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HOW A COMMUNITY HOSPITAL EMERGENCY DEPARTMENT COPED WITH A MASSIVE BLIZZARD

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INTRODUCTION

Although the great snowstorm of '78 is now history, for those of us who lived through it, it was a mixture of serious, eerie and sometimes comical events. For those of us who were more or less directly involved with its consequences, it will be a long remembered event. This, therefore, is an attempt to explain how one general hospital Emergency Department coped with a mammoth blizzard and was able to continue operations, while most people in the area were snowbound.

THE STORY OF EVENTS

The city of Pawtucket, Rhode Island is populated by approximately 90,000 people. It is situated in the northeastern section of the state and contains numerous small industries. Its working population comes from several surrounding "bedroom" communities in Rhode Island and neighboring Massachusetts as well as a significant number from the city of Pawtucket, itself. Downtown Pawtucket is approximately 4 miles from downtown Providence but actually the northern outskirts of Pawtucket fuse with the southernmost outskirts of Providence. Pawtucket is also surrounded by the cities of East Providence, Central Falls, and the town of Seekonk in Massachusetts.

The climate in Rhode Island is milder than in the other New England states. The maximum snowfall (40–55 inches per year) usually occurs in the western third of the state. In 1978 there were 2 snowfalls prior to February 6. One measured approximately 2 inches in mid January and one measured 8–12 inches in early February. The residents of the area began to feel that they were going to experience a winter with insignificant snowfall.

On Monday, February 6, 1978 a light snowfall began to occur in the area at about 10:30 a.m. Although the National Weather Service had predicted a massive snowfall about 30 hours earlier and within 15 hours "near-blizzard" conditions were predicted, people were complacent, expecting "just another snowfall". By 12:30 p.m. it was snowing much more heavily and there were 2 to 3 inches of snow on the ground. Still no one appeared to be too concerned (36 hours later there would be 36 inches of snow). Schools are usually discharged in the area between 1:30 and 2:30 p.m. but by 1:00 p.m. some consternation had arisen and students were let out 15 to 30 minutes early. School buses were late in arriving at many schools, however, and the students were compelled to wait for them.

It began to become apparent that this was not an ordinary storm, as snow was now gusting horizontally and piling up quickly on the

ground. Employers became alarmed and began to send employees home around 2:30–3:00 p.m. As a result most workers were discharged at about the same time. With the build up of surface snow and the mass exodus of workers, long lines of traffic began to build up on many major thoroughfares and on the two major highways in the area. Soon lesser highways also became inundated with traffic. As the storm progressed, vehicles began to be trapped at intersections and at the entrances and exits of the major highways. This in turn led to other vehicles becoming trapped on the roads and numerous occupants having to leave their cars in search of shelter. (Interestingly, those who ventured onto side streets and lesser roads, at this point, found little or no traffic around them and were able to proceed with no interruption as long as they were able to cope with a moderate build-up of snow on the roads.)

The storm raged on through the night and continued the following day to a lesser degree. Those who did manage to reach their destinations on Monday evening found that their cars were almost completely buried in snow by the following morning and that roads were impassable. Numerous people failed to reach their destinations however, and stayed in firehalls, schools and private homes. Rumors began to circulate that many people trapped in their cars had died from exposure and from asphyxiation. This was later disproved.

By Tuesday morning, the city was at a standstill with up to 4 feet of snow and stalled vehicles blocking the roadways. Late in the morning, snowplows began to make some headway and were able to plow one lane on some major streets and access roads. These lanes were for the use of Ambulance, Rescue, Fire and Police vehicles only.

Fig. 1.

Wednesday, two days after the storm had started, was sunny and bright. Only a few major thoroughfares were open to single lane traffic. Emergency vehicles were slowly plodding through these and trips which usually took 15 minutes were now taking at least 1 hour. By this time, a ban had been placed on unauthorized vehicular travel with $ 500 fine for violators. The scene in the area was one of utter devastation. Automobiles, buses and trucks were blocking intersections at odd angles (Fig. 1, 2 and 3). (Most of these vehicles had been abandoned 48 hours earlier.) There were huge ruts in the roads. Large num-

Fig. 2.

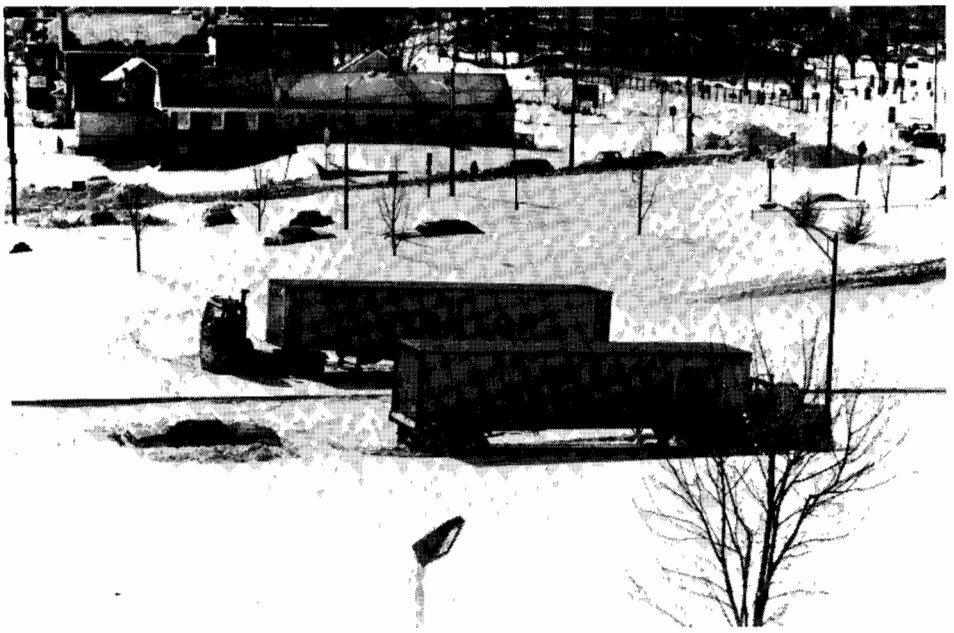

Fig. 3.

bers of people were out walking and milling around and yet there was an eerie quiet due to the fact that few vehicles were in operation. It looked and sounded as though the city were suffering from the aftermath of a major catastrophy.

One of the most difficult problems with the movement of rescue vehicles was the pedestrians. People, in general, tended to ignore the flashing lights of these units. When sirens were sounded, most moved aside, yet some were slow to do so, others defied their drivers until the last moment while still others became irritated and swore at the Rescue Personnel.

Rescue workers worked long and arduous hours. At one point, I saw 6 men go through waist deep snow to bring a man 150 feet from an apartment building by stretcher. Because of the weight and height of the snow, they began to trip and fall while carrying the patient. The stretcher never touched the ground, however, because as one man fell there was always another one present to catch the stretcher handle before it reached the ground.

On Wednesday, the Army began to arrive with personnel and heavy snow removal equipment and the tide of battle began to turn for this first time in 2 days.

At the Memorial Hospital in Pawtucket, Rhode Island it was fortunate that 2 physicians had been scheduled to work the 4:00 p.m. to 12:00 a.m. shift in the Emergency Department on Monday, February 6. This Department is usually quite busy, seeing on an average of 110 patients per day. As in most Emergency Departments, approximately 60% of these patients, present with minor injuries and illnesses can be dispensed of fairly quickly. As of noon Monday, February 6 not too many patients were arriving at the Emergency Department, due to increasing weather conditions. Some patients who routinely went to other facilities, were unable to reach them and had to be rerouted to Memorial. As a result only 59 patients were seen that day, but about 90% of these were true emergencies, requiring either admission or consultation.

By Tuesday morning the seriousness of the situation began to evolve. Medical and nursing staff were unable to get in to relieve the staff who had already worked two 8 hours shifts, and those who had worked were unable to leave. Those who were confined to their duties began to spell each other in order to obtain some rest. Fortunately, Tuesday's patient flow dwindled to 35 patients over a 24 hour period. Unfortunately, nearly all of these patients required some form of acute medical or surgical care.

The methods of patient arrival were varied: Fire Department Rescue, Ambulance, Police Department cruisers, stretchers on the front ends of jeeps, toboggans pulled behind jeeps and snowmobiles. One patient arrived with a broken leg, transported in the bucket of a front end loader.

As previously indicated, staffing initially became unregulated. Staff within the hospital relieved one another on a haphazard basis. Doctors and nurses who were not working and who were unable to get home, obtained sleep anywhere they could, whenever they could. Some slept in the Resident's Quarters, others slept on mattresses placed in conference rooms, while others got short naps on beds and stretchers in the Emergency Department.

In their off time on Tuesday, 2 members of the Emergency medical staff went walking in order to relieve their boredom and found themselves walking up the middle of Route 95, the state's major highway. They found this to be an eerie experience, surrounded by silence and what appeared to be a wasteland, with numerous vehicles abandoned by the sides of the road and blocking entrances and exits.

On Wednesday, with one lane traffic available on some streets, some additional staff

began to trickle in on foot and transported by authorized emergency vehicles: Fire Department, Police, Volunteers and Hospital. (The National Guard refused to transport medical and nursing personnel as they were involved in transporting patients, drugs and other hospital supplies.) With their arrival, some organization for working hours began to develop.

Where possible, nursing staff was placed on 8 hours shifts and medical staff was placed on 12 hour shifts. Some of the staff who had been on duty for 48 hours were sent home. Others, however, would have to pass through the city of Providence in order to reach their destinations. Since Providence was totally closed to all but essential emergency vehicles, these people had to wait until Friday or Saturday to reach home.

At one point on Tuesday, members of the resident staff were discussing how they could improve their efficiency when the idea of telephone triaging of Fire Department Rescue calls emerged. As a result, one member of the resident staff was assigned, on a daily basis, to the Central Fire Station and triaged calls to separate the necessary calls from those which were unnecessary and in this manner, kept the Rescue runs cut in half during their period of operation.

Residents assigned to this service also accompanied the Rescue vehicles on more serious runs and worked primarily as paramedics, starting IV's, giving drugs, etc.

There is a rather large parking lot adjacent to the Emergency Department at the Memorial Hospital. As it became apparent that there might be some problem in obtaining supplies and in transferring patients, this lot was cleared of snow and automobiles and used as a helipad. Over the next 4 days, several landings of small and medium helicopters took place from it for various reasons. The major problem with this site was that people were used to parking there. It became necessary to leave a security guard on duty to prevent this.

As the traffic routes began to open up slightly on Wednesday, the patient volume in the Emergency Department rose from the 35 seen on Tuesday to 60. (This became a continuing pattern throughout the week. As ease of availability in reaching the hospital increased, more patients with illnesses and injuries of lesser severity arrived in the Emergency Department, Table 1.)

TABLE 1

	Date	No. of patients seen
Monday	2/6/78	59
Tuesday	2/7/78	35
Wednesday	2/8/78	60
Thursday	2/9/78	81
Friday	2/10/78	82
Saturday	2/11/78	106
Sunday	2/12/78	107

Thursday it became evident that the hospital was experiencing a serious logistics problem. Due to the large number of patients admitted, hospital beds had run out and only a few patients who had been discharged were able to be sent home. Those who did manage to leave were sent in Fire Department and Police Department vehicles. One group of patients who lived south of Providence left by Army helicopter.

On Friday, the Police Department assigned an officer to coordinate the movement of discharged patients from the hospital and to aid in setting up transportation of hospital staff to and from the hospital.

On Saturday, traffic began to flow much more freely and the driving ban was lifted in some areas about noontime. Numerous vehicles suddenly appeared on the roads tying up Emergency Rescue vehicles as roadways were still very narrow (Fig. 4).

The lifting of the driving ban also brought a flood of patients into the Emergency De-

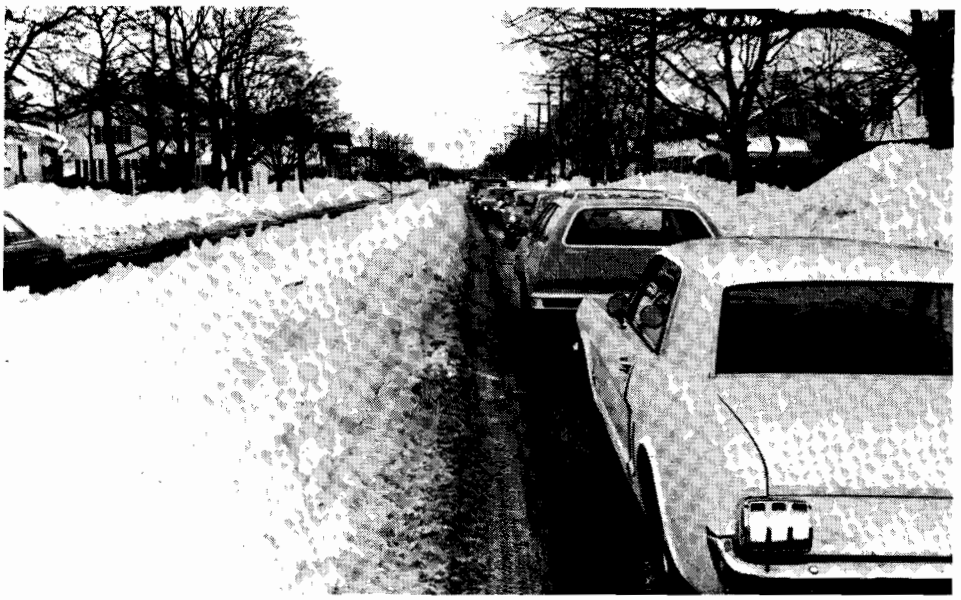

Fig. 4.

partment. Many of the patients seen on these 2 days had illnesses and injuries of minor nature but a larger than normal number of patients with serious illnesses continued to arrive. This pattern continued through the following day as well. By this time, medical and nursing staff were fatigued and the sudden increase in the number of patients placed a severe strain on them. By Sunday evening, (6 days after the storm began) the patient load in the Emergency Department returned to normal and it became possible to reinstate normal 8 hour shifts.

