly contributed to make this possible.

The characteristics of the ongoing volcanic eruptions and the spatial distribution of hazards were prime factors. The violent explosive eruption did not occur within weeks as had been expected. Baños was evacuated but nothing happened. During the ensuing months, the town experienced virtually no direct effects of the hazard. Ash fall was light and infrequent. There were occasional rumblings and inconsequential tremors but no lahars advanced into town and no pyroclastic flows reached populated areas at the base. The damage caused by hazards was elsewhere: further on down the road leading to Pelileo and Ambato; along the slopes of the volcano that bordered the Chambo River; in the highlands of Quero, Mocha and Guano.

Even these hazards had killed nobody, but periodic floods and pervasive unpredictable landslides had. In one frightening flash flood, just a few kilometers away, 13 people died. In other parts of Ecuador both types of hazard claimed
several dozen lives. Mount Tungurahua, sitting right at the backdoor to Baños, continuously threatened to do so, but took the life of no one.

Historically, the volcano had caused serious damage and some inhabitants had died, but that was beyond the personal experience of virtually any current resident. Devastating events, like the 1949 earthquake that destroyed nearby Old Pelileo, had killed thousands and had occurred within living memory.

Furthermore, among those who believed in miracles, when Tungurahua had threatened the town in the past, the Virgin of Baños had always interceded, saving most of the inhabitants from instant annihilation. The very characteristics of the space the town occupied, nestled at the base of the protective outcropping called Runtún, would save Baños and its inhabitants from destruction, according to local legend. This was, supposedly, one of the reasons the Dominicans who founded Baños had chosen that particular site in the first place: according to their calculations, it was protected by Runtún from any eruption of Tungurahua. The most recent eruptive cycle before the current event had been in 1916-1918. Baños had grown considerably since then when it was little more than a hamlet. Even in 1950, at the time of the first census ever in Ecuador, Baños had a mere 3,000 people. Thirty or more years earlier there were probably even fewer inhabitants but by the close of the twentieth century, the town had spread out so it occupied the entire width of the terrace between Runtún and the gorge of the Pastaza. In addition to this expanded downtown, busy little communities had built up in or near the valleys of the Ulba and Vazcún Rivers, both of which have
served as pathways for major hazards in prior eruptions. Would Runtún really still protect the entire urban area?

Another factor in the development of local perceptions of the hazard may have been that the eruption column, which could frequently be seen from other communities, was barely visible from downtown Baños, because it was partly hidden by intervening mountain slopes and ever-present clouds.

All of the preceding factors are well-established in the hazards literature as influencing perception: lack of recent, frequent, or intense experience with the hazard; lack of salience; and the power and persistence of myths and religious beliefs.

Efforts to effect the economic recovery of Baños, even though it was located in a hazardous area, were aided by the general state of political and social chaos. Although a new president had taken up the reins of power, the political and economic agenda did not change from that of his predecessor: dollarization of the economy; removal of subsidies on essentials like cooking gas and gasoline; announcement of new taxes and a higher level of taxation accompanied by more aggressive tax collecting by the authorities; privatization of some industries, threatening loss of public jobs; and overhaul and partial privatization of the Ecuadorian Social Security system. All of these programs threatened to make life even more difficult for Ecuadorians than it was already and further increase the economic vulnerability of evacuees. Many of the changes or proposed changes also threatened a system that was widely considered ineffective and corrupt but was also familiar and entrenched. Faith in
government as an institution capable of resolving the evacuee crisis was undoubtedly diminished due to the instability of the political system.

Before, during and after the evacuation many government bureaucracies were crippled by strikes or go-slow work stoppages. While many dedicated public employees responsible for essential services, including health and education, continued to perform their duties, their dedication and capacity to respond must have been stretched to the limit. Tens of thousands of public employees went unpaid for weeks at a time. People working in agencies directly or indirectly responsible for providing assistance and support services were being squeezed in the same economic vise that the evacuees were.

Given the socio-economic circumstances at the time, it is not surprising that for many evacuees the most viable solution to their problems was to return to Baños. As the data suggest, some believed they would find economic opportunities there, similar to those they had prior to the evacuation. Others returned because in Baños they would be in their own homes again, and they preferred this and the associated risk, to living like beggars in Ambato or wherever they had evacuated to. Destitution away from Baños was perceived to be a more immediate and real hazard than the uncertain likelihood of a violent eruption.

