Socioeconomic Influences on Livelihood Recovery of Filipino Families Experiencing Recurrent Lahars[1]

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In the aftermath of the 1991 eruption of Mt. Pinatubo in Central Luzon, the residents of Bacolor town in Pampanga Province incurred recurrent threats to life, livelihood, and property from lahars—flowing mixtures of volcanic debris and water—triggered by heavy monsoon and typhoon rains. A series of lahars beginning in 1991 severely damaged all but one of the villages of the town, burying them one or more times in deposits up to nine meters thick. We report findings based on interviews with 163 women in Bacolor households sampled from three buried communities. Drawing on a vulnerability perspective, we consider the damage to these households from exposure to the lahar hazard (event vulnerability) and also to their ability to recover from such exposure (consequence vulnerability). Multiple regression is used to predict the lahar damage experienced by a household in 1991, 1994, and 1995. Lahar damage was so widespread it was an equal-opportunity hazard, unrelated to family income, education, or home ownership. However, recovery from disaster varied by social class. Using multiple ordinary-least-squares and logistic regression, we ask what factors influenced family recovery of livelihood. The family's ability to recover their livelihood was greatly affected by level of education. The lahar years exaggerated the economic distinctions between families with more and less education.

INTRODUCTION

The 1991 eruption of Mt. Pinatubo, a volcano in Central Luzon Island, was the world's largest in the past 100 years (Janda et al. 1996). The explosive eruption expelled sand-sized ashfall that blanketed hundreds of square kilometers. In addition, pyroclastic flows — rapid, ground-hugging, searingly-hot mixtures of gas and volcanic debris — deposited on the volcano slopes several cubic kilometers of particles ranging in size from silt to boulders. In the aftermath of the eruption, residents in the surrounding area incurred recurrent threats to life, livelihood, and property from lahars (Rodolfo 1995). Lahars are flowing mixtures of volcanic debris and water—triggered by heavy monsoon and typhoon rains. Resembling freshly-mixed concrete in behavior and consistency and containing 60-90 percent solid materials by weight, lahars flow down the channels of rivers that drain the volcano at speeds of up to 35 kilometers per hour on the slopes. As they reach the plains, lahars spread out and can bury large areas in debris several meters thick in a few minutes (Umbal and Rodolfo 1996).

The municipality most affected by the Pinatubo lahars is Bacolor, Pampanga, 39 km east-southeast of

the Pinatubo summit and 65 km north-northwest of Manila. At the time of the eruption, this historic town had 67,259 residents and 21 *barangays* or villages (NSO 1990). The townspeople spoke Capampangan as a first language and were predominantly of Catholic faith. This pretty town with 600 years of rich history had been the provincial capital of Pampanga for 160 years until 1904; for a brief period (1762-1764), the capital of the Philippines; and from 1942 to 1944, even the main headquarters of the occupying Japanese Imperial Army (Henson 1955). It had been a commercial center even before the Spanish arrived in Pampanga in 1571. During the periods of Spanish and American colonial rule, Bacolor was known for its culture, arts, and fine ancestral homes (Larkin 1993). Located in the heart of the fertile central Luzon agricultural district that supplies rice and sugar cane to much of the Philippines, Bacolor at the time of the eruption was a quiet farming and bedroom community nestled between three urban centers – San Fernando to the east, Guagua to the west, and Angeles City to the north. The Pasig-Potrero River, a lahar channel that drains the volcano, passes through the town just before it enters the flat plain of the Pampanga delta and spreads out. Between 1991 and 1995, almost the entire town of Bacolor was buried at least once in lahar deposits up to nine meters thick. All of its barangays were affected, and all but one was severely damaged.

An extreme natural hazard event such as a major lahar does not necessarily constitute a disaster, becoming one only when it causes so much damage to a human community that it swamps the community's ability to cope with it. In the words of Oliver-Smith (1992: 13):

> ...a disaster occurs when a natural phenomenon brings damage or loss to the major social, organizational, and physical facilities of a community to the degree that the essential functions of the society are interrupted or destroyed, resulting in individual stress and social disorganization of varying severity.

By this definition, there is no question that the lahar experience constituted a disaster for Bacolor residents. The town had experienced various natural, medical, and political calamities in the past but none recent or of such magnitude (Lamug et al. 1999).

The multiple years of lahars and the widespread destruction and displacement of people damaged the regional economy, increased the demands on the national as well as the provincial and local governments, and devastated the finances of affected families. This study examines the effects of the lahars on the town-people's lives — their economic wellbeing — and the factors that predict the extent of these effects. The very first step in a family's financial recovery is to reestablish *hanapbuhay*, or livelihood. We focus on this first step, using as our unit of analysis the family or, more precisely, the household – which often comprises an

extended family. Our specific research questions are as follows: 1) What factors predict the lahar damage experienced by a household in three years of major flows? 2) What factors influenced the ability of a family to rebuild their livelihood capacity?