CONCLUSIONS

During the record snowstorm which blanketed Rhode Island on February 6, 1978:

1. Most people in the area were released from work at the same time. This resulted in the main roads and highways becoming clogged with traffic.
2. The Interstate Highways were left open. Had these been closed when it became apparent that a major storm was in progress, automobiles would have been forced to use secondary roads. When vehicle occupants leave their vehicles on an Interstate Highway, there is no means of obtaining shelter, other than to seek the nearest entrance or exit ramp, leave the highway and then look for the nearest building. In the case of most secondary roads, houses and other buildings are adjacent to them and much more readily available for shelter.
3. With the exception of 1 area television station, there was no major source of information. Many people in the area were sheltered in schools, etc. while others were without power. Most had radios but few of these people had access to a television set. Radio stations in the area carried on with regular programming and information was only occasionally given. As a result, people were not kept fully informed of what was really happening and of how to obtain aid and services in emergency situations. Secondary shelter areas, restaurants, service stations, etc. were not announced. The result was that telephones were used unnecessarily and long waits for a dial tone resulted.
4. The travel ban was not gradually lifted in most areas. This resulted in numerous

automobiles suddently appearing on roads which were still quite narrow and deeply rutted. Many of these became stalled and long line-ups occurred. This hindered the continuing efforts of Rescue and other essential vehicles.

5. The use of physicians to triage incoming Fire Department Rescue calls resulted in cutting down the number of Rescue runs to approximately half. This is an area which should possibly be looked into for permanent implementation.

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PREDICTING RESPONSE TO HURRICANE WARNINGS: A REANALYSIS OF DATA FROM FOUR STUDIES

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INTRODUCTION

With the rapid buildup of population in coastal areas, concerns are growing that hurricane disasters involving thousands of casualties may lie in the nation's not-so-distant future (American Meteorological Society, 1976; Baker, 1978). The principal means of averting such losses is the process of warning and evacuation, the adjustment which is primarily responsible for the trend of decreasing hurricane deaths since the turn of the century (National Oceanic and Atmospheric Administration, 1972). General consensus exists that major improvements in forecasting hurricane landfall locations is unlikely in the foreseeable future, however. For that reason, one outgrowth of the National Science Foundation-supported Assessment of Research on Natural Hazards project was a recommendation that research into issues which could improve warning response be given increased priority (Brinkmann, 1975). As a member of the team which formulated that proposition, I feel that a more critical examination of the role of social scientific research into the hurricane warning-response system is merited.

Studies dealing with hurricane evacuation date back to at least 1953 (Rayner), but four post-hurricane sample surveys provide the basis of most of what is known (or believed) about human response to hurricane warnings (Moore et al., 1963; Wilkinson and Ross, 1970; Baker et al., 1976; Windham et al., 1977) [1].

The four sample survey studies mentioned above will be reviewed, and their analyses will be extended with respect to one dependent variable: whether or not the survey respondent evacuated his or her home in response to the hurricane warning. The goal of the review is to identify useful variables which predict evacuation behavior. Three criteria will be employed for selection of useful predictors: (1) statistical significance, (2) strength of association, and (3) replicability. Initially a χ^2-test of independence is performed for each contingency table. If a relationship between evacuation and the predictor is detected at the .05 level of significance, a measure of the strength of the association (Goodman and Kruskal's τ_b) is computed. Finally, consistency of the findings across studies is assessed. All statistics reported for the Moore et al., Wilkinson and Ross, and Windham et al. studies were computed by the author from raw data appearing in the original survey reports. Most of the statistics for the Baker et al. study were computed from data not appearing in the original report.

THE STUDIES AND THEIR STORMS

Specific characteristics of a given storm affect the warning process and, presumably, the response to warnings. For example, storm intensity, storm behavior prior to landfall, time of landfall, and speed of onset of a hurricane might interact with the predictor variables to affect the evacuation decision. To explicate as many of the relevant warning response factors as feasible, the three hurricanes are discussed below.

Carla [2]

The first major investigation of hurricane warning response occured a few weeks after hurricane Carla in 1961. Carla appeared as a tropical depression in the Caribbean on Monday, September 4, eventually moved through the Yucatan channel into the Gulf of Mexico, and by Friday (September 8) was labeled a "large and dangerous" hurricane. Forecast landfall location was revised several times westward; on Friday, Carla was expected to hit in the area of the "mouth of the Mississippi." Saturday the storm was forecast to make landfall near the Sabine Pass, and evacuation was advised from low-lying areas of Louisiana and the upper Texas coastlines. At that point, however, Carla became almost stationary still more than 200 miles offshore, alternately threatening Galveston and Corpus Christi. Finally, during late afternoon on Monday, September 11, the hurricane made landfall about 60 miles northeast of Corpus Christi. As predicted, it was a large and severe hurricane, with hurricane-force sustained winds extending over an area more than 100 miles wide. Peak gusts were estimated at 175 m.p.h., and storm surge was over 16 feet; wave uprush established an inside high water mark of 22 feet.

Number of evacuees might have been as high as half a million, or more than 60% of the population of the warning area. "Only" 45 deaths were reported, and the evacuation was regarded as successful, compared to what some observers expected (almost 600 were killed in southwestern Louisiana by Audrey just four years before).

Interviews were conducted in more than 1,500 households ranging from Cameron Parish, Louisiana to Calhoun County, Texas (the area of maximum impact). Data was collected a few weeks following the hurricane (Moore et al., 1963).

Camille [3]

Tropical storm Camille was first sighted 500 miles south of Miami on Thursday, August 14, 1969. The following day Camille became a hurricane, and on the next day (Saturday) a hurricane watch was issued from St. Marks, Florida to Biloxi, Mississippi. As the storm moved northwest in the Gulf of Mexico, it was expected to turn northward, but persisted more westerly. Consequently, warnings were shifted westward: the first warnings were for the Florida Panhandle area, then extended to include Biloxi, and then to Grand Isle, Louisiana. Early Sunday morning (August 17) Camille was 250 miles south of Mobile, Alabama, and residents of the eventual landfall area were being advised to evacuate (with predictions of 15–20 foot storm tides). The worst hurricane in most residents' memories had struck in 1947 and served as a point of reference. Moving at about 15 m.p.h., Camille made landfall just west of Pass Christian, Mississippi at 11:00 Sunday night. The storm surge was the highest on record – almost 25 feet – and winds were estimated to have climbed up to 200 m.p.h., with 150 m.p.h. gusts extending 50 miles laterally. One-hundred forty deaths were reported, 5,000 homes were destroyed, and 12,000 homes were heavily damaged.

Researchers from Mississippi State University interviewed approximately 400 respondents four to six weeks after the hurricane had struck. All interviews were in Harrison County, Mississippi, including the hardest hit area and extending 25 miles eastward. Interviewing was confined to an area within a few blocks of the water's edge (Wilkinson and Ross, 1970).

Eloise [4]

Late on Tuesday, September 16, 1975 tropical storm Eloise intensified to hurricane strength near the Dominican Republic. Subsequently, the cyclonic system diminished in power, but after crossing the Yucatan Peninsula on the 21st, Eloise reintensified and attained hurricane status again on Monday, the 22nd. At that time the storm was 350 miles south-southeast of New Orleans and had been moving to the north-northwest. Shortly after that, a little more than 200 miles south of New Orleans, Eloise turned north-northeasterly. National Hurricane Center advisories made the storm appear to slow its forward speed, then turn more easterly, then northly than was actually the case. Warnings issued early on the 22nd from Grande Isle, Louisiana to Apalachicola, Florida were extended eastward to include Cedar Key, Florida shortly after midnight. At 9:45 p.m. on the 22nd a National Weather Service statement advised relocation from low-lying places in the area which was eventually struck hardest, and 10-foot above normal tides were forecast.

Landfall occurred at 7:00 a.m. on Tuesday, September 23, halfway between Fort Walton Beach and Panama City Beach, Florida (60 miles east of the center of the warning area delineated on the morning of the 22nd). Maximum winds were estimated at 125 m.p.h., and the surge height reached 12–16 feet in some places. Peak surge lasted only 30 minutes as the hurricane moved forward at almost 25 m.p.h. Possibly because the eye of the storm and its most destructive quadrant passed over a realtively undeveloped area and because it struck after the Labor Day peak in tourism, no deaths were attributed directly to Eloise. Destruction in Fort Walton Beach and especially Panama City Beach resulted in $ 100 million in damages. An estimated 100,000 people from an area extending as far west as Mississippi evacuated. Eloise was the first major hurricane to affect Panama City this century; Agnes was espected to strike the area in 1972 but passed well to the east, prompting business interests to threaten a lawsuit against the National Weather Service as a result of tourists avoiding the area after hearing the "false" warnings.

A group at Mississippi State University, working with the National Weather Service since 1974, had prepared an interview schedule for use in a post-hurricane situation, and Weather Service personnel put it into practice just a week after Eloise struck. Two-hundred fifty interviews were conducted in the Fort Walton Beach-Destin area, and approximately 125 were gathered in Panama City Beach (Windham et al., 1977).

As part of a Florida Sea Grant study of the social impact of Eloise, a group from Florida State University also conducted interviews dealing with warning response. Interviews with 200 residents of Panama City and Panama City Beach were effected three months after the hurricane (Baker et al., 1976).

Summary

The storms studied had three principal characteristics in common: (1) they were all major hurricanes, (2) they all presented landfall forecasting problems, with warnings being revised a number of times, and (3) despite the early errors in exact landfall location, all three storms afforded lengthy periods of monitoring. They were also different in several respects:

(1) each struck a distinctly different coastal area, (2) each struck at a different time of day, and (3) the fatalities varied widely.

PREDICTORS OF EVACUATION

Over 75 variables were tested to assess their ability to predict evacuation. They have been grouped into 13 categories for the ensuing discussion.

Sources of information (Table 1)

Most coastal residents receive the majority of their information about threatening hurricanes from the media – primarily television, followed by radio. Source of information has little or no association with evacuation, however. How people first hear about a storm, how they receive their monitoring information about it, and how they first hear that it is expected to strike their area appear to make no difference. Radio broadcasts were found to be slightly more strongly related to high evacuation rate than television in one study, but the results did not replicate in a second investigation.

Evacuation advisements (Table 2)

Respondents who recalled being advised to evacuate before Carla were significantly more

TABLE 1

Sources of Information vs. Evacuation

Variable	Study	df[a]	P(χ^2)[b]	τ_b[c]
How 1st heard of storm	Eloise (FSU)	1	NS	
Primary source of information (radio vs. TV)	Eloise (FSU)	1	NS	
	Eloise (FSU)	1	NS	
Source of 1st warning (radio vs. TV)	Carla	1	.001	.01
	Eloise (FSU)	1	NS	
(media vs. other)	Carla	1	NS	
	Eloise (FSU)	1	NS	

[a] df indicates the degree of freedom in the contingency table. 1 + df gives the number of categories of the predictor variable.
[b] P(χ^2) indicates the significance level of the χ^2-test of independence performed on the data. NS indicates non-significance at the .05 level.
[c] τ_b indicates a measure of the strength of association in the contingency table, Goodman and Kruskal's τ_b.

TABLE 2

Evacuation Advisement vs. Evacuation

Variable	Study	df	P(χ^2)	τ_b
Advised to leave	Carla	1	.001	.11
	Eloise (FSU)	1	NS	
Officials went through neighborhood	Eloise (FSU)	1	NS	
Source of orders or advice	Carla	2	.01	.03

TABLE 3

Storm Watching vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
When 1st heard about storm	Eloise (FSU)	1	NS	
Care in monitoring storm	Carla	1	NS	
Length of time storm monitored	Eloise (MSU)	2	NS	
Kept tracking chart	Eloise (FSU)	1	NS	
Frequency of media monitoring	Eloise (FSU)	2	NS	
Increase in media monitoring	Eloise (MSU)	2	NS	
Lateness of media monitoring	Eloise (FSU)	1	NS	
	Eloise (MSU)	3	NS	
Warnings verified	Carla	1	.001	.01

likely to leave than those who had no such recollection, but the finding was not evident in Eloise. Officials going through a neighborhood "ordering" evacuation was not found to have made a difference in Eloise either. In Carla civil defense personnel were slightly less successful in eliciting evacuation than public officials.