The case of Baños surely is not unique. Wherever socio-economic conditions limit the choice of viable alternatives, people are forced to make hard decisions as to the type and degree of risk they believe they can best live with. These decisions frequently place them in harm's way.
Timeline

First Quarter 1999

<table>
<thead>
<tr>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Tungurahua and Baños</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other hazards\(^1\)

**Economic Data:**

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate(^2)</td>
<td>3.2%</td>
<td>5.9%</td>
<td>20.2%</td>
</tr>
<tr>
<td>CPI Ambato(^3)</td>
<td>1.63%</td>
<td>3.66%</td>
<td>14.69%</td>
</tr>
<tr>
<td>CPI Riobamba(^3)</td>
<td>4.35%</td>
<td>0.04%</td>
<td>11.04%</td>
</tr>
<tr>
<td>CPI Quito(^3)</td>
<td>3.01%</td>
<td>2.96%</td>
<td>13.26%</td>
</tr>
<tr>
<td>Unemployment(^4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Underemployment(^4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Political, Economic and Social events**

Bank crisis comes to a head; demand and savings deposits frozen for six months; time deposits for one year

---

\(^1\) Other major natural hazards that occurred in Ecuador.

\(^2\) The national inflation rate is the monthly cumulative.

\(^3\) The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.

\(^4\) Unemployment/underemployment rates are the national average for the year.
Second Quarter 1999

Mt. Tungurahua and Baños

Instability observed at Mt. Tungurahua

Other hazards¹

<table>
<thead>
<tr>
<th>Economic Data:</th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate²</td>
<td>26.9%</td>
<td>28.0%</td>
<td>30.3%</td>
</tr>
<tr>
<td>CPI Ambato³</td>
<td>4.90%</td>
<td>0.9%</td>
<td>3.0%</td>
</tr>
<tr>
<td>CPI Riobamba³</td>
<td>6.31%</td>
<td>1.01%</td>
<td>1.79%</td>
</tr>
<tr>
<td>CPI Quito³</td>
<td>5.26%</td>
<td>0.39%</td>
<td>2.87%</td>
</tr>
</tbody>
</table>

Unemployment⁴ - - -

Underemployment⁴ - - -

Political, Economic and Social events

1 Other major natural hazards that occurred in Ecuador.
2 The national inflation rate is the monthly cumulative.
3 The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
4 Unemployment/underemployment rates are the national average for the year.
Third Quarter 1999

<table>
<thead>
<tr>
<th>Mt. Tungurahua</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>and Baños</td>
<td>Mt. Tungurahua placed on technical alert (Sept. 8); Civil Defense starts public awareness programs; alert level raised to yellow and official response initiated (Sept. 15); census taken of Baños population; evacuation exercise Baños (Sept. 28).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other hazards**¹

<table>
<thead>
<tr>
<th>Economic Data:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate</td>
<td>34.3% 35.0% 37.4%</td>
</tr>
<tr>
<td>CPI Ambato</td>
<td>4.03% 0.86% 2.96%</td>
</tr>
<tr>
<td>CPI Riobamba</td>
<td>4.3% 1.02% 2.0%</td>
</tr>
<tr>
<td>CPI Quito</td>
<td>2.65% 0.65% 2.04%</td>
</tr>
<tr>
<td>Unemployment</td>
<td>- - -</td>
</tr>
<tr>
<td>Underemployment</td>
<td>- - -</td>
</tr>
</tbody>
</table>

**Political, Economic and Social events**

<table>
<thead>
<tr>
<th>Government announces fuel increase and new system of taxation.</th>
<th>Ecuador defaults on Brady Bond interest payments</th>
</tr>
</thead>
</table>

Private sector strongly opposes tax reform effort

Transport workers and indigenous people strike; government announces it will hold prices on fuel until July 2000

---

¹ Other major natural hazards that occurred in Ecuador.
² The national inflation rate is the monthly cumulative.
³ The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
⁴ Unemployment/underemployment rates are the national average for the year.
Fourth Quarter 1999

Mt. Tungurahua and Baños

First eruption (Oct. 5); alert level raised to orange and evacuation of Baños and neighboring communities ordered (Oct. 16); first attempt to return to Baños (Nov. 3); last permitted reentry under military escort (Nov. 6); 2,500 people in shelters (Nov. 15). Lahars frequent October/November.

Other hazards

<table>
<thead>
<tr>
<th>Economic Data:</th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate</td>
</tr>
<tr>
<td>October: 43.1%</td>
</tr>
<tr>
<td>November: 52.2%</td>
</tr>
<tr>
<td>December: 60.7%</td>
</tr>
<tr>
<td>CPI Ambato: 5.04%</td>
</tr>
<tr>
<td>CPI Riobamba: 4.43%</td>
</tr>
<tr>
<td>CPI Quito: 5.46%</td>
</tr>
<tr>
<td>Unemployment: 14.4%</td>
</tr>
<tr>
<td>Underemployment: 56.9%</td>
</tr>
</tbody>
</table>

1 Other major natural hazards that occurred in Ecuador.
2 The national inflation rate is the monthly cumulative.
3 The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
4 Unemployment/underemployment rates are the national average for the year.

Social unrest prevalent among Public Sector workers, particularly in health, education and petroleum, due to precarious salary/wage conditions.