History of lahars in three Bacolor barangays

Not all Bacolor barangays had the same experience with lahars in any given year, although all were affected eventually. Over a several year period, lahars buried all the houses in most barangays up to the second-story level or higher. Yet many families were determined to stay. Struggling to reclaim their homes and to protect them from future flows, some townpeople raised their houses on stilts or added rooms or new stories on top of their existing houses.[2] The following is a brief history of the lahar burial experience in three buried barangays in the five-year period following the 1991 eruption.

Cabambangan is the poblacion or downtown barangay in the town proper of Bacolor. According to household heads, the barangay was buried by 1 meter of lahar deposits in 1991, 1 meter in 1992, 1.5 meters in 1994, and finally 2.5 meters in 1995, a year of several lahar events. Over the five year period, the total deposition was 6 meters (Lacsamana and Crittenden 1997). By 1996, 73 percent of the families in Cabambangan had raised their house at least once, including 12 percent who had done so twice.

Cabetican, a residential community in the town proper, was buried 2 meters in 1991, 1 meter in 1994, and another 3.5 meters in 1995. In all, the barangay was buried by 6.5 meters of deposits. By 1996, 52 percent of the families had raised their house one or more times, including 8 percent who had done so twice and 5 percent who had done so three times.

Cabalantian, a suburban community to the east of the town proper, experienced flooding but no lahars from 1991 through most of the 1995 rainy season. Then, in October 1995, the entire barangay was buried by 8 to 9 meters without warning in a single calamitous event lasting six hours. In 1996, no families resided in the barangay and no rebuilding activity had occurred.

Vulnerability, entitlement, and deprivation

A disaster involves an encounter between an extremely hazardous event and a vulnerable human population. According to Blaikie and others, the defining characteristic of a disaster is that "a significant number of vulnerable people experience a hazard and suffer severe damage and/ or disruption of their livelihood system in such a way that recovery is unlikely without external aid" (Blaikie et al. 1994: 21).

But what is vulnerability? Given the occurrence of an extreme natural hazard, vulnerability is the likelihood that a person or community will be negatively affected by that hazard (Bolin and Stanford 1998). It is the

degree to which life and livelihood are put at risk (Blaikie et al. 1994). As such, it is grounded in people's *capacity* to avoid, cope with, resist, and recover from the impact of the hazard (Blaikie et al. 1994, Bolin and Stanford 1998).

The human effects of disasters are not random. It is well documented that some societal groups, particularly the poor, are more susceptible than others to loss and suffering from natural hazards, and are less likely than others to recover from these effects (Hewitt 1983, Blaikie et al. 1994, Bolin and Stanford 1998, Morrow 1999). Risks are unevenly distributed among individuals, households, communities, and nations.

The vulnerability perspective, first systematized by Hewitt (1983), has emerged as a scholarly response to these observed social patterns. According to this perspective, vulnerability to a natural hazard is largely a social characteristic grounded in the socioeconomic processes that structure daily life circumstances (Wisner 1993, Blaikie et al. 1994, Cannon 1994, Hewitt 1997, Bolin and Stanford 1998). In addition to an understanding of physical hazards, vulnerability analysis considers the social inequalities that affect people's capacities to cope with these hazards. In sum, risks are viewed as a complex combination of hazard and vulnerability.

Groups differ in their vulnerability to natural hazards not because of their intrinsic characteristics, but because of the resources they can mobilize when confronted with a potential calamity. People's vulnerability comes from exposure to a hazard in combination with the social, economic, and political factors that constrain their ability to cope with it (Bolin and Stanford 1998). The most vulnerable are those with the fewest choices, whose lives are constrained by socioeconomic factors such as poverty, education and access to employment (Blaikie et al. 1994). Vulnerability analysis considers how socioeconomic and political inequality structures the impact of a natural hazard on people's lives.

Access to resources, always unequally allocated across society, affects not only the losses that people experience in a disaster, but also the recovery strategies available to them (Bolin and Stanford 1998). Thus, to understand why a disastrous event harms some people more than others, one must consider unequal exposure to hazards and unequal access to resources for dealing with them, both of which may be structured by socioeconomic status (Cannon 1994).