Storm watching (Table 3)

The attention devoted to monitoring the threatening hurricane is almost totally unrelated to whether one evacuates. It does not matter (1) how early one becomes aware of the hurricane, (2) how carefully (self-reported) one monitors the storm, (3) how long one monitors the storm, (4) whether one keeps a hurricane tracking chart, (5) how often one seeks media information about the storm, (6) whether one watches or listens to media weather information more frequently than usual, or (7) (in a special case when landfall occurred at 7 a.m.) whether one stayed up late monitoring the media the night before.

People who had a second source verify warnings of Carla were slightly more likely to evacuate than people who did not have verification of the information.

Belief storm would hit (Table 4)

Coastal residents who believe a hurricane will strike their area might reasonably be expected to be more likely to evacuate than residents who do not believe the storm will strike. Data tend to bear this out, but the relationship is weak and pertains only shortly before landfall. No time frame was reported for the Carla study, but "believers" were slightly more likely to evacuate. Ten or more hours before actual landfall, respondents to the Camille and Eloise (MSU) surveys could not be differentiated with respect to eventual evacuation on the basis of whether they believed the hurricane would strike. Three to seven hours before landfall, believers were a little more likely to leave. The FSU study of Eloise found no difference eight hours before landfall.

TABLE 4

Belief Storm Would Hit vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Expected direct hit	Carla	1	.001	.01
Expected direct hit at:				
14 hours before landfall	Camille	1	NS	
10 hours before landfall	Camille	1	NS	
4 hours before landfall	Camille	1	.01	.03
8 hours before landfall	Eloise (FSU)	2	NS	
18 hours before landfall	Eloise (MSU)	1	NS	
10 hours before landfall	Eloise (MSU)	1	NS	
7 hours before landfall	Eloise (MSU)	1	.01	.02
3 hours before landfall	Eloise (MSU)	1	.01	.03

Expectation of damage (Table 5)

A much better predictor of evacuation is how bad one expects the storm to be. Those who expected wind damage to be high in Camille were most likely to leave, as were those who expected winds to do damage to roofs in Eloise. People who thought winds would be strong enough to overturn automobiles were even more likely to evacuate, and to a lesser extent the same was true of people who expected surge from Eloise to reach their house. Related to expected water damage is how high one believes his house to be above mean sea level. Mississippi residents who believed their elevation to be lower than 15 feet above mean sea level were most likely to evacuate before Camille. Respondents in the "don't know" category were also highly probable to leave their homes.

Confidence in weather forecasting (Table 6)

Only one of the four studies attempted to relate confidence in weather forecasts to evacuation, and the results are confusing. People who believe that weather reports are usually accurate were more likely to evacuate than people who do not believe in forecasts, but the frequency with which respondents listen to forecasts was unrelated to evacuation.

TABLE 5

Expectation of Damage vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Wind damage anticipated	Camille	1	.01	.03
Wind damage anticipated to roofs	Eloise (MSU)	1	.001	.03
Wind damage anticipated to autos	Eloise (MSU)	1	.001	.06
Water damage anticipated	Camille	1	.001	.11
	Eloise (MSU)	1	.001	.03
Perceived elevation	Camille	5	.001	.06

TABLE 6

Confidence in Weather Forecasting vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Confidence in weather forecasts	Eloise (FSU)	1	.01	.03
Listen to weather forceasts often	Eloise (FSU)	3	NS	
Confidence in hurricane landfall	Eloise (FSU)	3	.01	.06
		1	NS	
Confidence in hurricane severity	Eloise (FSU)	3	.003	.08
		1	NS	

There is strong evidence that confidence in forecasts regarding a hurricane's landfall location and severity is associated with evacuation, but the meaning of the relationship is unclear. Respondents who felt that landfall predictions are almost always right or rarely right (the opposite extremes) were least probable to leave. Those in the "usually right" and "sometimes right" categories evacuated more frequently. When Table 6 is collapsed to two categories of confidence ("almost always/usually," "sometimes/rarely") the association with evacuation vanishes. People who feel that predictions of hurricane severity are almost always right were the least likely to evacuate, and the "sometimes right" category had the highest proportion of leavers. Again, when Table 6 is collapsed to only two categories of confidence, no relationship is detected.

Recall of forecast information (Table 7)

Regardless of time period before landfall, respondents who recalled the forecast wind speeds of Camille and Eloise within 10 m.p.h. were no more or less likely to evacuate than those who could not recall the forecast wind speed. In Eloise, people who recalled the forecast most accurately were less prone to evacuate than those who either overstated or understated the forecast. Residents who could recall what the predicted surge height had been 10 hours before landfall could not be differentiated from those who could not recall, but those who recalled the four-hour predic-

TABLE 7

Recall of Forecast Information vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Recall of predicted wind (w/in mph)	Camille	1	NS	
	Eloise	1	NS	
Recall of predicted wind (over/under)	Eloise (MSU)	2	.01	.02
Recall of predicted water (w/in 2 ft.):				
10 hours before landfall	Camille	1	NS	
4 hours before landfall	Camille	1	.05	.01

tion were actually least likely to have left. The latter counter-intuitive finding may be attributable to the fact that most leavers had evacuated more than four hours before landfall, thus they would be less likely to have heard the surge prediction made at that late hour.

Knowledge about hurricanes (Table 8)

One commonly espoused solution to enhancing evacuation is public education; i.e., making the public more aware about hurricane dangers and proper response to warnings (see Christensen and Ruch, 1977). The effect which such programs have on evacuation is questionable, although they may be useful in bringing about behaviors other than those tested for in this review. In point of fact, knowledge about hurricanes and hurricane safety rules were consistently not found to be associated with evacuation behavior. The only variable in this category which might constitute an aspect of hurricane awareness that was related to evacuation was knowledge of one's homesite elevation. Respondents who could give their elevation within one foot accuracy were considerably less likely to evacuate than people who either overestimated or underestimated their elevation.

(Recall from Table 5 that residents who believed their elevation to be low or did not know their elevation were most probable to leave.) Knowledge of hurricane terms, familiarity with hurricane safety rules distributed by the National Oceanic and Atmospheric Administration, and awareness of the existence of or location of public shelters were all *un*-associated with evacuation.

Previous hurricane experience (Table 9)

Measurement of an individual's previous hurricane experience is difficult because the measure usually depends on the respondent's recall and beliefs. A common error is for

TABLE 8

Knowledge about Hurricanes vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Knowledge of house evaluation	Camille	1	.001	.04
Number of hurricane terms known	Camille	1	NS	
Number of hurricane safety rules known	Camille	1	NS	
	Camille	2	NS	
Had seen copy of rules	Camille	1	NS	
Had heard of list of rules	Camille	1	NS	
Knowledge of public shelters	Eloise (FSU)	1	NS	
Knew definition of "warning"	Eloise (MSU)	1	NS	
Knew definition of "low-lying-area"	Eloise (MSU)	1	NS	
Possessed copy of safety rules	Eloise (MSU)	1	NS	
Had heard of list of rules	Eloise (MSU)	1	NS	

TABLE 9

Previous Hurricane Experience vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Previous disaster experience	Carla	1	NS	
Previous hurricane experience	Camille	1	NS	
Number of hurricanes experienced	Camille	1	NS	
Previous hurricane experience	Eloise (FSU)	1	NS	
Recency of hurricane experience	Eloise (FSU)	2	NS	
Previous hurricane experience	Eloise (MSU)	1	NS	
Severity of previous hurricane	Eloise (MSU)	2	.02	.02
Damage in previous hurricane	Eloise (MSU)	1	NS	
Family injury in previous hurricane	Eloise (MSU)	1	NS	
Evacuated in previous hurricane	Carla	1	.001	.03

coastal residents to believe they were affected by hurricanes to a greater degree than they actually were. That is, they might have only been on the fringes of a hurricane system, receiving gale-force winds, but believe they experienced the storm's full strength. All the variables in Table 9 are subject to that sort of error to varying degrees. Furthermore, all three study areas are on the Gulf Coast, the region of the United States which had the greatest frequency of hurricane activity during the 1960's and early 1970's. Thus, to some extent, the aggregate "background experience level" for the area as a whole was higher than other parts of the U.S. coastline during the same period.

Taking the results at face value, however, it seems clear that presence or absence of previous experience, *per se*, is unrelated to evacuation. The same is true with respect to the number of hurricanes experienced, recency of one's experience, and whether damages or injuries were suffered by one's household. Severity of hurricanes experienced previously was related to evacuation in Eloise, but those who had experienced a major hurricane (which meteorologists classify as major) were less likely to evacuate than respondents who had experienced a low-intensity hurricane or who had no previous experience. Residents who had evacuated in previous hurricanes were also the most probable to evacuate in Carla.

Length of residence (Table 10)

Two concerns have been expressed frequently that relate the length of time an individual has lived in a coastal area to his or her probability of evacuating: (1) over three-fourths of the residents of coastal counties have never experienced a major hurricane due to their short period of residence, and (2) some coastal areas have had no major hurricane for so long that long-term residents may be complacent (Hebert and Taylor, 1975). The experience

TABLE 10

Length of Residence vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Number of years lived in area	Camille	1	NS	
	Eloise (FSU)	1	NS	
	Eloise (MSU)	1	.01	.02
Number of years lived in home	Camille	1	.05	.01

issue was discussed in the previous section; the relationship between residence period and evacuation is unclear, but probably weak.

One of the four studies on which this review is based (Windham et al., 1977) reported evidence of a strong association between length of residence and evacuation, asserting that Wilkinson and Ross' (1970) Camille data also supported their finding. The generalization (labeled the "experience-adjustment paradox") indicated that newer residents were more likely to evacuate than residents who had lived in the study area for a longer period (five years or more). The Mississippi State study of Eloise does reveal a weak association consistent with the "paradox," but the Florida State survey found no relationship, and the published Camille data, analyzed again for this review, indicated no association either. The Camille study does, however, suggest that people who had lived at the same address (not just the study area) for less than five years were slightly more likely to evacuate than people living at the same address five years or more.

Site characteristics (Table 11)

An encouraging finding is that people who most need to evacuate appear to be the most

TABLE 11

Site Characteristics vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Homesite elevation	Camille	4	.001	.19
Geographical area of risk	Camille	3	.05	.02
	Eloise (FSU)	2	.001	.09
	Eloise (MSU)	4	.001	.11
Damages sustained	Camille	3	.001	.05
	Eloise (FSU)	2	NS	
	Eloise (MSU)	2	NS	
Age of house	Camille	3	.05	
Construction materials	Camille	3	.05	.02
Number of stories	Camille	1	.01	.02
Type of dwelling	Eloise (MSU)	2	NS	

likely to leave, although variables in this section may be confounded with other predictors of response to an extreme degree. Elevation of the respondent's home above mean sea level exhibited one of the strongest associations with evacuation produced by any of the four studies. The relationship was clearly monotonic with people living in lowest-lying areas being the most likely to leave. Recalling Table 8, respondents who were most knowledgeable about their residential elevation might have been those whose elevation was highest. Unfortunately, the variable was reported only in the Camille study, although other – less straightforward – variables suggest the same conclusion. In Camille evacuation was greatest in the hardest hit area (Pass Christian and Long Beach). In the Eloise study reported by Windham et al. evacuation was considerably higher in the beach areas (Okaloosa, Destin, Panama City Beach) than in the more protected areas fronting Chotawhatchee Bay. The Florida State survey following Eloise indicated that evacuation was highest in the beach areas, then the bay-bayou areas, and finally, inland areas.

Damages sustained were related to evacuation only in Camille. In Eloise, however, the more severe damage was concentrated in the beachfront area of Panama City Beach, and owners of those structures were generally unavailable for interview either because they were not permanent residents of the area or because the structure was damaged beyond habitability. Thus, there was relatively little variation in damages experienced by most of the sample respondents.

The Camille study included several variables relating to construction attributes of the respondent's house. Age of the house was not associated with evacuation, but people living in two-story structures were less prone to leave than people living in one-story buildings. Mobile homes were categorized as a type of construction material (rather than wood, brick, veneer, or masonry), and their dwellers were the most probable to evacuate. One of the Eloise investigations (MSU) classified mobile homes as a type of dwelling (vs. single-family and apartment) and found no relationship with evacuation.

Demographic characteristics (Table 12)

The most consistently collected data might be grouped loosely under the heading of demographic attributes of the respondent. Certain characteristics – sex, marital status, and occupation – were unassociated with evacuation in any of the four studies. Education was related to leaving in only one of the four studies in which it was tested; income, number of children in the respondent's family, and number of families in the respondent's dwelling were tested and found associated with evacuation only in the Carla study. Whether the respondent owned or rented his or her dwelling was investigated in three of the studies but found to predict evacuation in only one.