Remittances from Ecuadorians living abroad total US$1.084 billion in 1999.
First Quarter 2000

<table>
<thead>
<tr>
<th>Mt. Tungurahua and Baños</th>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass return to Baños (Jan. 4-5)</td>
<td>First warning siren installed in Baños</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loud explosions/lava founting/frequent ash columns in January and February; debris flows through June; overall mild activity, decreasing through June. Lahars common January-February.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other hazards**

- Heavy rains

---

**Economic Data:**

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate¹</td>
<td>14.3%</td>
<td>25.8%</td>
<td>35.3%</td>
</tr>
<tr>
<td>CPI Ambato²</td>
<td>15.35%</td>
<td>12.39%</td>
<td>5.39%</td>
</tr>
<tr>
<td>CPI Riobamba³</td>
<td>12.89%</td>
<td>14.33%</td>
<td>7.3%</td>
</tr>
<tr>
<td>CPI Quito³</td>
<td>14.97%</td>
<td>7.98%</td>
<td>6.45%</td>
</tr>
<tr>
<td>Unemployment⁴</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Underemployment⁴</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

---

**Political, Economic and Social events**

- President announces dollarization of economy Jan. 9; deposed Jan. 21 in *coup d’état*; VP assumes presidency with backing of United States
- Change in government results in many new bureaucratic appointments including replacement of Governor of Tungurahua Province and other officials involved in hazard response
- In Jan. cost of basic food basket for family of 4 was $178.75. Typical income for family of 5 was $74.94
- US$2 billion loan package from IMF/WB/ADC;
- Dollarization of national accounts;
- Starting mid-March and continuing through early April protests and strikes mainly against food and fuel price increase

---

¹ Other major natural hazards that occurred in Ecuador.  
² The national inflation rate is the monthly cumulative.  
³ The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.  
⁴ Unemployment/underemployment rates are the national average for the year.
## Second Quarter 2000

### Mt. Tungurahua and Baños

- **April**: Ash columns; expulsion of large boulders
- **May**: Debris flows through June; overall mild activity
- **June**: Ice storms in

### Other hazards

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy rains cause floods and landslides (14 dead total); 300 people in Quito evacuated where 3 die</td>
<td>Tungurahua; in Imbabura and Carchi 12 die in landslides; floods claim 34 lives total nationwide</td>
</tr>
</tbody>
</table>

### Economic Data:

<table>
<thead>
<tr>
<th>Metric</th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate</td>
<td>49.1%</td>
<td>56.8%</td>
<td>65.1%</td>
</tr>
<tr>
<td>CPI Ambato</td>
<td>8.56%</td>
<td>4.03%</td>
<td>6.48%</td>
</tr>
<tr>
<td>CPI Riobamba</td>
<td>8.29%</td>
<td>6.22%</td>
<td>4.63%</td>
</tr>
<tr>
<td>CPI Quito</td>
<td>8.35%</td>
<td>4.77%</td>
<td>6.02%</td>
</tr>
<tr>
<td>Unemployment</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Underemployment</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Political, Economic and Social events

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nationwide protests against government austerity measures</td>
<td>Ecuador’s 18 electric companies strike in support of 3-month old labor dispute at one plant</td>
</tr>
<tr>
<td>Strike by 41,000 public employees ends</td>
<td>Pachakutik Party (mainly composed of indigenous Indians) makes important gains in local elections</td>
</tr>
<tr>
<td>Government/CONAIE talks re economic, social, and political programs break off (resume in September)</td>
<td></td>
</tr>
</tbody>
</table>

---

1. Other major natural hazards that occurred in Ecuador.
2. The national inflation rate is the monthly cumulative.
3. The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
4. Unemployment/underemployment rates are the national average for the year.
### Third Quarter 2000

#### Mt. Tungurahua and Baños

<table>
<thead>
<tr>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased activity; ash fall in Ambato, Baños, Cotaló, Pelileo, Patate, etc.</td>
<td>Alert level downgraded to yellow for town of Baños only; shelters close</td>
<td></td>
</tr>
</tbody>
</table>

#### Other hazards¹

- Activity at Guagua Pichincha near Quito.
- Earthquakes Guayas Province and Quito

#### Economic Data:

<table>
<thead>
<tr>
<th>National inflation rate²</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>69.1%</td>
<td>71.4%</td>
<td>77.7%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPI Ambato³</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.74%</td>
<td>1.92%</td>
<td>4.14%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPI Riobamba³</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.12%</td>
<td>0.6%</td>
<td>4.49%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPI Quito³</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.79%</td>
<td>1.35%</td>
<td>4.85%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unemployment⁴</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Underemployment⁴</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

#### Political, Economic and Social events

- 54-day strike by 14,000 health workers ends
- Demonstrations against dollarization
- U.S. dollar becomes official currency
- Debt with Club of Paris restructured
- Election issues
- Talks resume between CONAIE and Government
- Refugees from Colombia moving into northern Ecuador