Sen's (1981) analysis of deprivation and entitlement can be applied to the problem of securing livelihood in a damaged economy. This approach suggests that a family's unemployment or underemployment (a deprivation) is best understood not as a simple function of the supply of jobs but also as a function of the family's entitlement, based on the resources its members command, to the means of livelihood (a commodity) that are available. The family's ability to exchange its resources, such as land, capital, skills, educational credentials,

or labor power, for livelihood will depend on the family's place in the class structure as well as prevailing rules governing entitlement to convert these resources into livelihood. These rules depend in part on social and political factors as well as the nature and health of the economy. Sen's approach encourages us not just to describe patterns of vulnerability but also to seek explanations for these patterns.

Differential vulnerability may also reflect political, religious, ethnic, and national divisions. Given its ethnic and religious homogeneity, the Bacolor populace is stratified primarily in terms of social class. Its political sources of vulnerability, arising from external factors such as a chaotic, indecisive, and overstretched national government and from fierce competition between towns to influence hazard mitigation policy and practice, are discussed elsewhere (Crittenden 2001, Lamug et al. 1999). In this article we focus on differential vulnerability among Bacolor families.

To facilitate understanding of the effects of the lahars on the lives of Bacolor families over a period of time, we elaborate the vulnerability perspective by drawing on the Nigg and Miller (1994) distinction between event and consequence vulnerability. Event vulnerability refers to vulnerability to damage from the direct impact of a hazard. Consequence vulnerability is that associated with the process of recovery from exposure to the hazard. Our first research question focuses on factors that predict event vulnerability in the form of damage experience. The second question, concerning factors related to recovery of livelihood, addresses the issue of consequence vulnerability.

Event vulnerability

Disasters caused by natural hazards are global phenomena, but increasingly their burden is disproportionately borne by people in developing countries and, within these countries, people lower on the socioeconomic continuum (Aptekar 1994). Several explanations have been offered for the relationship between socioeconomic status and vulnerability to the direct impact of a hazardous event. First, for economic reasons, an increasing proportion of people live on land that is susceptible to damage from physical hazards, such as a floodplains, steep hillsides, or volcano slopes (Aptekar 1994, Blaikie et al. 1994, Berke and Beatley 1997, Morrow 1999). To the extent that they recognize the hazard, people with more economic resources can avoid these dangerous places. If they nonetheless choose them, like wealthy Californians who desire the prestige and view of a mountainside building site, their resources allow them to anticipate, mitigate, and cope with the risk (Aptekar 1994, Bolin and Stanford 1991, 1998). For example, they may purchase housing insurance that will reduce any losses incurred as a result of an untoward event. Second, people with higher socioeconomic status tend to live in more substantial housing or housing that is better engineered to withstand known hazards (Bolin and Stanford 1991, Aptekar 1994, Nigg

and Miller 1994, Berke and Beatley 1997, Morrow 1999). These first two explanations may not apply to the Bacolor lahars as well as to other disaster contexts. Mt. Pinatubo had not erupted within recorded history, so there was no reason to suspect that Bacolor was unsafe or, for that reason, an undesirable place to live. Rich and poor lived in close proximity in all the study barangays. Clearly, wealthier families lived in more substantial houses than poorer families. However, once lahars flowed out of the river channels as they approached the plain, they slowed down and filled and surrounded every structure, however flimsy or sturdy, without destroying it in the process. The only advantage a more substantial house might have would be its height. Except in the calamitous Cabalantian event, a taller house was less likely to be totally buried in any given lahar event. A second story might remain intact above the buried first story.

A final explanation is that people with more resources have greater access to protection from the hazard agent in the form of preparedness and hazard mitigation on the part of the household or community (Wisner 1993). Although little preparation for the initial lahars was possible, this explanation is more plausible with respect to the impact of later lahar seasons.

Consequence vulnerability

To recover from exposure to a hazard is to achieve a state that would have been achieved if the hazard had not occurred (Bolin and Stanford 1991). Recovery involves restoration of physical and psychological health, physical resources, and the social relations required to use them (Blaikie et al. 1994). The adverse effects of a disaster on employment may last for years (Berke and Beatley 1997). We focus here on recovery of livelihood.

Social class is an important predictor of the extent and timing of household recovery from a disaster (Bolin and Bolton 1986, Oliver-Smith 1992, Berke and Beatley 1997). The disaster may produce losses for wealthy and poor families alike, but poorer and less advantaged households recover more slowly and less completely (Bolin and Stanford 1991). Families with fewer resources have more difficulty reconstructing their livelihoods. This means they may be more vulnerable to the effects of subsequent hazard events. Disasters caused by natural hazards often magnify social inequalities that existed beforehand (Oliver-Smith 1992, Bolin and Stanford 1991, Nigg and Miller 1994).