Age is frequently mentioned as a critical variable because of the restricted mobility of older people. The Camille and Eloise surveys reported by Mississippi State revealed no relationship between age and leaving. The Carla study found a weak association, with residents over 60 being slightly less evacuation-prone than people between 40 and 60, and both groups being less likely to leave than respondents between 20 and 40. The authors of the report noted, however, that although the older age group was least probable to evacuate, the respondents stated that they chose voluntarily not to leave, and were not forced to stay in their homes because of low mobility. The Baker et al. survey after Eloise indicated that when age was classified into five categories, the youngest group (18–25) was most likely to evacuate and the oldest group (over 60) was second

TABLE 12

Demographic Characteristics vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Age	Carla	2	.02	.01
	Camille	2	NS	
	Eloise (FSU)	4	.03	.01
		2	NS	
	Eloise (MSU)	2	NS	
Education	Carla	2	.001	.03
	Camille	2	NS	
	Eloise (FSU)	2	NS	
	Eloise (MSU)	2	NS	
Income	Carla	3	.001	.04
Occupation	Carla	5	NS	
	Camille	7	NS	
	Eloise (MSU)	7	NS	
Marital Status	Camille	1	NS	
	Eloise (FSU)	1	NS	
	Eloise (MSU)	1	NS	
Sex	Carla	1	NS	
	Camille	1	NS	
	Eloise (FSU)	1	NS	
	Eloise (MSU)	1	NS	
Number of children in family	Carla	3	.001	.01
Number of families in building	Camille	1	.01	.03
Health	Eloise	2	NS	
Owner/renter	Camille	1	NS	
	Eloise (FSU)	1	NS	
	Eloise (MSU)	1	.01	.02

TABLE 13

Miscellaneous Variables vs. Evacuation

Variable	Study	df	$P(\chi^2)$	τ_b
Extent of neighborhood evacuation	Carla	2	.001	.24
	Camille	1	.001	.05
	Eloise (FSU)	3	.001	.13
Felt role conflict	Carla	1	NS	
Degree of discussion	Carla	1	.001	.02
With whom discussed	Carla	1	.01	.01
Number of emergency preparations	Eloise (FSU)	1	NS	
Home weather instruments	Eloise (FSU)	1	NS	
Boat ownership	Eloise (FSU)	1	NS	
Church attendance	Eloise (FSU)	1	NS	

most probable (although appreciably less so than the first group). When categories are collapsed to conform to those reported in Table 12 for the other three studies (18–40, 41–60, over 60), no significant difference in evacuation rate existed for the three groups.

Miscellaneous variables (Table 13)

Several additional variables fit into no general category on the basis of commonality with other variables. One of the best predictors consistently identified is the extent of evacuation which took place in the respondent's neighborhood. People who lived in areas from which most of their neighbors evacuated were also likely to have evacuated. One explanation traditionally proposed for this association is a conformity phenomenon: people are reluctant to leave if their neighbors are not leaving and are reluctant to stay if their neighbors are not staying. The variable is hopelessly confounded with other predictors, however. The association probably reflects the fact that evacuation rate was greatest in the most hazardous areas and that Civil Defense or other officials advised or ordered evacuation from those areas. Thus, if a respondent evacuated from a neighborhood in which most others did the same, he or she and the others may have been motivated primarily by a commonly perceived need to leave and may have acted independently of one another.

The Carla study looked into a number of elements of the respondent's decision process. Feeling an obligation to fulfill roles (such as professional) which would prevent someone from evacuating apparently did not keep him or her from leaving. Those who discussed the evacuation issue with others a great deal were more likely to evacuate, and those who had discussions with people outside their family were more probable to leave than those who had discussions with family members only.

The number of emergency preparations made by the respondent, operation of home weather instruments, boat ownership, and church attendance all failed to exhibit a relationship with evacuation.

CONCLUSIONS

The list of variables selected and analyzed for this review is not totally exhaustive of those reported in the published reports, but it is extensive and representative. Many other warning response issues such as time of evacuation and how far away people evacuated are not addressed. More discussion, qualification, and explanation of findings reported here could have been included in each predictor variable group, but the cost would have been a much longer article. The general comments below may serve the same purpose at lesser length.

Strength of relationship

The four studies are characterized by failure to identify consistently strong predictors of evacuation. The first of the studies (Moore et al.) is replete with significant χ^2-tests, but the huge sample size (1,500) overstated the importance of the variables. Indeed the best measure of strength of relationship in contingency tables is open to debate. Goodman and Kruskal's τ_b allows comparison of two or more tables regardless of sample size or the number of categories involved, and it satisfies the convention of a value of zero implying complete lack of association and a value of one implying perfect association. In this case the value indicates the reduction in one's probability of error in predicting whether or not a respondent evacuated, if one knows something about the respondent with respect to the predictor variable in

question. From Table 13, for example, one would be 24% less likely to err in predicting whether a respondent evacuated in Carla, if it were known to what extent the respondent's neighborhood evacuated.

Of the 120 contingency tables reviewed here, a third of them produced relationships significantly greater than zero (at the .05 level or better). But only 14 of the significant tables yielded a value of τ_b greater than .05 and only six gave a value greater than or equal to .10. The strongest relationship was .24.

A ten percent reduction in error in predicting evacuation is less than overwhelming, but the τ_b measure is more arbitrary than it may appear. Goodman and Kruskal's λ, a similar "reduction in errors" measure, usually gives a larger value than τ_b, but sometimes gives a value of zero when an association is actually present. Some observers might feel the "proportional reduction in errors" understates the difference which might exist across categories of the predictor variables. For example, in Eloise, 85% of respondents who believed water would reach their house evacuated, compared to 66% of those who didn't believe it would. The τ_b value was only .03.

Causality, control, and multiple effect

The matters of association, prediction, and relation are quite distinct from causality. As poor as existing research is at identifying predictors, in no case can it be said that the studies have revealed what causes evacuation. Surely much of the association of certain variables with evacuation is causal, but previously published inquiries have yet to demonstrate that assertion.

The Carla study in a few isolated cases did "control" for one predictor variable while testing for association between another predictor and evacuation. It thereby sometimes produced qualifications for the relationship detected: discussion was associated with greater evacuation only if people were not ordered to evacuate, for example. Such a test is the exception rather than the rule, however, and the formal process of testing for higher order interactions is unreported in hurricane evacuation literature. Whereas individual variables do not predict evacuation well, it is unknown how well combinations of variables already tested can predict when acting together.

Measuring evacuation

Part of the failure to identify powerful predictors may stem from inappropriate measurement of evacuation. All four of the studies reviewed simply measured whether the respondent left home seeking safety from the hurricane. (The Carla study differentiated between leavers who went to local shelters and those who went out of town, but the two groups were combined for this review to make the studies comparable.) It is tempting to presuppose that evacuation is the proper warning response and that it is the behavior which should be maximized.

It is probable, however, that some of the stayers did not need to evacuate and that some of the leavers would have been safe staying at home. Thus, evacuation may not always be the proper response. Deciding who did not need to evacuate is tricky business, and employing hindsight is cheating because the respondent did not have benefit of such knowledge in reaching his evacuation decision. Storm surge was underestimated in Camille and Eloise, and "hurricane proof" houses have been demolished by hurricanes. Caution is certainly advisable. In the four studies reviewed, few of the respondents probably should have stayed home, so the measurement problem may have been small.

A more discriminating measure of evacu-

ation might also be revealing. For example, how early an evacuee leaves, how far he or she goes, and what form of shelter he or she seeks might be associated with predictors more strongly than the coarser indication of whether the respondent left or not.

Future directions for research

The most reassuring conclusion evident in the surveys is that the most risky areas have been the most extensively evacuated. The studies reveal little, though, that will be effective in enhancing the likelihood of evacuation. This is not to belittle the importance of the previous work, however. It has indicated limitations on the effects which might otherwise have been expected to result from manipulation of certain variables, and it has laid the groundwork for further efforts. Further efforts to identify correlates to evacuation should consider the following suggestions.

1. The correlates should be useful (i.e., manipulatable). A principal motivation for warning response research is to provide clues for bringing about more rational response to warnings. Identifying changes in dissemination procedures which might result in greater evacuation would be more useful than discovering personality traits which correlate with evacuation, for example.

2. Analyses should be more sophisiticated. The χ^2-test on two variables reveals too little; at the very least, interpretable measures of the strength of the relationship should be computed. Variables should be treated in combination to a) partial out the effect of inter-correlated predictors, b) test for interactions, and c) assess multiple prediction.

3. Controlled laboratory experiments should be pursued. Controlled experiments, despite limitations because of their lack of certain aspects of realism, may nevertheless provide indications of the relative importance of variables expected to affect evacuation and which are inter-correlated outside the laboratory. While some designs may be elaborate, others may consist of pencil-and-paper information-integration tasks.

4. Rather than simply assessing evacuation, a measure of appropriateness of response should be used. Ideally, a team of hurricane experts should judge, given the same information the respondent possessed, whether he or she should have evacuated. Alternatively, an area in which all residents should have evacuated might be employed as the sampling frame.

A multi-faceted study currently underway at the University of Minnesota is attempting to satisfy several of the above conditions. Predictor variables are combined and analyzed via discriminant analysis, a computer game (dealing with tornado warnings) is used to operationalize an experimental design, and a rough effort is made to evaluate whether evacuation is appropriate for respondents (Carter et al., 1978). Such steps are laborious and sometimes expensive, but given the shortcomings of previous surveys, such steps appear necessary if advances are to be made in enhancing evacuation.

NOTES

1 Generalizations produced by research into response to warnings of other hazards (Mileti, 1975) may in some cases apply as well to hurricane situations, but certainly there are a number of characteristics unique to hurricanes. Pertinence of findings from evacuation studies involving hazards other than hurricanes will not be included in this discussion.

2 Descriptions of the meteorological and warning aspects of Carla come from Moore et al. (1963) and Dunn (1962).

3 Descriptions of the meteorological and warning aspects of Camille come from Wilkinson and Ross (1970) and Simpson and Sugg (1970).

4 Descriptions of the meteorological and warning aspects of Eloise come from NOAA (1975) and Hebert (1976).

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EVACUATION DECISION-MAKING IN NATURAL DISASTERS*

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When seeking to manage the consequences of natural disaster, evacuation is an important tool in the hands of authorities. In particular, evacuation which is instituted *before* disaster impact can result in the preservation of life, reduction of personal injuries, and the protection of property. Thus, when there is sufficient forewarning – and evacuation is an appropriate coping strategy – pre-impact evacuation of a threatened population is an effective means of mitigating the negative consequences of natural disaster.

As a means of adjusting to natural hazards, evacuation is a process with a very long history. As early as the fifth century B.C., the Greek historian Herodotus described Egyptian evacuations in the face of the seasonal flooding of the Nile River. Indeed, evacuation is a concept which pervades journalistic, popular and professional literature on disaster. In spite of its apparent ubiquity, however, very little attention has been devoted to examining variables which are important in individuals' decisions to evacuate in response to a disaster warning.

This paper will review empirical studies of warning response, particularly focusing upon pre-impact evacuation of threatened populations, and summarize the available findings. The summary may be seen as a conceptual framework of inter-related hypotheses describing the relationships among variables which *past research suggests* are important in individuals' decisions to evacuate. This paper should not be seen as an attempt to develop a formal theory. Instead, it represents an effort to order the empirical literature by organizing existing findings into a general conceptual framework. The remainder of the paper is structured around three primary tasks: (1) development of a theoretical perspective of evacuation behavior; (2) a review of empirical literature; and (3) assembling findings into a tentative framework.

EVACUATION IN THE CONTEXT OF WARNING RESPONSE

Much of the early social scientific research on evacuation was conducted within the framework of man-made rather than natural hazards. Following World War II, a number of studies were released which focused on German (United States Strategic Bombing Survey, 1947a), Japanese (United States Strategic Bombing Survey, 1947b), and English (Titmuss, 1950) efforts to remove people from threatened cities and at the same

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time maintain the production and flow of military support goods. This literature however, tends to focus upon either the social psychology of stressful life events, or problems in the logistics of administration in evacuated areas (cf. Titmuss, 1950: 177–180). Although some research focused upon psychological factors in motivating families to evacuate and remain away from their homes (Janis, 1951), most studies were reports of the relative success of failure of various evacuation efforts and not specific attempts to integrate findings or develop principles for understanding the process of evacuation.

Although several studies conducted in the past decade have focused upon problems of evacuation (Drabek and Boggs, 1968; Drabek, 1969; Drabek and Stephenson, 1971; Mileti and Beck, 1975), there remains a paucity of analytic models which identify important variables and specify patterns of expected relationships. While research on evacuation in natural hazards has largely examined pre-impact attempts to remove threatened families, the literature is fairly small and widely scattered. Furthermore, some of the most comprehensive research was conducted as long ago as the middle 1950's (cf. Lammers, 1955, on the Holland floods). In this section, a theoretical context for evacuation will be developed as an initial step toward laying the basis for a framework describing the determinants of evacuation in natural hazards. The focus here is upon describing factors in *voluntary evacuation* which takes place prior to disaster impact.