---

¹ Other major natural hazards that occurred in Ecuador.
² The national inflation rate is the monthly cumulative.
³ The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
⁴ Unemployment/underemployment rates are the national average for the year.
### Fourth Quarter 2000

<table>
<thead>
<tr>
<th>Tungurahua and Baños</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent mudflows</td>
<td>Low-level activity</td>
<td>Low-level activity</td>
<td></td>
</tr>
<tr>
<td>but ash fall in Ambato for several days</td>
<td>15,000 acres of crops lost to drought and freezes in Tungurahua Province.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other hazards**

- Flash flood in Chimborazo: 30 dead.
- Earthquake in Ibarra, Imbabura Province

### Economic Data:

<table>
<thead>
<tr>
<th>National inflation rate</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>82.5%</td>
<td>86.4%</td>
<td>91.0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPI Ambato</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.65%</td>
<td>1.19%</td>
<td>1.55%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPI Riobamba</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.39%</td>
<td>1.91%</td>
<td>2.73%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPI Quito</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.33%</td>
<td>3.26%</td>
<td>1.8%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unemployment</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>9.0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Underemployment</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>65.9%</td>
<td></td>
</tr>
</tbody>
</table>

### Political, Economic and Social events

- Government removes subsidies on cooking gas and other essential items; prices rise dramatically.

---

1. Other major natural hazards that occurred in Ecuador.
2. The national inflation rate is the monthly cumulative.
3. The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
4. Unemployment/underemployment rates are the national average for the year.
First Quarter 2001

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tungurahua and Baños</strong></td>
<td>Mudflow Cusúa canyon</td>
<td>Mudflows Heavy rain/floods</td>
<td>Mudflows</td>
</tr>
<tr>
<td></td>
<td></td>
<td>throughout Ecuador: 39 die in</td>
<td>in Sucumbios and Orellana;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sucumbios and Orellana; landslide</td>
<td>landslide kills 3 in Alausí,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>kills 3 in Alausí, Chimborazo;</td>
<td>in Azuy 8 villages isolated by</td>
</tr>
<tr>
<td></td>
<td></td>
<td>by landslides.</td>
<td>landslides.</td>
</tr>
<tr>
<td><strong>Other hazards</strong></td>
<td>Two die at Guagua Pichincha Volcano</td>
<td>Two die at Guagua Pichincha Volcan</td>
<td>Two die at Guagua Pichincha Volcano</td>
</tr>
<tr>
<td></td>
<td>in Quito.</td>
<td>in Quito.</td>
<td>in Quito.</td>
</tr>
</tbody>
</table>

**Economic Data:**

<table>
<thead>
<tr>
<th></th>
<th>National inflation rate(^2)</th>
<th>CPI Ambato(^3)</th>
<th>CPI Riobamba(^3)</th>
<th>CPI Quito(^3)</th>
<th>Unemployment(^4)</th>
<th>Underemployment(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>7.0%</td>
<td>5.4%</td>
<td>6.79%</td>
<td>6.72%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>10.1%</td>
<td>1.84%</td>
<td>3.43%</td>
<td>2.03%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>12.5%</td>
<td>2.58%</td>
<td>1.12%</td>
<td>2.58%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Political, Economic and Social events**

<table>
<thead>
<tr>
<th></th>
<th>President declares nationwide state-of-emergency on February 2</th>
<th>Unions and other groups demand reversal of December price hikes</th>
<th>On February 7 Government agrees to stabilize cooking gas price at $1.60 and freeze some fuel prices through year-end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protests/mass demonstrations;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>major roads closed; thousands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>march on Quito; 6,000 indigenous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>people occupy a university; five</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>die in conflicts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gap between monthly income and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>expenses for family of 4 is</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US$89.36 (INEC)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Other major natural hazards that occurred in Ecuador.
2 The national inflation rate is the monthly cumulative.
3 The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
4 Unemployment/underemployment rates are the national average for the year.
Second Quarter 2001

<table>
<thead>
<tr>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Tungurahua and Baños</td>
<td>Lahars</td>
<td>Magmatic intrusion in dome; ash fall and lahars</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lahars.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heavy rains,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>evacuation along Pastaza, Vazcún and Ulba Rivers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold ((8^0 \text{ to } 10^0 \text{ C})).</td>
</tr>
</tbody>
</table>

Other hazards\(^1\)

Landslides on Papallacta-Baeza road kill at least 39 people

### Economic Data:

<table>
<thead>
<tr>
<th></th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate</td>
<td>14.4%</td>
<td>14.6%</td>
<td>15.2%</td>
</tr>
<tr>
<td>CPI Ambato(^3)</td>
<td>1.45%</td>
<td>(0.06%)</td>
<td>1.58%</td>
</tr>
<tr>
<td>CPI Riobamba(^3)</td>
<td>0.34%</td>
<td>(1.07%)</td>
<td>0.49%</td>
</tr>
<tr>
<td>CPI Quito(^3)</td>
<td>0.56%</td>
<td>(0.13%)</td>
<td>1.22%</td>
</tr>
<tr>
<td>Unemployment(^4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Underemployment(^4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Political, Economic and Social events

Strike by health care professionals

Potato glut results in price collapse; farmers affected in Tungurahua and Chimborazo Provinces (increased harvest may have resulted from suppression of pests by ash fall from Tungurahua

---

\(^1\) Other major natural hazards that occurred in Ecuador.