Residential tenure — whether a family owns or rents its home – is an important aspect of class (Bolin and Stanford 1998). Some disaster assistance programs explicitly exclude the poorest families. For example, the Philippine government resettlement program for families dislocated by Pinatubo lahars was limited to those who could prove ownership of their house and lot.

Families with more resources are better able to invest in human capital, such as education, enabling them to

obtain more stable, better-paying jobs (Becker 1993). Education is a general, transferable resource that promotes one's ability to adjust to changing labor market conditions, and that retains its value when one moves to a new location. Thus, education is a particularly valuable resource for maximizing employment opportunities in a depressed post-disaster economy. Education may also be associated with proficiency in gaining access to assistance programs (Morrow 1999).

METHODS

Design and sample

Our research is based on a community survey conducted in 1996 about the experience of families in the aftermath of the eruption (Lamug et al. 1999). We interviewed 163 adult women informants, those designated as the "woman of the house", whose families had resided at the time of the eruption in the three barangays chosen because of their differing histories of burial by lahars. We did not consider the many outlying barangays that were completely destroyed before 1994 nor two additional barangays in the town proper whose lahar history was similar to Cabambangan and Cabetican. Also excluded from this analysis was Calibutbut, the only barangay whose residential areas never were reached by lahars.

We sampled families from these barangays in four categories of resettlement status: those who stayed in the community; those involved in the national government's temporary staging centers; those in newly constructed resettlement communities; and those who had relocated to other towns without government assistance. The particular sites we chose were popular destinations for families from the selected barangays. Table 1 summarizes the distribution of respondents by barangay of origin and resettlement status. The sample from the three affected barangays includes mainly those who were relocating with

Table 1. Distribution of Respondents by Barangay of Origin and Current Status of Resettlement (in percent)

	Barangay of Origin			
Resettlement Status	Cabalantian	Cabambangan	Cabetican	Total
Stayed in Barangay		26.8	27.1	16.6
In Staging Center	79.4	7.3	11.9	36.8
In Resettlement Community	4.8	56.1	42.4	31.3
Moved Elsewhere	15.9	9.8	18.6	15.3
Total	100.1	100.0	100.0	100.0
(Base N)	(63)	(41)	(59)	(163)

government assistance, but also a few who stayed or resettled on their own. Almost 80 percent of the residents of Cabalantian, the most recently hit community, were in temporary staging centers, and none resided in the barangay. Cabambangan and Cabetican residents were in all four categories of resettlement status. Our results are limited in generalizability to the particular barangays and resettlement sites included. We treat barangay and resettlement status as fixed factors in our analysis.

Outcome measures

To answer our research questions, we considered several outcomes: the damage experienced by the family in each of the lahar years – 1991, 1994, and 1995 – and overall; and family livelihood over the five-year period following the eruption.

Damage experience

Respondents reported the level of damage to their family's neighborhood, house or home, and place of livelihood for each year of lahars. The damage experience index, assessed in 1991, 1994, and 1995, was a count of items for which the woman reported moderate or severe damage (range: 0 to 3). In addition, we computed a cumulative damage index by summing damage across the three years (range: 0 to 9).

Family recovery of livelihood

We assessed livelihood recovery over the five-year period with three indicators: a) whether the father of the family was employed in 1996; b) family monthly per capita income in 1996; and c) poverty status in 1996, estimated according to the annual per capita poverty threshold for 1994 (NEDA 1995). For each indicator, the 1991 level was used as the baseline.

Analysis

For each major outcome, we began our analysis by describing the trends over time. Then, to answer our research questions we used ordinary-least-squares multiple regression for continuous outcome measures or multiple logistic regression analysis for dichotomous outcomes, in our predictive models.

Predictors

We used two dummy variables for Cabambangan and Cabetican to represent the barangay of origin. Cabalantian was the omitted reference category.

Cumulative damage experience was used as a predictor in the models for predicting recovery of livelihood.

Several indicators of socio-economic status (SES) were used as predictors in the models. Poverty status in 1991 was determined using the NEDA (1991) formula. Monthly per capita income in 1991, computed from respondent reports, was logged to normalize the distribution. With respect to level of education, mother's education and father's education yielded such similar results in all our analyses that we combined these into a single variable, family level of education. We coded the respondent's

and her spouse's level of education as 1 for less than high school, 2 for high school, and 3 for a credential beyond high school. The family's level of education was an average of these two. By this definition, 43.6 percent of the families had less than high school education (< 2) and 16.6 percent had more than high school education (3). High school education was the omitted reference category in the regression equations. Home ownership was defined as family ownership of their house and its lot. By this definition, 67 percent of the families were home owners.