Historically, students of natural hazards have treated evacuation as one possible protective measure which may be taken in response to a hazard warning message. Hence in the literature of disaster research, the study of evacuation is usually subsumed under the general rubric of warning systems and individuals' adaptive or protective responses. Most of these studies have used a social systems' view of warning processes (Chapman, 1962; Janis, 1962; Williams, 1964; McLuckie, 1970; Mileti, 1974). Such models typically emphasize macroprocesses operating on an aggregate level; concern is with detection–dissemination subsystems, response subsystems and the like. For example, Harry B. Williams (1964) basic warning response model is composed of parameters which are structural in nature. This essentially four-phase model represents the warning process in terms of:

1. Sources of information about the nature of the threat;
2. The official decision to issue a warning;
3. The channels through which the warning is communicated to the public; and
4. The response of the public.

Systems models have proved quite useful for research in which the primary unit of analytic interest is the community (cf. Dynes et al., 1972). Taken alone however, system models of community warning processes are less useful in representing factors that shape individual or family behavior.

Consequently, investigators interested in the individual as a primary unit of analysis have usually supplemented the social systems' framework with some social-psychological model. Such models have included psychoanalytic and psychodynamic framework (Tyhurst, 1951; Menninger, 1952; Leopold and Dillon, 1963), reference group or role theory approaches (Anderson, 1968; Form and Loomis, 1956), symbolic interactionism (Drabek and Boggs, 1968; Drabek, 1969), and behavioral principles (Mileti, 1974:35–46). The theoretical problem which must be given careful consideration when choosing a supplementary framework centers upon the difficulty some models have in allowing for the fact that processes important in warning response decisions proceed simultaneously at two levels of abstraction. For

example, we know that the individual's assessment of personal risk and the reality of the disaster threat are important factors in his decision to evacuate. But it is also known that two additional factors related to community preparedness, the content of the warning message and number of times it was received, contribute to assessments of risks and the formation of warning belief. Thus, we must be concerned *both* with aspects of the individual and attributes of the community system.

Psychoanalytic theories are not easily adapted to the consideration of factors *external* to the individual in explaining warning response (cf. Lifton and Olsen, 1976) and Mileti (1974:163–166) reports empirical difficulties in adapting behavioral principles to studies of warning responses. Descriptive research using a symbolic interactionist perspective appears promising, but as yet no systematic attempt has been made to explicitly formulate an analytic model based upon this approach. Recently some attention has been devoted to integrating one or more of the social-psychological perspectives with a systems model, thereby producing a flexible analytic paradigm which either implicitly or explicitly acknowledges the operation of processes at several levels of abstraction (cf. Drabek, 1969:336–337, Drabek and Stephenson, 1971:199–202; Gillespie and Perry, 1976:303–305; Perry et al., 1974:115–119).

Gillespie and Perry (1976), in an attempt to refine Barton's (1970) systems model of disaster behavior, have argued that by integrating the premises of an emergent norm approach to collective action (cf. Turner, 1964:389–392); Turner and Killian, 1972: 21–25) with a systems perspective, one gains the flexibility necessary to adequately characterize processes and interrelationships which prevail at both individual and community levels of abstraction. The adoption of an integrated systems-emergent norm approach also provides a framework for the *temporal ordering of factors* in personal reaction to warnings and helps to isolate important theoretical dimensions.

The emergent norm approach has been developed primarily by Ralph Turner and Lewis Killian (1972) as an alternative to contagion and convergent perspectives on collective behavior. Emergent norm perspectives focus upon the development of situational norms and expectations which arise as a function of some crisis or change in the social or physical environment which renders traditional norms inappropriate (cf. Fritz, 1957:8, Form and Nosow, 1958:14–28; Barton, 1963:20–22; Anderson, 1969:92–93; Anderson, 1968: 298–307). Drabek (1968:143–144) has succinctly summarized the emergent norm orientation to disaster behavior:

> Societies are composed of individuals interacting in accordance with an immense multitude of norms, i.e., ideas about how individuals *ought* to behave... Our position is that activities of individuals... are guided by a normative structure in disaster just as in any other situation... In disaster, these actions... are largely governed by *emergent* rather than established norms, but norms nevertheless.

Thus, human behavior in disaster can be conceptualized as nontraditional behavior in response to a changing or changed social and physical environment. The emergent norm perspective is concerned with the *process* beginning with changes in the stimulus environment which requires a new (or different) "definition of the situation" and ending with some change in the individual's behavior which is responsive to this different definition of the situation. With respect to the study of warning response, warning itself serves as the event which signals that a pending change in the environment could render traditional (established) norms inoperative. Thus, a redefinition of the situation is required, and situational norms are developed to cope with

the changed social and physical environment. The human response of interest is the act of evacuation – and the cluster of situational norms which encourage individuals to undertake that act or some other appropriate personal protective measure.

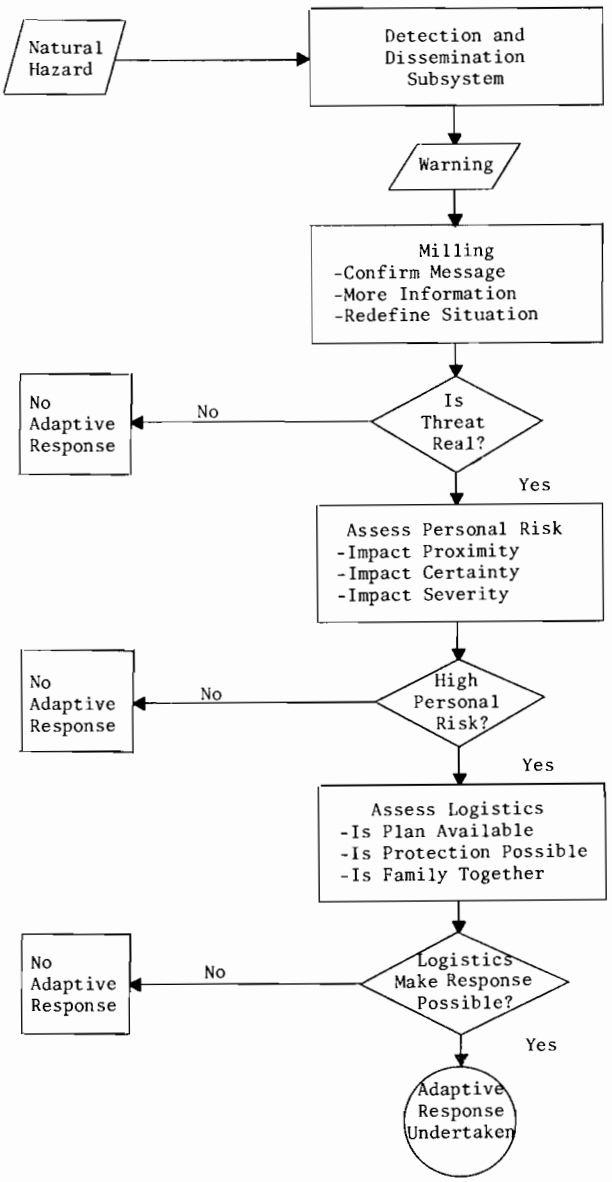

Fig. 1. Flow diagram of systems-emergent norm issues in individual response to natural hazard warning (arrows represent temporal paths).

The adoption of an emergent norm perspective highlights important processes typically ignored when systems theory is used alone: namely, those processes that operate *between* the issuance of a call to evacuate and the public response. Furthermore, a careful review of existing theoretical and empirical literature permits the isolation of specific processes that occur as part of post-warning redefinition of this situation. From the standpoint of an emergent norm approach, whether or not the desired response (e.g., evacuation) occurs is dependent upon the outcome of this process of redefining the situation. The major processes involved in post-warning attempts to restructure the normative environment are illustrated in Fig. 1. First, there is an initial milling process which focuses upon *confirming* the warning message, gathering further information and establishing a warning belief. Assuming that a warning belief is established, further milling centers upon the problem of assessing personal risk – the determination of one's *proximity* to the impact area and the individual's perception of the *certainty,* and probable *severity* of disaster impact. Finally, if personal risk appears high, necessitating some adaptive response, individuals assess the logistics of making such a response. Only *after* these processes have operated are we able to suggest that any protective response (evacuation or otherwise) will be undertaken.

It should be emphasized here that concern is with the application of certain tenets of emergent norm thinking to the problem of warning response in disaster. It is *not* the goal of this paper to elaborate an emergent norm "theory" of human behavior and derive from it propositions which explain evacuation decision-making. While such an undertaking would be commendable and in keeping with the highest standards of the philosophy of social science (cf. Homans, 1967; Blalock, 1969; Wallace, 1971), it is

both beyond the scope of the present paper and unnecessary for the task at hand. Indeed, to utilize emergent norm imagery (or any other theoretical perspective for that matter) to structure a problem which is subsequently addressed in terms of the existing empirical literature certainly does not depend upon a formalized elaboration of the theory. Finally, it is acknowledged that, as an approach to the study of collective behavior, emergent norm theory (like any other theory) has strong and weak points (see Tierney, 1977 for a thoughtful critique). Note, however, that emergent norm theory does unequivocally provide what is sought for this paper; namely, a set of ordering assumptions upon which a general framework for viewing evacuation behavior may be based (cf. Weller and Quarantelli, 1973:674).

DETERMINANTS OF EVACUATION BEHAVIOR

The emergent norm perspective, as outlined above, suggests three variables of major importance in evacuation: (1) the presence of an *adaptive plan,* (2) the individual's *definition of threat as real* (i.e., the development of a warning belief) and (3) the level of *perceived risk.* In addition to these variables which are included on theoretical grounds, there is considerable consensus in the empirical literature regarding the importance of three more variables: the *family context* in which the warning is received, the patterns of *kin relationships* in which the family is enmeshed and the level of *community involvement.* Using these six variables as a starting point, the following sections review pertinent research findings to identify other variables which are antecedent to these and assess the interrelationships among all of the variables, as well as the impact of each upon the target response – evacuation.

Adaptive plan

Studies of evacuation often overlook the fact that in order to effectively clear an area, residents must either have prior knowledge of some standing evacuation plan or be informed of such a plan by officials. Hamilton et al. (1955:120) interviewed a disaster victim who reported:

> We couldn't decide where to go or what to do. So we grabbed our children and stuff and were just starting to move outside. Where if it had just been ourselves, we might have taken out. But we didn't want to risk it with the children.

This family received a warning to evacuate, but had no plan which identified safe routes for exit or appropriate destinations. Thus, even if one wants to evacuate, the absence of a plan for so doing is sufficient to hinder any adaptive response.

The problems of families *not* evacuating (or evacuating to an even more dangerous location) when evacuation routes and destinations are not well known or well published has been widely documented with a variety of types of natural hazard (cf. Windham et al., 1977:15). Although not universally implemented, most manuals for community predisaster preparation encourage the planning and dissemination of evacuation routes (cf. Leonard, 1973; Healy, 1969). Therefore, the possession of adaptive plan, at a very minimum, a route and safe destination, is positively related to the probability of evacuation.

Research indicates that individuals' knowledge of an adaptive plan depends largely upon two factors: warning content and prior experience. Williams (1964:91–93) has pointed out that the most effective warning messages are clear, specific, consistent and, if possible, contain instructions for an appropriate protective response. The warning message itself, whether delivered via official

channels or through kin and friendship networks, is one source of an adaptive plan. It has also been reported that the *experience* of warning and/or evacuation provides the individual with a potential adaptive plan for future hazards, simply by replicating his past behavior (Bernert and Ikle, 1952:133–135).

Perception of threat as real

For *any* adaptive response to be defined as necessary, the individual must perceive the threat described in the hazard warning to be real. Hence, unless the warning is believed to be valid, no action (protective measure) is likely to be undertaken (cf. Janis, 1962:59–66; Williams, 1964:94; Anderson, 1968:299–304; Mileti, 1975:21–23; Janis and Mann, 1977). The importance of establishing a situational definition of real threat is underscored by the existence of a large empirical literature detailing the ways in which people go about *confirming* hazard warnings (Drabek, 1969:344; Drabek and Stephenson, 1971:195). In general, the empirical literature indicates that the greater the perceived threat the greater the probability of evacuation.