\(^2\) The national inflation rate is the monthly cumulative.

\(^3\) The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.

\(^4\) Unemployment/underemployment rates are the national average for the year.
### Third Quarter 2001

<table>
<thead>
<tr>
<th>Tungurahua and Baños</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahars</td>
<td>Major ash emissions and state of emergency August 14. Baños unharmed but local emergency committee announces it is strengthening emergency plan. Overall low levels of activity in Sept.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other hazards¹</th>
<th>Landslide on Loja-Zamorrand road: 2 dead, 1 missing</th>
<th>Drought in Sierra</th>
<th>Drought in Sierra</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Record snowfall in northern Sierra leaves 200 stranded</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Economic Data:

<table>
<thead>
<tr>
<th></th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate²</td>
<td>15.45%</td>
<td>15.95%</td>
<td>18.32%</td>
</tr>
<tr>
<td>CPI Ambato³</td>
<td>(0.11%)</td>
<td>0.47%</td>
<td>2.66%</td>
</tr>
<tr>
<td>CPI Riobamba³</td>
<td>1.24%</td>
<td>1.55%</td>
<td>4.55%</td>
</tr>
<tr>
<td>CPI Quito³</td>
<td>0.14%</td>
<td>0.61%</td>
<td>3.38%</td>
</tr>
<tr>
<td>Unemployment⁴</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Underemployment⁴</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Political, Economic and Social events

- Approximately 4 million Ecuadorians emigrated since 1990.
- VAT decreased from 14% to 12% effective September 1.
- Cost of basic food basket is $292.97; average income for family of 4 is $200.76.
- Increase in food costs in central Ecuador blamed on strike by banana workers and Tungurahua.

---

¹ Other major natural hazards that occurred in Ecuador.
² The national inflation rate is the monthly cumulative.
³ The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
⁴ Unemployment/underemployment rates are the national average for the year.
### Fourth Quarter 2001

#### Mt. Tungurahua and Baños

- **October**
  - Pandoa residents petition authorities for evacuation road

- **November**
  - Lahars

- **December**
  - Pondoa residents petition authorities for evacuation road

#### Other hazards

- **Drought in Sierra**
- Low water-level of Pastaza threatens Agoyan generating capacity
- August-November was driest period in the Sierra in 20 years. Flood kills child in Ambato

#### Economic Data:

<table>
<thead>
<tr>
<th></th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>National inflation rate</td>
<td>19.71%</td>
<td>21.62%</td>
<td>22.44%</td>
</tr>
<tr>
<td>CPI Ambato</td>
<td>1.28%</td>
<td>1.35%</td>
<td>0.27%</td>
</tr>
<tr>
<td>CPI Riobamba</td>
<td>1.72%</td>
<td>1.56%</td>
<td>(0.86%)</td>
</tr>
<tr>
<td>CPI Quito</td>
<td>1.88%</td>
<td>2.24%</td>
<td>1.00%</td>
</tr>
<tr>
<td>Unemployment</td>
<td>-</td>
<td>-</td>
<td>10.9%</td>
</tr>
<tr>
<td>Underemployment</td>
<td>-</td>
<td>-</td>
<td>57.3%</td>
</tr>
</tbody>
</table>

#### Political, Economic and Social events

- **CONAIE, labor unions and other groups threaten mobilizations in opposition to privatization of electric utilities**
- **Privatization of electric utilities postponed until January 2002**
- **New Social Security Law enacted**
- **Strike by health workers**

- **Price of Ecuadorian crude dips to $17 per barrel**

#### Remittances in 2001 from Ecuadorians abroad total US$1.415 billion


---

1. Other major natural hazards that occurred in Ecuador.
2. The national inflation rate is the monthly cumulative.
3. The Consumer Price Index (CPI) rates for Ambato, Riobamba and Quito are shown as percent increase (decrease) over prior month.
4. Unemployment/underemployment rates are the national average for the year.
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169


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PATV Producciones. Video footage. No date or title available.