Resettlement status was represented by three dichotomous dummy variables: staging center; resettlement community; and elsewhere. Stayed in the barangay was the omitted reference category.

RESULTS

Damage experienced

Trends

For the total sample, the reported damage experienced by families increased over time, with a mean of 1.08 for 1991 (SD = 1.24); 1.62 (1.28) for 1994; and finally, 2.31 (1.03) in 1995.

Predicting damage

We estimated models for predicting the damage experienced by families each separate year as well as cumulative damage experienced. Predictors in these models are the community and indicators of socioeconomic status: home ownership, 1991 poverty status or log per capita monthly income, and family education. Table 2 summarizes the version of these models that includes poverty status as an indicator of family economic level. In each of the four models, damage experience was a function of where a family lived. Reported damage in 1991 and 1994 was greater in barangays Cabambangan and Cabetican than in Cabalantian. In 1995, the damage was greater in Cabalantian. Respondents from Cabambangan and Cabetican reported more cumulative damage over the three lahar seasons.

In all four models, reported damage experience was unrelated to family socioeconomic characteristics, including home ownership, poverty status, or education. An alternative set of equations not shown in Table 2, with 1991 logged per capita income substituted for poverty status as a predictor in each model, yielded similar results. The models explain comparable proportions of the variation in damage, and family income had no predictive power, except in 1994, when 1991 log per capita income was positively related to damage experienced that year (b = .58, p < .05). The effects of other predictors were unchanged.

Lahar burial was so widespread in these communities as to represent an equal-opportunity hazard, with damage unrelated to family income, education, or home ownership. In this sense, the lahar crisis in Bacolor was an atypical disaster. All of the families

Table 2. Multiple Regression Equations Predicting Damage Experienced by Families by Year and Overall

Predictors	1991			1994			1995			Cumulative 91-95		
	B[a]	SE[b]	P[c]	B	SE	P	B	SE	P	B	SE	P
Community												
Cabambangan	1.00	.24	< .01	1.68	.22	< .01	-.55	.23	< .05	2.13	.49	< .01
Cabetican	1.55	.20	< .01	1.90	.19	< .01	-.71	.19	< .01	2.74	.40	< .01
SES												
Home Owner	.13	.19	N.S.	.04	.17	N.S.	-.20	.18	N.S.	-.03	.37	N.S.
In Poverty 1991	.30	.28	N.S.	-.31	.25	N.S.	.02	.26	N.S.	.01	.55	N.S.
Family Education												
Less than H.S.	-.08	.20	N.S.	-.05	.19	N.S.	.10	.19	N.S.	-.04	.41	N.S.
More than H.S.	.39	.26	N.S.	-.19	.24	N.S.	-.25	.25	N.S.	-.06	.52	N.S.
Intercept	.16		N.S.	.56		< .05	2.82		< .01	3.53		< .01
R^2 (Adjusted)	.320		< .01	.467		< .01	.100		< .01	.249		< .01

[a] Unstandardized regression coefficient

[b] Standard error

[c] Two-tailed probability

in our study – poor or rich – lost their houses by the end of the 1995 lahar season. Many also lost livelihood and a few, even loved ones. All of them faced the monumental challenge of rebuilding homes and lives in the midst of turmoil, the threat of future lahars, and a crippled economy. Rebuilding a residence is a major expense for any family, and the lahar crisis had limited the resources available to families for meeting even day-to-day needs. A family with a mortgage on its destroyed home was faced with the prospect of repaying the debt in addition to securing a new domicile. Private home insurance is prohibitively expensive and quite rare, and insurance attached to a government mortgage protects only the lender, not the homeowner. Except for assistance from family members living elsewhere, loans for homebuilding were not available. Many families also needed to find new livelihoods.

Although lahars are an equal-opportunity hazard, the ability to recover from disaster is not the same for the rich and the poor. We turn now to ask what factors helped families in the lahar-stricken barangays to recover their ability to earn a livelihood.

Recovery of livelihood

What were the effects of the lahar years on the livelihood capacity of Bacolor families? Eighty-six percent of our survey respondents reported that the lahars had harmed their family's ability to earn a living. When asked to specify the harm, their most common responses fell into the

following categories: loss of work or decreased income (39%); burial of farm land (12%); necessity to seek employment far from home (7%); and loss of everything (6%).

Trends

Table 3 summarizes the changes in the economic wellbeing of families from 1991 to 1996, with respect to livelihood. In 1991, 42 percent of the respondents and almost all of their spouses were employed. By 1996, employment had declined to 31 percent of the wives and 72 percent of the husbands. Over the five year period, monthly per capita income increased by a tiny amount, P150 per capita. However, the per capita poverty threshold (NEDA 1991, 1995) increased much faster, so that the poverty rate for families in the sample almost tripled, reaching 30.5 perent by 1996.