Four factors important in producing a warning belief or enhancing the individual's perception of threat may be derived from existing research findings: warning content, prior experience, the number of warnings received and the warning source. Warning content and prior experience with disaster are important in that each affords information to the individual upon which an assessment of threat is made (Lachman et al., 1961: 1409). A warning that contains precise information about the hazard and its probable consequences is more likely to create the "reflexive fear" which contributes to the individual's belief that the warning is to be taken seriously (Janis, 1962:59–66; Levanthal et al., 1967:314). Anderson (1969: 100) has also pointed out that individuals who have recently experienced a natural hazard are more sensitive to warnings and are more likely to attempt some adaptive response. Indeed, a study of people who left their homes in response to what turned out to be a false warning reports that "few of the evacuees complained about being misled by the false alarm: the vast majority said that they would evacuate again under the same circumstances" (Janis, 1962:85). Assuming that a warning is confirmed, it can be argued that previous experience with disaster (even with false alarms) enhances warning belief and the probability of an adaptive response. A recent study of evacuation in response to hurricanes on the Gulf coast would seem to contradict this contention by reporting that a large proportion of people who failed to evacuate were long-time residents of the area who presumably had previously experienced the problem (Windham et al., 1977). Two qualifiers must be considered in the interpretation of this finding. First, the data are *not* unequivocal; two communities were studied and in one of them, the proportion of people with prior experience is nearly the same among both "stayers" and "leavers". Secondly, hurricanes on the Gulf coast are a recurrent disaster threat, with possibly *several impacts* in a single season. Although empirical studies are not available, it is possible to speculate that under such conditions prior experience becomes a "constant" with *no* relationship to evacuation. This is another possible interpretation of the Windham et al. (1977:29) study. A more cautious interpretation of the data, however, would suggest that recent experience with a valid warning contributes positively to the development of a warning belief (i.e., perception of real threat).

There is evidence that the number of warnings an individual receives increases the

chance of an adaptive response. Drabek (1969:340–341) has indicated that a frequent response to an initial warning is disbelief; although subsequent warnings may provide no new information, it is argued that repetition increases warning belief (Mileti and Beck, 1976). Numerous studies have shown that individuals rarely evacuate after hearing a single warning and that additional warnings enhance the probability of evacuation (Mileti, 1974; Fritz and Marks, 1954: 41, Fritz and Mathewson, 1957:51–53).

Finally, research indicates that the more credible the source from which one receives a warning, the more likely one is to believe that the threat is real. Drabek and Boggs (1968:445), in a study of flood warning response, report that "families were warned through three distinct processes: (1) authorities, (2) peers, (3) mass media... those warned by an authority were less likely to be skeptable of the warning." The warning confirmation literature generally supports this contention, suggesting that people more often seek other sources for confirmation when they receive warnings from peers or media than when the source is an authority or kinsman.

Personal risk

In assessing personal risk, concern centers upon the individual's perception of the probability that impact of the hazard agent will result in great damage or destruction to his person or property (cf. Fritz and Marks, 1954:29–31; Diggory, 1956). Withey (1962: 104–107), in developing a series of stages of reaction to threat, emphasizes the importance of the individual's perception of "the probability of the impending event occurring [and] the severity, to the individual, of such a development." Put slightly differently, personal risk may be thought of in terms of individual's conception of his proximity to impact and the certainty and severity of the impact. Studies have shown that the perception of personal risk has a direct affect on the nature of the individual's response to a warning (Menninger, 1952:129; Williams and Fritz, 1957:46–50; Withey, 1964:86).

Glass (1970:64–67) in discussing "contingency responses" to threat points out that unless a person is convinced that impact is certain and that he is within the danger area, there is general reluctance to cooperate with emergency plans. Menninger (1952), in reporting evacuation problems during the summer of 1951's Kansas floods found that "an amazing number of people refused to believe that the flood would hit them... [and].. would not move themselves or their belongings out of their houses." Similar findings have been reported by Tyhurst (1951:764), and Danzig et al., 1958:51–53). Thus, it can be argued that a direct relationship exists between personal risk and the probability of evacuation.

Warning content and prior experience have been shown to be closely related to the individual's level of perceived personal risk. It is fairly routine that warning messages of an impending natural hazard contain information on where, when, and the probable force of disaster impact (Mogil and Groper, 1977; Moore et al., 1963:31–33; Williams, 1957: 15–19). Furthermore, the individual's prior experience, as well as his reading of environmental cues, contributes to the perception of personal risk (Drabek and Boggs, 1968:445–447; Windham et al., 1977:49).

Family context

As Killian (1952) has indicated, the study of human behavior in disaster must take into account the network of community and family roles in which the individual is immersed. Furthermore, research to date suggests that in the event of conflicting responsibilities among various roles, "the majority of persons involved in such dilemmas resolve

them in favor of loyalty to the family..." (Killian, 1952:311). In particular, we know that families faced with disaster seek to protect members (Quarantelli, 1960) and generally perform as units when undertaking any protective behavior. Studies of evacuation have revealed that "when they did evacuate, families left as units... these data provide additional support for the hypothesis that families move as units and remain together, even at the cost of overriding dissenting opinions" (Drabek and Boggs, 1968:446). Support for the contention that families evacuate as a group may also be drawn from studies of the bombing of London during World War II (Titmuss, 1950:172; Bernert and Ikle, 1952: 133–135). The primary consequence of these findings is to introduce an additional constraint on evacuation: unless the family is together or missing members are safely accounted for, evacuation will not occur. Thus, family context is positively related to the probability of evacuation.

Ethnicity and age indirectly effect family context. Family structure as well as kin relations, vary among ethnic groups. Staples (1976:123), for example, reports that "... the Black kinship network is more extensive and cohesive than kinship bonds among the White population... a larger proportion of Black families take relatives into their households." As indicated above, the structure of the household is important in defining family context. Age of the head of household is important for family context in two ways. In general, age correlates with the life-cycle position of the family, and especially among minorities, with the generational depth of the extended family household (Lansing and Kish, 1957:512). Furthermore, the presence of aged persons in a household (or a household composed of aged people), has been cited by disaster researchers as a factor which complicates family evacuation by increasing the complexity of family role responsibilities Thus, Ellemers (1955:421) points out that "old and sick people were unable to leave their homes at the time of the flood warning." Hill and Hansen (1962:186) have also observed that the "extended family household is poorly organized to meet threats and hardships, for its very young and very old members are often ill-equipped to meet such sudden challenges." In terms of our knowledge of family tendencies to adapt to disaster as a unit, it becomes clear that such "deficiencies" of individual family members reflect upon the performance of the group.

Kin relationships

Kin relationships are here conceived in terms of people's interaction and exchange patterns with their kinsmen. Several studies of communities in disaster have pointed out that very close kin relationships promote post-disaster recovery success among victims (Drabek et al., 1975:486; Bolin, 1976:268; Drabek and Key, 1976:90). Although less often studied, kin relationships also play an important role in the warning dissemination process and, consequently, in the promotion of successful adaptation to disaster warning (Clifford, 1956:113–124). In particular, one's interaction patterns with kin have an impact upon the content, source and number of warnings an individual receives.

Drabek and Stephenson (1971:199) report that "extended family relationships were crucial as warning messages and confirmation sources... telephone conversation with relatives during the warning period were usually a key factor." Official warning messages broadcast via mass media are sometimes vague, often not heard by all the potential victims, and are usually confirmed via some other source (Mileti and Beck, 1975:30; Drabek, 1969:341; Bates et al., 1963:11–13). Thus, kinsmen can supply both additional information (i.e., warning content), and serve as con-

firmation sources for hazard warning. It has also been found that people who hear disaster warnings relay the information to kinsmen who reside within the probable impact area (Drabek and Boggs, 1968:445–447). This has the immediate effect of *increasing* the number of warning messages received by potential victims. Furthermore, during such contacts help from kin which may promote a successful adaptive response to the warning may be offered or solicited. In studying flood evacuations, Drabek (1969:345) found many victims who evacuated in response to a relative's invitation to "come over and spend the evening just in case this thing might be serious."

Studies have shown that the nature and frequency of relationships with primary kin are very much affected by ethnicity, and age (cf. Litwak and Szelenyi, 1969:465; Sussman and Burchinal, 1968; 1962). In general, Anglo-American elderly are relatively more socially isolated (Bennett, 1973:179), and exhibit greater variation in income and wealth accumulation than minority elderly (Terrell, 1971: 363). Aged Blacks, in contrast, tend to be more uniformly poor but are also more actively involved in kin network (cf. Jackson, 1971; Kent, 1971; Babchuk and Ballweg, 1971). Jackson (1972:271) in a study of southern Black grandparents concludes that "these findings help to debunk myth of... the disintegrating or ephemeral kinship ties between aged and aging Blacks... they indicate that many Black grandparents serve as a point of anchorage for grandchildren and provide kinds of support for them unavailable from their own parents." Perry and Perry (1959: 45–59) have also commented on the greater cohesion among relatives in Black as opposed to White communities facing disaster. Elderly American Indians, perhaps even more than Blacks, tend to fall into low income brackets and be deeply involved with the extended family (Taylor and Peach, 1974:154).

Finally, it should be pointed out that age and ethnicity have a direct impact on warning response, in addition to the indirect relationship through kinship described above. McLuckie (1970:38) indicates that "different classes or ethnic groups have varying conceptions of what constitutes adaptation to a threat, or credibility of community organizations which might be involved in issuing warning messages." Hence, what might be perceived as appropriate protective behavior by Blacks or Indians may not at all be related to the adaptive behavior promoted by some official agency in its warning message. It is also known that aged people in general respond less enthusiastically to disaster warning and calls for evacuation (Friedsam, 1962:155–157). Studies of English evacuation during World War II indicate that even as the bombs were falling some aged citizens still refused to be evacuated (Titmuss, 1950:451; Ikle, 1951: 135).

Community involvement

Community involvement refers to the individual's patterns of interaction with friends (neighbors), and his participation in voluntary associations and other community organizations. Barton (1970:63–124) has pointed out that the extent of people's integration into the community affects the content, source, and number of warnings received in much the same way as kin relationships. The greater one's social contacts, the more likely one is to receive more information regarding a potential hazard. It is generally agreed that when both kin and community contacts are available, kin relationships are more important in evacuation decision making (Drabek and Boggs, 1968). The reason for including community involvement, however, is that when kin bonds are weak or absent, ties to the community can serve a similar function as far as a model of evacuation behavior is concerned.

As with kin relationships, community involvement varies with age and ethnicity. Blacks, in particular, are cited as relatively more involved in voluntary and formal organizations than Whites or other minority groups (Babchuck and Thompson, 1962; Oram, 1966; Renzi, 1968). Tomeh (1973:99) points out that, with respect to membership in voluntary associations, "studies... show higher participation rates for Blacks at all social class levels, especially lower class." Previous research which did not control for social class erroneously reported Black participation rates lower than White rates (Wright and Hyman, 1966:32).

Although it is generally argued that social isolation – shrinking friendship networks and decreased affiliations with organizations (Watson and Maxwell, 1977:59–66) – characterizes most aged people, it has recently been acknowledged that the variance along this dimension is greater than previously believed" (Cottrell, 1974:49–57). Broadly defined, however, community involvement tends to decline with increasing age of the head of household (Harry, 1970).

SUMMARY OF THE DETERMINANTS OF EVACUATION

Based upon the literature review presented above, one can begin to sort out and order research findings, and summarize the data which bear upon the important dimensions derived from a systems-emergent norm framework for warning response. The most important function of this review is that it provides information on empirical findings which allow one to construct (inductively) images of causal order and to infer possible relationships among variables. As Blalock (1969:8) points out such inductive reasoning combined with information deduced from theoretical frameworks, represents the initial step in the development of causal theory.

Based upon information from the review of the empirical literature, one can define a series of hypotheses which identify factors important in evacuation and specify the interrelationships among these factors. The identification of factors (variables) to be interrelated is based upon theoretical considerations – that is, important issues derived from an emergent norm-system perspective – and existing empirical evidence – that is, research-based data regarding the relationship between each factor and the target adaptive response of evacuation. Each numbered statement characterizes the hypothesized relationship of a major variable to evacuation; sub-statements specify the relationship between a major variable and variables antecedent to it.

1. The more precise the individual's adaptive plan, the higher the probability of evacuation.
   - 1a. Recent prior experience with disaster impact increases the chance that an individual will have a precise adaptive plan.
   - 1b. The more detailed the warning message, the more likely it is to provide an adaptive plan.
2. The greater the individual's perception of real threat (warning belief), the greater the probability of evacuation.
   - 2a. The more recent the individual's prior experience with disaster, the more likely he is to perceive the threat as real.
   - 2b. The more precise the warning message the greater the chance that the individual will perceive the threat as real.
   - 2c. As the number of warnings received increases, so does the degree to which the threat is perceived as real.
   - 2d. Receipt of a warning from a credible source (or confirmation by a credible source) increases the degree to which the threat is perceived as real.
3. The higher the level of perceived personal

risk, the greater the probability of evacuation.

3a. Recent prior experience with disaster is positively related to the level of perceived personal risk.

3b. To the extent that the warning message specifies the location of impact, level of perceived personal risk for persons within the impact area will increase.

3c. To the extent that the warning message specifies that disaster impact will be severe, persons within the projected impact area will experience increased levels of perceived risk.

4. To the extent that family (household) members are together or accounted for, the probability of evacuation is increased.

5. The closer one's relationship to extended kinsmen, the more likely one is to evacuate.

5a. The closer one's relationship to extended kinsmen, the more likely one is to receive additional warning information through these contacts.

5b. The closer one's relationship to extended kinsmen, the greater the number of potential credible sources for warning information.

5c. The closer one's relationship to extended kinsmen, the more warnings the individual will receive from these contacts.