APPENDICES
APPENDIX I
Translation of Questions from 2000 Questionnaire

(Questions asked of all respondents)

1. Are you worried about the volcano?  
   □ 1 = Not worried  
   □ 2 = A little worried  
   □ 3 = Somewhat  
   □ 4 = Very worried  
   □ 5 = Extremely worried

2. Did you have to evacuate?  
   □ Yes  
   □ No  
   If not evacuated, skip to question #17

3. When were you evacuated? Indicate month/year.  
   ________________

4. Did you leave voluntarily?  
   □ Yes  
   □ No

5. Where did you go?  
   (Probes: Shelter first? Then relocated to other place? Friends? Family?)

6. Did anyone help you to evacuate?  
   □ Yes  
   □ No

7. If yes, who helped you?  
   □ Family member  
   □ Friend  
   □ Govt. agency  
   □ NGO  
   □ Other, please specify:  
   ________________  
   ________________  
   ________________
   □ No help

8. Who came with you when you evacuated?  
9. Did all of your children accompany you when you evacuated?  
   □ Yes  
   □ No

10. At the time, did you think it was necessary to evacuate?  
    □ Yes  
    □ No
Appendix I (Continued)

(Questions asked in Baños only – early returns)

11. For how long were you evacuated?  
   - 1 = Less than a week  
   - 2 = 1 to 2 weeks  
   - 3 = 3 weeks to 1 month  
   - 4 = 1 to 3 months  
   - 5 = 3 to 6 months

12. Why did you come back?

*********************************************************************************************
****************************************
QUESTIONS FOR QUIMIAG & COLEGIO BOLIVAR (NON-RETURNED EVACUEES)

13. Do you want to return to your home?  
   - Yes  
   - No

14. Why haven’t you returned?

*********************************************************************************************

15. Why did you decide to evacuate?  
   (Probe: Who made the decision? Was the decision discussed within the family?)

16. Now, do you think that the volcano is a risk to you and your family?  
   - 1 = No risk  
   - 2 = Little risk  
   - 3 = Moderate risk  
   - 4 = High risk  
   - 5 = Very high risk

QUESTIONS FOR NON-EVACUEES

17. Do you think that the volcano is a risk to you and your family?  
   - 1 = No risk  
   - 2 = Little risk  
   - 3 = Moderate risk  
   - 4 = High risk  
   - 5 = Very high risk
Appendix I (Continued)

18. Do you think it (the volcano) posed a risk to those who evacuated? □ Yes □ No

***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***

INDICES OF PROBLEMS – A lot of things have been going on in Ecuador in the past year. I’d like to know what kinds of things have affected you and your family, in particular.

48) Has your family faced any crises in the last 6-8 months? □ Yes □ No

49) If yes, what are they?
(Probes: Loss of crops, loss of livestock, loss of home, loss of bank funds, evacuation, lack of money, devaluation, coup d’etat, volcano, flooding, family illness, family death, other)

50) Please rank responses from worst to least bad:
(Probe: Which was the worst?)

***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***   ***

52) What has the government done to help people affected by the volcano?

53) What have non-governmental agencies done to help people affected by the volcano?

54) What do you think the government should do to help people affected by the volcano?
APPENDIX II

Translation of Questions from 2001 Questionnaire

(Questions asked of all respondents)

1. Are you worried about the volcano? (F)
   - 1 = Not worried
   - 2 = A little worried
   - 3 = Somewhat
   - 4 = Very worried
   - 5 = Extremely worried

2. Did you have to evacuate? (F)
   - Yes
   - No
   If not evacuated, skip to question #17

3. Where did you go:

4. When did you return home?  ________________

5. Why did you return?  _______________
   (Probe: Did you return voluntarily?)
   - Yes
   - No

6. Did anyone help you return? (F)
   - Yes
   - No

7. If yes, who helped you? (F)
   - 1 = Family member(s)
   - 2 = Friend(s)
   - 3 = Military
   - 4 = Government agency
   - 5 = NGO
   - 6 = Other
   - 7 = No one

8. How did they help you?

________________________________________________________________

9. Who came with you when you returned? (F)
   (Probe: Is anyone in your family still evacuated?)
Appendix II (Continued)

10. Do you think the volcano is currently a risk to you and your family?

- 1 = No risk
- 2 = Little risk
- 3 = Moderate risk
- 4 = High risk
- 5 = Very high risk

(Questions for non-evacuees – Control group)

11. Do you think the volcano is a risk to you and your family?

- 1 = No risk
- 2 = Little risk
- 3 = Moderate risk
- 4 = High risk
- 5 = Very high risk

12. Do you think the volcano was a danger to those who evacuated?

- Yes
- No

---

48. Since you returned, have you had any problems, such as

- 1 = Loss of crops
- 2 = Loss of cattle
- 3 = Loss of home
- 4 = Financial loss
- 5 = Lack of money
- 6 = Devaluation
- 7 = Volcano
- 8 = Flooding
- 9 = Family illness
- 10 = Death in family
- 11 = Family separation
- 12 = Violence
- 13 = Other

(please identify other crises)

____________________________________
____________________________________
____________________________________
Appendix II (Continued)