Predicting father's employment in 1996

We estimated two logistic regression models for predicting whether the father of the family, or the respondent's husband, was employed in 1996, summarized in Table 4. In the first model, predictors were community of origin, cumulative damage, home ownership, family education, and resettlement status. The second model added a control for the father's employment in 1991.

In the 27 families with more than high school education for both parents, all of the fathers were working in 1996. This "perfect" relationship made it impossible to estimate the models. To solve this problem, we looked for families in which one spouse had high school education and the other had more than high school and in which the father of the family was not employed. There were five such families. We reclassified one of them as more than high school to weaken the relationship between education and employment. Which family to reclassify was an arbitrary choice, but all choices yielded equivalent results. After this adjustment, the first model accounted for about 35 percent of the variation in the likelihood of working; the likelihood of the father working was lower in families from Cabambangan, relative to Cabalantian, and those who owned their home.

Table 3. Economic Wellbeing of 163 Families, 1991 and 1996

Indicator	1991	1996	Change
Wife working (%)	41.60	31.30	-10.30
Husband working (%)	92.20	72.50	-19.70
Monthly per capita income (pesos)	1,800.00	1,950.00	+ 150.00
In poverty (%)	11.30	30.50	+ 19.20

Table 4. Multiple Logistic Regression Models Predicting Father's Employment in 1996

Predictors	B[a]	OR[b]	P[c]	B	OR	P
	Model 1			Model 2		
Community						
Cabambangan	-2.48	.08	< .05	-2.55	.08	N.S.
Cabetican	-1.43	.24	N.S.	-1.52	.22	N.S.
Cumulative Damage	-.22	.80	N.S.	-.26	.77	N.S.
SES						Home
Owner	-2.09	.12	< .01	-1.97	.14	< .01
Family Education						
Less than H.S.	-1.10	.33	< .05	-1.26	.28	< .05
More than H.S.[d]	2.66	14.36	< .05	2.75	15.67	< .05
Father Employed 1991	—	—		3.47	32.03	< .01
Resettlement Status						
Staging Center	-1.46	.23	N.S.	-1.37	.25	N.S.
Resettlement Community	.74	2.09	N.S.	1.65	5.21	< .05
Elsewhere	1.12	3.08	N.S.	1.10	2.75	N.S.
Intercept	5.47		< .01	2.29		N.S.
-2 Log Likelihood	114.144			100.922		
Nagelkerke R²	.352			.460		
Model C² (df)	35.396 (9)		< .01	48.618 (10)		< .01

[a] Logistic regression coefficient

[b] Odds ratio

[c] Two-tailed probability

[d] Adjusted to weaken the relationship

Father's employment was least likely in families with less than high school education (p < .05) and most likely in those with more than high school education (p < .05). In the second model, which accounted for about 46 percent of the variation in the dependent variable, the likelihood of the father working in 1996 was decreased by home ownership and low family education. The father was more likely to be employed if he was working in 1991, if both parents had more than high school education, and if the family was located in a resettlement community.

Predicting monthly per capita income in 1996

We estimated two multiple regression models for predicting log monthly per capita income (Table 5). The first model predicted income on the basis of community, cumulative damage, home ownership, family education, and resettlement status. This equation explained about 30 percent of the variation in income as

Table 5. Multiple Regression Models Predicting Log Monthly Per Capita Income in 1991 and 1996

Predictors	Model 1			Model 2		
	B^a	SE^b	P^c	B	SE	P
Community						
Cabambangan	-.12	.10	N.S.	-.10	.13	N.S.
Cabetican	-.10	.09	N.S.	-.08	.08	N.S.
Cumulative Damage	-.01	.01	N.S.	-.02	.01	N.S.
SES						
Home Owner	.10	.06	< .10	.05	.05	N.S.
Family Education						
Less than H.S.	.01	.06	N.S.	.02	.06	N.S.
More than H.S.	.46	.08	< .01	.38	.08	< .01
Log Per Capita Income 1991				.44	.07	< .01
Resettlement Status						
Staging Center	-.08	.10	N.S.	-.15	.10	N.S.
Resettlement Community	.06	.08	N.S.	-.02	.07	N.S.
Elsewhere	.11	.11	N.S.	-.03	.10	N.S.
Intercept	.07		N.S.	.18		N.S.
R^2 (Adjusted)	.299	< .01		.447	< .01	

[a] Unstandardized regression coefficient

[b] Standard error

[c] Two-tailed probability

a positive function of home ownership (one-tailed $p < .05$) and more than high school education ($p < .01$). When log monthly per capita income for 1991 was added as a control, model 2 accounted for almost 45 percent of the variation in 1996 income. In this final model, the only significant predictors were 1991 income and education greater than high school, both positively related to 1996 income. Controlling for initial per capita income, families in which both spouses had an educational credential beyond high school earned Php2,610 more per person in unlogged 1996 monthly income than did those in which one had only high school education. Income in 1996 was not related to the original community of origin, the total damage experienced, home ownership, or resettlement status.