6. The greater one's participation in the community, the more likely he is to evacuate.

6a. The greater one's participation in the community, the more likely one is to receive additional warning information from these contacts.

6b. The greater one's participation in the community, the greater the number of potential credible sources for warning information.

6c. The greater one's participation in the community, the more warnings the individual will receive from these contacts.

7. Families headed by aged persons, or extended family households containing aged, are less likely to evacuate in response to hazard warnings.

7a. As age increases, the frequency of contacts with kinsmen decreases.

7b. As age increases, the level of community participation decreases.

7c. In general, with other factors constant, as age increases, the number of warnings received decreases.

8. Cultural factors (race/ethnicity) influence the extent to which a family is likely to evacuate.

8a. Cultural factors (race/ethnicity) play an important role in defining appropriate patterns of interaction with kinsmen.

8b. Cultural factors (race/ethnicity) play an important role in defining the ways in which the family relates to the community.

8c. Cultural factors (race/ethnicity) play an important role in definition of family role responsibilities.

The above statements summarize empirical findings from studies of individuals' response to warnings as they relate to the problem of evacuation. The assumed causal order implied in the propositions reflects four basic theoretical assumptions resulting from the adoption of an emergent norm perspective. First, it is assumed that the warning itself serves as a stimulus to individuals which requires (or suggests) that an environmental change is pending and some restructuring of the situation is necessary. Second, it is acknowledged that social restructuring takes the form of several "milling processes" wherein assessments are made of the extent to which the threat is real and the level of personal risk involved. Third, this restructuring involves the collection of information which may be drawn from the warning message, the source of the warning, and one's prior experiences under similar cir-

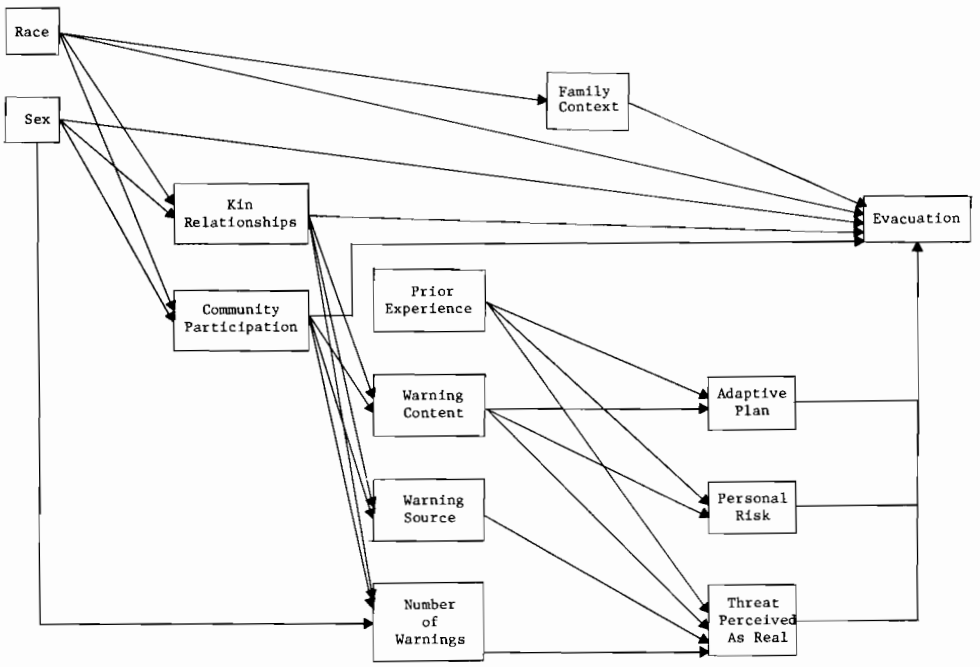

Fig. 2. Diagram of variables important in individual decisions to evacuate (arrows represent relationships, either direct or indirect).

cumstances as well as kin or community contacts. Finally, it is acknowledged that certain characteristics of the individual (e.g., family role responsibilities, kin relationships, community development, age, race/ethnicity) must be taken into account as factors which affect either directly or indirectly the outcome of the posited milling process (this outcome being evacuation).

The relationships specified above are graphed in Fig. 2. This conceptual framework represents a sketch of the interrelationships among factors believed to be important in individual decisions to evacuate in the face of natural disaster. The value of this framework lies in the fact that it is an explicit attempt to integrate existing research findings along explicit theoretical lines. As such, the hypotheses highlight important variables, conditions and relationships which should be given careful scrutiny when addressing the problem of understanding people's decision-making processes relative to evacuation warnings.

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POST DISASTER CONSENSUS AND CONFLICT IN A TRADITIONAL SOCIETY: THE 1970 AVALANCHE OF YUNGAY, PERU [1]

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When disaster strikes, a community caught up in the crisis may undergo severe individual and collective stress both during and after impact. In coping with that stress and adapting to the conditions of crisis and hardship, people display distinctive patterns of social organization. These social organizational patterns are functions of the adaptive strategies developed to cope with the problems facing both individuals and society in general in the various stages of the disaster and its aftermath. The focus and mechanisms used to identify people socially for individual and collective action are crucial in understanding the nature of specific adaptations developed to cope with the problems of natural disaster.

For many years one of the more consistent findings in social research in human adaptation to natural disasters has been the emergence of approximate time-stage linked patterns of social cooperation and conflict in stricken communities. In a recent article, Quarentelli and Dynes attempt to isolate the conditions under which conflict and cooperation appear during and after major natural disasters in the United States (1976). Within this American context, the authors observe that their conclusions regarding the frequency of community cooperation in early emergency stages are cross-culturally consistent, while later stage post-disaster conflicts involve more variation due to specific socio-cultural conditions. The purpose of the present effort is to consider the immediate events and long term processes of a non-American natural disaster, the Yungay, Peru avalanche of May 31, 1970, and examine from a social organizational perspective the emergence of patterns of consensus and conflict in the crisis. This examination reveals both considerable cross-cultural consistency as well as some variation from the patterns of consensus and conflict seen in American disasters.

While generalization must be attempted wherever possible, it must also be recognized that natural disasters, as historical events, particularly in some areas of the world, present unique conditions which may require unusual or unique responses. Certainly, the amount of anticipation or preparation time is important in determining the nature of initial responses to the crisis of disaster. The kind and degree of anticipation, however, varies considerably with the context and nature of the event. There are some natural disasters, hurricanes, for example, that may be considered "anticipated" hazards because of predictable environmental factors; and internal adjustments and arrangements can be made to minimize their ability to create severe crisis in a society. In complex societies, agen-

cies and institutions are created to cope with the stresses occasioned by such crises. There are as well institutionalized means of systematically calculating the risk involved in occupation of a specific area which include means of mitigating the effect of recurring environmental dangers (Greaves, 1973).

However, it has been tragically proved, particularly in the last decade, that the problems of disaster impact and aftermath are compounded by the conditions of underdevelopment. A disaster can obliterate the fragile results of slow, tortuous efforts taken over many years toward infrastructural development. From an institutional standpoint, many Third and Fourth World nations, in their concentration on pressing development needs, have no disaster contingency plans and no specific institutions designed to take responsibility in the event of natural catastrophe [2]. Response to such an event, as happened in Peru in 1970, tends to be of an ad hoc nature. However, in a similar vein, Sjoberg has spoken of conditions of chronic crisis in reference to Third and Fourth World social structures as adaptations to "a continual reign of terror" (1962:361). Upon viewing the massive destruction after impact in Peru, many people spoke of the seismic events of May 31, 1970 as the culmination of "a four hundred year earthquake" (presumably beginning with the Spanish conquest of the area in 1533). In this context, there are some disasters anticipated or unanticipated, whose scale simply confounds preliminary adaptive strategies within the society's current assessment of risk.

The 1970 Peruvian earthquake which devastated the north central coastal and Andean regions of Peru was a disaster of precisely these proportions. The disaster took place in an area of the world all too accustomed to earthquakes and avalanches of considerable scale. The location of Andean settlements high above valley floors has been spoken of as one possible pre-Columbian adaptation to the geologic hazard of avalanche. Certain other adaptive strategies have been traditionally undertaken in the historic era, such as locating cities behind hills to protect them from avalanches from the unstable glaciated peaks. However, often economic necessity requires locating cities near the glacier-fed rivers which flow down from the mountains and are the natural paths followed by landslides. Other forms of earthquake mitigation, such as antiseismic construction methods and/or materials were developed long after construction of traditional highland cities or were too expensive for all but the most wealthy to adopt.

THE PRE-DISASTER SYSTEM

Yungay was the capital of the province of the same name in the department of Ancash in north central Peru. Yungay province is one of six located in the narrow intermontane valley known as the Callejon de Huaylas. The callejon (corridor) is in effect one of the valleys of the Santa River which bisects it on its northward course before turning sharply west to the sea. The western slopes of the valley rise abruptly to the arid heights of the Cordillera Negra (black chain), a range of rugged blunt peaked mountains reaching as high as 16,000 feet. Although the rise is more gradual, the green foothills of the eastern slopes eventually give way to much steeper inclines which culminate in the perpetually glaciated snow peaks of the Cordillera Blanca (white chain). The highest peak of the range is Huascaran, a twin peaked colussus whose northern summit reaches 21,860 feet and whose southern peak attains 22,190 feet, both of which overlooked the city of Yungay. Many of the other peaks in the Cordillera Blanca are over 18,000 feet and virtually the entire 125 mile range is snow and ice-capped. The upper reaches of the Cordillera Blanca peaks are very sharply angled, ranging from 45° to nearly 90°, and many of them are dangerously unstable. The north peak of

Huascaran is probably the most unstable ice-capped zone of the entire range. The city of Yungay with its 4,500 inhabitants nestled in the curve of a hill which had protected it from a landslide from the north peak of Huascaran which had buried the neighboring town of Ranrahirca in 1962.

Although Yungay was slightly north of the geographic midpoint of the valley, it was traditionally considered to be a central place for the region. In addition, as capital of its province, the city was the seat of most of the important institutions for the province. The vast majority of the province's educational, economic, political and religious institutions were located in the city. The population of the province, indeed of the entire region, is composed primarily of a small, powerful urban elite of land, commercial and professional interests, a small urban service and economic sector and a vast rural peasant population engaged in traditional agriculture.

Land and society in the province were dominated by the largely urban dwelling wealthy class while the vast peasant population was involved in the labor intensive, small scale agriculture of hacienda lands or minifundia holdings. Yungay agriculture was predominantly subsistence oriented with some small surplus available for exchange, usually in the market of the city. The Indian sector of the peasantry, by far the largest, was composed of monolingual Quechua speakers whose culture differed markedly in many respects from that of the dominant local version of the national society. However, a small percentage of the peasant agriculturalist population was composed of an upwardly mobile, western oriented group often referred to as *Cholos* who occasionally combined agriculture with small commercial ventures or artisan skills. In many respects this group directed much of their attention and ambitions as much toward the city, as toward the internal life of their community of residence.

Thus, the city of Yungay serviced not only an urban population, but was also a regional center for a large rural population. A peasantry four to five times the size of the urban population depended on the city for marketing purposes, as the ritual center for a complex politico-religious authority system, and as the locus of political and administrative power for the province. The peasants of Yungay province were tied to the city by social and ritual ties of peonage and *compadrazgo* (ritual co-parenthood), by the religious links of the church and the fiesta system, by the political links of district and provincial government and by economic participation in the large and thriving land and labor factor as well as commodity markets. The city, in turn, exploited the peasantry for their agricultural produce and labor services and as consumers for the economic, religious and administrative services of the urban institutions.

THE DISASTER

On May 31, 1970, a massive earthquake rocked the coast and Andean regions of north-central Peru. It registered 7.7 on the Richter scale and unleashed such devastation that it has been referred to as the worst natural disaster in the history of the western hemisphere. While incredible damage occurred in the coastal areas, the most catastrophic effects of the earthquake were felt in the Callejon de Huaylas. Almost all of the urban areas in the traditional highland valley were reduced to piles of adobe rubble and suffered extremely high mortality [3]. The center of the destruction was the city of Yungay, which was obliterated by an immense avalanche loosed from the north peak of Huascaran by the tremors of the earthquake.

The thirty-first of May is the feast of Corpus Christi. The day had been clear and warm and the town of Yungay was crowded with peasants, in town for Mass and marketing, and tourists, visiting the highland city so well known for its picturesque traditional

highland atmosphere. The plaza of Yungay was one of the best vantage points in the entire valley from which to view and photograph the imposing presence of Huascaran as well. Yungay on this particular Sunday was enjoying all the normal bustle of its market and church activities. There was an air of expectancy among the children and younger people because the Verolina Circus would be giving an afternoon performance in the soccer stadium at the edge of the city. As the afternoon wore on, the town was calm and quiet. With many of the children enjoying the circus in the stadium, the adults were sitting in the sun in the palm shaded plaza or relaxing at home. Many had tuned in their radios to the World Cup soccer matches being broadcast from Mexico City.