49. Please rank the three worst problems, starting with the worst:

__________________________________________________________________________

__________________________________________________________________________

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

67. What has the government done to assist people affected by the volcano?

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

70. What do you think the government should do to help people affected by the volcano?
APPENDIX III

Legends about the Virgin and Natural Hazards

The settlement established by the Dominicans in 1553 experienced the benefits and the dangers of its location at the base of an active volcano. Hazard and religion became interwoven in a number of myths and legends about the miraculous powers of patron saint of Baños, the Virgen del Rosario de Agua Santa (Our Lady of the Rosary of Holy Water). Four are outlined here:

The Virgin of Baños had just been taken from her shrine for a street procession in February 1773 when Tungurahua began to erupt. According to a local report the statue raised an arm as if blessing the volcano which immediately ceased all activity and no-one was harmed (Martínez, 1932 in Apolo, 2000; Guevara, 1995). To this day the February miracle is remembered in Baños during the Carnival festivities that precede Lent. It attracts thousands of pilgrims from surrounding communities and from other parts of Ecuador.

Later that same year, during an April eruption, some residents sought refuge in the church where the statue was housed. The Virgin protected them and they were the only people saved (Martínez, 1932 in Apolo, 2000).

The Virgin’s divine intercession also helped some townspeople survive the cataclysmic earthquake of 1797. These people too escaped by taking refuge in the church dedicated to the Virgin (Reyes, 2000).

In 1886, eruptions of Mount Tungurahua blocked the flow of the famous thermal waters. The Virgin restored the flow when the local priest, “...as though inspired by the Mother of God took one of the Virgin’s hands and placed it on the
spot where the spring used to flow. With great joy those present saw the lost spring flow forth immediately” (Martínez, 1932, in Apolo, 2000 198-99; researcher’s translation).
APPENDIX IV

Copyright Releases

Authorization from Diario El Universo, Ecuador, to use copyrighted photograph

----- Original Message -----  
From: "Natalia Tamayo" <ntamayo@eluniverso.com>  
To: <lane2563@bellsouth.net>  
Sent: Thursday, October 03, 2002 11:55 AM  
Subject: Respuesta Diario El Universo

Estimada señorita,

La Gerencia de Redacción de Diario El Universo autoriza la reproducción, con fines académicos, de la foto solicitada por usted y que fue publicada el 17 de agosto del 2001. Favor registrar crédito de autor: Diario El Universo.

Saludos cordiales

Eco. Nathalia Tamayo  
Jefe de Documentación  
Diario El Universo  
Tel: 593-4-249 0000 Ext. 286  
Fax: 593-4-249 2925

La noticia del día léala en www.eluniverso.com

Translation

Dear Miss [Lane],

The Editors of Diario El Universo authorize the reproduction, for academic purpose, of the photo you requested and which was published on August 17, 2001. Please give credit to the author: Diario El Universo.

Sincerely,

Economist Nathalia Tamayo  
Head of Documentation  
Diario El Universo  
Tel: 593-4-249 0000 Ext. 286  
Fax: 593-4-249 2925

Read the daily news at www.eluniverso.com
Appendix IV (Continued)

Request to Diario El Universo, Ecuador, for permission to use copyrighted photograph

-----Mensaje original-----
De: Lucille Lane [mailto:lane2563@bellsouth.net]
Enviado el: Martes, 01 de Octubre de 2002 07:30 a.m.
Para: Jefatura de Redaccion
Asunto: Solicitud para reproducción de una foto publicada en El Universo

Estimados Señores:

Esta es para solicitar permiso para usar una foto que se publicó en la edición electrónica de su diario del 17 de agosto de 2001.

Soy estudiante de geografía en la Universidad de la Florida del Sur en Tampa, estado de la Florida, EEUU, y estoy preparando una tesis de maestría que tiene a ver con las erupciones del Volcán Tungurahua. Quisiera mostrar algunos de los efectos de la caída de ceniza pero durante las visitas que hice a la zona el volcán no estaba emitiendo ceniza, entonces no pude tomar fotos adecuadas.

La foto publicada el 17 de agosto del 2001 se tomó en San José de Sabañag y muestra a un campesino sacudiendo las ramas de un árbol que esta cubierto de ceniza. Adjunto una copia del mismo sacada de la versión electrónica de ese diario.

La finalidad del uso es puramente académico y sin fines de lucro y la foto se utilizaría solamente en el documento de tesis. Si se permite ocupar esta foto, se haría con la siguiente anotación o cualquier anotación que ustedes me indiquen: "© El Universo. Reprinted by permission." (reproducido con el permiso de El Universo.)

En la espera de sus noticias me despidó, cordialmente,

Lucille Lane
Correo electrónico: lane2563@bellsouth.net
Dirección: 31195 Park Ridge Dr.,
Brooksville, FL 34602
USA
Tel.: (352) 540-9746
Translation

Subject: Request to reproduce a photograph published in El Universo

Gentlemen:

This is to request your authorization to use a photograph that was published in the August 17, 2001, electronic version of your newspaper.