Predicting poverty status in 1996

Table 6 summarizes two multiple logistic regression models for predicting the likelihood that a family would be poor in 1996. The first model predicted this likelihood on the basis of community of origin, home ownership, family education, and resettlement status. The second model was the same except that poverty status in 1991 was added as a control. The first model, in which education was the only significant predictor, accounted for approximately 16 percent of the variation in 1996

Table 6. Multiple Logistic Regression Models Predicting Family Poverty Status in 1996

Predictors	Model 1			Model 2		
	B[a]	OR[b]	P[c]	B	OR	P
Community						
Cabambangan	.37	1.44	N.S.	.29	1.33	N.S.
Cabetican	.32	1.37	N.S.	.34	1.41	N.S.
Cumulative Damage	.09	1.10	N.S.	.13	1.14	N.S.
SES						
Home Owner	-.23	.79	N.S.	-.17	.84	N.S.
Family Education						
Less than H.S.	-.44	.65	N.S.	-.50	.61	N.S.
More than H.S.	-2.46	.08	< .05	-2.36	.09	< .05
Poverty in 1991	—	—		1.79	5.98	< .01
Resettlement Status						
Staging Center	.28	1.32	N.S.	.52	1.68	N.S.
Resettlement Community	-.60	.55	N.S.	-.35	.70	N.S.
Elsewhere	-.64	.52	N.S.	-.34	.72	N.S.
Intercept	-.74		N.S.	-.17		N.S.
-2 Log likelihood		157.623			145.788	
Nagelkerke R^2		.163			.244	
Model X^2 (df)	17.425	(9)	< .05	26.215	(10)	< .01

[a] Logistic regression coefficient
[b] Odds ratio
[c] Two-tailed probability

poverty status. In particular, if both parents had more than high school education, a family's likelihood of being poor in 1996 was less than one tenth as high as if at least one had only high school. The second model, with initial poverty status added as a predictor, accounted for about 24 percent of the variation in 1996 poverty status. Not surprisingly, a family that was poor in 1991 was more likely than others to be poor in 1996. Controlling for poverty status in 1991, education beyond high school still decreased the likelihood of a family falling into poverty by 1996 by over 90 percent. In both models, poverty status was unrelated to the original community, the total damage experienced, home ownership, or resettlement status.

The importance of education in recovering livelihood

We have examined the factors that related to a family's ability to begin economic recovery from the eruption and its aftermath. In particular, we have considered the predictors of three aspects of the family's ability to earn a livelihood in 1996: whether the father of the family is employed; monthly per capita income; and

poverty status. In each case, after controlling for the pre-eruption level of the livelihood indicator, we have found that the most important factor determining the family's economic wellbeing in 1996 is the educational background of the parents. Higher education on the part of the respondent and her spouse markedly enhanced the family's ability, when faced with the personal and community devastation from the Pinatubo lahars, to recover income, to secure employment in a damaged economy, and to avoid plunging into poverty. Less than high school education had the additional effect of hindering the family's ability to secure employment for the man of the household.

Table 7 summarizes the relation of family education level to the three aspects of livelihood before and after the lahar devastation. In 1991, most of the men of the household were employed, and their likelihood of having a job was not significantly related to level of education. By contrast, each increase in level of education increased the likelihood of the father's employment in 1996. Monthly per capita income was positively related to level of education even in 1991, but the relationship was much stronger in 1996. Over the five-year period, per capita income increased only in families with higher education, whereas those with high school education suffered an absolute decline. The poverty rate for families in the three communities was much lower in 1991, and the level of education in the family was not significantly related to poverty status at that time. By 1996, there was a marked difference in the poverty rates of families with and without higher education.