I am a student of Geography at the University of South Florida in Tampa, State of Florida, USA, and I am preparing a master's thesis that has to do with the eruptions of Tungurahua Volcano. I would like to show some of the effects of the ash fall however, during the visits I have made to the affected zone, the volcano was not emitting ash, and therefore I was unable to take appropriate photographs.

The photo taken on August 17, 2001, was taken in San José de Sabañag and it shows a farm worker shaking the limbs of a tree that is covered in ash. Attached is a copy of same taken from the electronic version of your newspaper.

The use is strictly for academic purposes and not for profit, and the photograph would be used only in the thesis document. If you authorize the use of this photograph, it would be done with the following notation or any notation that you might request: "© El Universo. Reprinted by permission."

Awaiting your advice, I am, Sincerely,

Lucille Lane
email: lane2563@bellsouth.net
Address: 31195 Park Ridge Dr.,
Brooksville, FL 34602
USA
Tel.: (352) 540-9746
Appendix IV (Continued)

Authorization from Dario La Hora - Ambato, Ecuador, to use copyrighted photograph

----- Original Message -----  
From: "La Hora ambato" <lahora@andinanet.net>  
To: "Lucille Lane" <lane2563@bellsouth.net>  
Sent: Wednesday, November 27, 2002 1:36 PM  
Subject: permiso aprobado

Querida Lucille
Nuestra redacción y en particular el editor de Diario La Hora Ambato, le dan el permiso para que usted ocupe esa foto con la inclusión del texto que sugiere: Diario LA HORA reproducido con autorización. Además agradecemos que nos siga en la transmisión de las noticias de nuestra ciudad. Suerte en la elaboración de su tesis.

Atentamente
Diario La Hora

Translation

Dear Lucille

The editorial department, and in particular, the editor of Diario La Hora Ambato, authorize you to use that photo, with the inclusion of the text you propose, i.e. Diario La Hora Reproduced with permission. Additionally, we thank you for following the news in our city. Best wishes in the preparation of your thesis.

Sincerely,
Newspaper La Hora
Appendix IV (Continued)

Request to Diario La Hora – Ambato, Ecuador, to use copyrighted photograph

----- Original Message ----- 
From: "Lucille Lane" <lane2563@bellsouth.net>
To: <ambato@lahora.com.ec>
Sent: Wednesday, November 27, 2002 9:52 AM
Subject: Solicitud para ocupar foto publicada en La Hora (Ambato)

> A la Gerencia de Redacción del Diario La Hora
> 
> Estimados Señores
> 
> Esta comunicación es para obtener su permiso para usar una foto que se
> publicó en el Diario La Hora (Ambato) el día 18 de octubre de 2001.  Se
> adjunta una copia electrónica de la foto que lleva el título "Baños
> Multitudinaria manifestación de fé y gratitude" y que tiene que ver con la
> conmemoración del segundo aniversario de la evacuación Baños.
> 
> Soy estudiante de geografía en la Universidad de la Florida del Sur en
> Tampa, estado de la Florida, EEUU, y estoy preparando una tesis de
> maestría
> que tiene a ver con las erupciones del volcán Tungurahua. Una parte de la
> tesis relata, de forma resumida y solo para información, la evacuación de
> Baños y el retorno de los habitantes a su ciudad.
> 
> La finalidad de uso, entonces, es puramente académico y sin fines de lucro
> y no
> la foto se utilizaría solamente en el documento de tesis. Si se permite
> ocuparla se lo haría con alguna anotación que Uds. indiquen, como por
> ejemplo: © Diario La Hora - reproducido con permiso (en ingles: © Diario
> La
> Hora. Reproduced by permission)
> 
> En la espera de sus noticias me despido, cordialmente,
> 
> Lucille Lane
> 
> Correo electrónico: lane2563@bellsouth.net
> Dirección: 31195 Park Ridge Dr.
> Brooksville, FL 34602
> Tel.: (USA) 352-540-9746
Translation

To the Editorial Department Diario La Hora
Sirs:
This communication is to request your authorization to use a photo that was published in the Diario La Hora (Ambato) on October 18, 2001. A digital copy of the photo is attached. The photo is titled "Baños thousands in manifestation of faith and thanks" and it relates to the second anniversary of the evacuation of Baños.

I am a student of Geography at the University of South Florida in Tampa, State of Florida, USA, and I am preparing a master's thesis that has to do with the eruptions of Tungurahua Volcano. Part of the thesis relates, in a summary manner, and for background information, the evacuation of Baños and the return of the inhabitants to their town.

The purpose of use, therefore, is strictly academic, and not for profit, and the photograph would be used only in the thesis. If you consent to its use for this purpose, it would be done with any notation that you suggest, for example: © Diario La Hora. Reproduced by permission.

Awaiting your advice, I am, sincerely,
Lucille Lane
e-mail: lane2563@bellsouth.net
Address: 31195 Park Ridge Dr.
Brooksville, FL 34602
Tel.: USA (352-540-9746