Table 7. Economic Wellbeing by Family Level of Education

| Indicator/Year | Level of Education | | | | | |
	< H.S.	H.S.	> H.S.	F[a]	g[b]	P[c]
Father Working (%)						
1991	91.9	91.5	95.0		.075	N.S.
1996	61.0	74.6	100.0		.533	< .01
Monthly Per Capita						
Income (mean pesos)						
1991	1,343.	1,620.	3,483.	9.89		< .01
1996	1,344.	1,424.	4,599.	32.95		< .01
In Poverty (%)						
1991	12.9	14.3	0.0		-.269	N.S.
1996	32.8	38.1	7.4		-.238	< .05

[a] F-test for comparing means
[b] Goodman and Kruskal gamma, a measure of ordinal association
[c] Non-directional p value for F, directional value for g

Table 8. Distribution of Father's Occupational Category in 1991 and 1996, Ranked by Modal Educational Credential for the Category

Occupational Category	Modal Education	1991 (%)	1996 (%)
Professional, Technical, Administrative	More than high school	4.3	5.1
Clerical	More than high school	6.4	5.8
Sales Manager	More than high school	5.0	4.3
Other	High school or more	3.5	5.0
Service	High school	5.7	5.1
Construction	High school	28.4	23.9
Skilled Labor	High school	21.3	18.8
Overseas Contract Worker	High school	6.4	4.3
Not Working, Retired	High school	7.8	27.5
Production	High school or less	1.4	0.0
Agriculture	Less than high school	9.9	0.0
Total		**100.1**	**99.8**

Why was education so much more important to a family's livelihood capacity in the troubled post-lahar economy than before the eruption? Of course, employment was a scarcer commodity in 1996 than in 1991. However, Sen's (1981) approach directs us to seek an explanation for variation in deprivation of and entitlement to this commodity in the mode of production in the economy and the relationship of families to these modes. Before the eruption, both the economy and the status system of Bacolor were primarily based on land ownership. The majority of families did own land, often inherited land. In addition to housing the family, this land often provided livelihood. Land owners farmed their land, rented it to others, and opened business enterprises on it. People without land worked for livelihood in the enterprises of land owners.

Within the limitations of our small sample of families, we can gain some insight into the changes in the economy during the lahar years by considering the occupations fathers held in 1991 and 1996 and the typical (modal) level of education for men in those occupations in 1991. Our occupational categories, based on respondents' open-ended reports are crude; for example, the agricultural category might include large land-owning farmers, farmers working their own small plots, and farm laborers. Table 8 shows that father's employment contracted overall, from 92 percent in 1991 to 72 percent in 1996. Most occupational categories contracted between 1991 and 1995,

but those in which the modal educational credential was lowest – agriculture and production, together comprising over 11 percent of the fathers in 1991 – disappeared during the five years after the eruption. These likely were the occupations most tied to local land, which could no longer be converted into livelihood. Occupations for which the typical educational credential was more than high school – professional, technical, administrative, clerical, and sales manager — contracted little, from 15.7 percent to 15.2 percent over the same period.

CONCLUSIONS

We have used a vulnerability perspective to understand the patterning of the effects of the Pinatubo eruption and its laharic aftermath on families in three Bacolor communities. For this particular disaster context, the distinction between event and consequence vulnerability is a useful addition to the perspective, because the factors that predicted initial damage differed markedly from those that predicted recovery of livelihood and psychological wellbeing.

The lahars that buried Bacolor in the five years following the Pinatubo eruption were no respecters of social stature and privilege. Damage and losses were incurred equally by rich and poor, more and less educated, and were determined only by location relative to the hazard.

Although families with more or fewer resources all suffered major losses, they had unequal capacity to recover their livelihoods. In general, destruction from the post-eruption lahars exacerbated existing inequalities and created new ones.

Education was the most important socioeconomic resource in the recovery period. It was not very important in determining a family's level of economic wellbeing before the eruption, and it was unrelated to the damage that a family suffered from the lahars. However, the ability to recover livelihood was greatly helped by higher education. Sen's entitlement and deprivation approach provides insight into why the years of lahars exaggerated the economic distinctions between families with more and less education. Other forms of wealth, such as home ownership, were of little use to an affected family in the five-year eruption aftermath. Most real estate was damaged by lahars and could not be used for livelihood production. Before the eruption, education beyond high school was a useful, but not necessary credential for employment. It became a critical resource when livelihood was scarcer and land ownership in Bacolor could not be used to create livelihood. Unlike real estate and other material goods, education is a transferable resource that *cannot* be taken away by a disaster and that can be exchanged for livelihood in various localities.

NOTES

1 Funded by the Center for Integrative and Development Studies, University of the Philippines. A previous version was presented at the meeting of the Asian Association of Social Psychology, Manila, Philippines, July 30, 2003.

2 See Crittenden (2001) and Crittenden and Rodolfo (2002) for more details on the house-raising processes developed by town residents.

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