The earthquake began at 3:23 p.m. with a gentle swaying motion for a few seconds followed by violent lateral tremors for about 45 seconds, making it difficult to walk or run. The adobe buildings of Yungay began to crumble after about 15 seconds of the heavy tremors. Red roof tiles rained dangerously to the ground as the whitewashed walls of Yungay's homes trembled violently in the quake, some crashing into the narrow streets, and others collapsing inward upon their residents. People were thrown to the ground and were quickly enveloped in debris and clouds of thick dust thrown up by the shaking earth and the falling buildings. The movement of the quake then began a vertical motion and the rain of debris and destruction increased. Many people in Yungay sought shelter in the church, the largest building in town. Others ran from their collapsing houses to the main plaza hoping to avoid the rain of tiles from the high roofs in the center of town. Some, all too few, sensed a further danger after the final tremors and began to climb the hills surrounding the doomed city. Still others, who had not been trapped by fallen structures, ran to cemetery hill, the only high ground in the vicinity of the central area of the town.

The new and greater threat soon became apparent in the form of a deafening roar of wind, and a lashing hail of tiny stones, hurled by the force of displaced air from the mass of an oncoming avalanche. The violent tremors of the quake had shaken loose a gigantic slab of ice and rock about 800 meters wide and more than a kilometer long from the sheer northwest face of Huascaran at an estimated altitude of between 5,500 and 6,500 meters. This immense mass, constituting more than 25 million cubic meters of ice and rock at its source, dropped almost a vertical mile before colliding with a lower glacier and careening down the valley at a velocity which reached a top speed of 435 kilometers per hour, picking up in its way huge masses of morainal material and hurling literally thousands of boulders, some weighing thousands of tons, down into the valley. The momentum of the slide carried it the 16 kilometers from its origin on Huascaran to the valley floor and the city of Yungay in less than four minutes. It was due primarily to the extreme velocity of the avalanche that Yungay was buried. The Yungay lobe of the avalanche was formed when the mass of ice, rock and mud hurtled over a ridge some 200 meters high which separated Yungay from the main lobe of the avalanche which followed its original course over Ranrahirca. Eyewitnesses report seeing a "wall of debris as high as a ten story building" loom suddenly over the ridge and then crash down upon the town, enveloping it totally, consuming everything in its path on its descent to the river below the town. All that remained of Yungay some four minutes after the quake had ceased its tremors were four palm trees (of the approximate forty-eight) where the main plaza had been, a group of survivors huddled at the base of the statue of Christ on the top of the destroyed cemetery hill, some 200 terrified children and a few adults in the half destroyed stadium and an immense mass of dull grey, viscous mud, interrupted by

chunks of ice from the glacier and huge granidiorite boulders. The total volume of ice, mud and rock which descended that day from Huascaran upon Yungay, Ranrahirca and the Santa River is estimated to be approximately 50 million cubic meters (Erickson, Plafker and Fernandez Concha, 1970:1–12).

While it is difficult to establish any specific pattern of behavior of the people caught up in this horror, the accounts of survivors provide a general idea of what occurred. In general, three kinds of responses were elicited by the onset of the quake and avalanche. Many people said that they felt that the day of judgment had arrived. Friends and families knelt, embracing each other, amidst the fury of the destruction and resigned themselves to death. A few of these people survived the initial destruction of their homes and were able to escape the oncoming avalanche by running to high ground after the earthquake had stopped. The second pattern which emerges from survivor accounts consists of those who attempted to aid other people. Some perished in their efforts and some survived. For example, one individual who was in his car at the moment of impact began picking people up as he drove toward the outskirts of town. The third general behavioral response consisted of flight, plain and simple. The danger of avalanche was well known to Yungainos since the neighboring town of Ranrahirca had been buried by a similar landslide in 1962. Many people, including those who had been with their families, simply began to run towards high ground. Others were awakened to the danger of avalanche by the warnings of other people and began their flight, either toward the high ground of the cemetery or to the slopes of the surrounding hills. One phrase in particular stands out in the narrations of those who simply fled; the loss of "my sense of compassion, of pity" (Zabaleta Figueroa, 1970:37).

In this moment of crisis of extreme severity, those who had resigned themselves to die, did so in the context of their families. Those who helped, or thought to help, concerned themselves first with their families. Many died in the futile attempt to extract their loved ones from the rubble before the arrival of the avalanche. Other people who aided their fellows did so largely in the progress of their own escape. The primary social focus in these moments of extreme crisis seemed to be on the self and family. During many initial emergency situations, according to Quarantelli and Dynes, "... while there is considerable anxiety about the welfare of family members and other relatives, much rescue activity is directed toward those whose social tie is simply that of another human being in trouble" (1976:143). The relatively scant data we have for this kind of altruism during the Yungay impact should not lead us to any conclusions regarding cultural differences. The lack of preparation (none), the speed of onset (elapsed time from first tremor to total obliteration was approximately four minutes), the difficulty of rescue conditions (most of the population was trapped in the rubble of their homes) and the overwhelmingly destructive power of the disaster agent demonstrate clearly that the only rational response in such a situation was flight. There is also the likely possibility that the evidence for greater altruism was buried with those who engaged in it. Again, from the standpoint of rational behavior this lack of evidence for greater altruism is understandable in that there was little hope for the community and role obligations beyond those associated with family (and even those in many circumstances) shrank to insignificance in the face of the oncoming holocaust.

THE IMMEDIATE POST-IMPACT PERIOD

The moments following the death of Yungay are described by survivors as a ghastly silence, disturbed only by the distant and receding rumble of the avalanche swollen river

proceeding northward to further destruction. While some survivors were immobilized by the shock, within minutes others had turned to aiding the injured and searching for wounded in the viscous mud of the avalanche. A small number of people, less than a dozen, miraculously survived the full impact of the avalanche and were saved from suffocation by the rapid action of other survivors.

As evening descended, the entire earthquake zone of north central Peru continued to shudder under the impact of numerous and violent aftershocks. In the shattered valley of the Callejon de Huaylas, survivors dispersed into the hills surrounding their destroyed cities. Near Yungay, the survivors began clustering in two groups, in Aura just to the south and in Pashulpampa, just to the north of the buried city. The subprefect, the maximum political authority of the province, and one of the town's five physicians had escaped the avalanche and had taken shelter in the lee of a large hill in Pashulpampa. The subprefect assumed immediate responsibility. A number of committees were formed among the able-bodied survivors, for the acquisition of meat, the acquisition of vegetables, a commission for the construction of shelter and a commission to nurse the wounded. The subprefect ordered all the animals in the area divided in two groups: those with surviving owners and those without owners, and therefore, immediately available for use. Food was scavenged from the destroyed houses in peasant communities and Indian peasants descended from their hillside hamlets with offerings of food from their own meager surpluses.

Over in Aura, the mayor of Yungay, who had also survived, assumed responsibility for obtaining adequate water and food supplies for the survivors grouped in that location. In addition to conserving, boiling and bottling water, and prohibiting sales and price hikes in the few stores left in that suburban settlement, the mayor organized seven committees of four persons each who were in charge of the communal cooking in the five different sectors of Aura. Each of these committees was given the responsibility of obtaining and cooking food for everyone in that particular zone of the town. Both in Aura and in Pashulpampa owners of crops or animals readily donated them for food for all survivors.

Both Aura and Pashulpampa within hours of the disaster began attracting scores and soon hundreds of victims from both the urban and rural sectors. However, the fate of Yungay and the suffering of the survivors was unknown to the outside world. The entire area of the Callejon de Huaylas was so enveloped by massive clouds of dust raised by the earthquake that it took four days for the outside world to ascertain the fate of Yungay and send the first assistance. All roads to the valley had been destroyed by the earthquake and the dense clouds of dust obscured any aerial view of Yungay's fate. In the interim period the growing number of refugees in both Aura and Pashulpampa huddled in the frigid Andean nights, protected only by makeshift cornstalk shelters and any blankets which could be found in the peasant communities nearby. During the days the survivors busied themselves in the tasks of collecting food and water, building more shelters, and tending the wounded. The subprefect also ordered clear areas not far from Pashulpampa to be marked by strips of red and white colored paper to designate a landing area for the helicopters which could be heard, but not seen, passing overhead.

In short, the immediate post-impact period in the Yungay area was characterized by considerable social solidarity and cooperation. The crisis had an immediate status-leveling effect on the nacent community of survivors which it had created. A sense of brotherhood, cutting across both class and

ethnic lines, prevailed as Indian and *Mestizo,* lower and upper class, collaborated in the collective efforts to obtain immediate necessities. Both the subprefect and the mayor stated that in this initial period of two to three days there was a great respect for their offices and a heightened spirit of unity and common identity. "We are all brothers," was the characteristic phrase during this time and the degree of organized, purposeful activity on behalf of the community was ample demonstration of the survivors' adherence to such an attitude. People implicitly felt the need for unity and cooperation of all people if they were to solve the problems which faced them in the immediate aftermath. The individual faced problems which could not be solved by the individual alone. In fact, since virtually all individuals faced the problems of shelter, warmth, clothing and food, they became community wide problems with solutions backed by community consensus and effort. Such behavior is not at all atypical of disaster victims in many cultural contexts. According to Turner, this all-encompassing sense of brotherhood constitutes both an ideological confirmation and a strong motivation that all individuals in the community will contribute their efforts to the tasks necessary for the survival of all (1967:62). Often, much, if not most, of the immediate work of rescue and relief operations are dealt with in an informal fashion by the victims themselves before outside assistance arrives (Fritz, 1968: 205).

As time wore on in the days prior to any communication or aid from the outside world, the stress began to tell on the past-impact solidarity of the survivors. More and more people, urban survivors from the cemetery and hillside refugees, and rural people whose homes had been demolished in the earthquake began gravitating toward Pashulpampa where the subprefect and the doctor were in charge. When the first helicopter landed some four days after the avalanche, there were more than three hundred people gathered in Pashulpampa, including wounded and many children from the half buried stadium where they had been watching the circus. With the advent of such a large number of people, more and more animals had to be slaughtered to feed them. Some animals whose owners had survived in Pashulpampa were being used to feed the population. One violent confrontation occurred when one of the authorities ordered the slaughter of a steer whose owner was not only alive and present but had not given his permission. Concepts of personal private property, which had literally disappeared right after the impact, began to be asserted again. This violent exchange between the authority and the owner signaled the beginning of the end of the post-impact solidarity.

The leaders of the growing camp also perceived that urban survivors were being quickly outnumbered by rural refugees. Consequently, the leaders undertook a project to identify and classify each individual in the camp. Included in this list and considered as *sobrevivientes* (survivors) were all peasants whose homes and communities had been destroyed by the avalanche as it coursed its way down the valley toward Yungay and Ranrahirca. Thus, in Pashulpampa everyone acquired a disaster identity and victims of the avalanche were differentiated from victims of the earthquake only. This differentiation was to take on increasing importance in the social organization of the various adaptive strategies of the survivors in subsequent months. In short, an in-group, out-group perception in terms of suffering and deservedness of aid appeared within the camp.

THE EMERGENCY AID PERIOD

The scope of the Yungay disaster was not known to the outside world for several days. Finally on the fourth day, the dust had cleared sufficiently for helicopters and other aircraft to get a view of the area around Yungay and

begin landing. The helicopters landed with food and blankets and ferried out the wounded and small children. By June 5, 70 tons of emergency supplies had been parachuted into the entire valley by the Peruvian air force and over 400 injured people had been evacuated (AID, 1970:263). However, the problem of food supplies was scarcely alleviated for the growing number of people in Pashulpampa. For about two weeks after impact the peasants from the Yungay hinterland continued to bring in their scant surpluses and give them to the survivors, but this soon terminated as the amount of aid increased. About a month after the disaster approximately 5,000 family camping tents were distributed throughout the valley. With the arrival of substantive forms of aid, the last of the spirit of interclass and ethnic group unity and brotherhood which had characterized early self-help efforts disappeared. The distribution of aid, as well as being divisive between the contingents of survivors in Aura and Pashulpampa also reawakened the sharp lines of social and ethnic differentiation between the Indian peasants and the middle and upper class townspeople. Essentially, the problem in the emergency aid period was first to make sure that one's own needs were properly taken care of and second to see that the interests of one's social group were being attended to or secured. Conflicts tended to be class or individual-oriented.

The argument that "the Indians never had anything to begin with, so why should they get help now?" was frequently heard among middle and upper class survivors. A DESCO preliminary report by Montoya, filed a month after the disaster, quotes an urban survivor:

> The Indians are those that are benefiting most from the aid. We, the decent people of Yungay, are only about 100 persons. The rest are all Indians. They ought to give more to us, the Yungainos who have lost everything. The Indians have everything they need, and besides, they are accustomed to live as they do (1970:8) [4].

According to Montoya and other witnesses, most of the aid was in fact going to the middle and upper sectors of Yungay Norte rather than to the rural Indians. Montoya's report quotes an individual from the neighboring village of Punyan:

> We from Punyan went to the subprefect to ask him for some aid and he told us to eat dirt, to eat shit, because there was no food for us, because they say there is not enough for the peasants (1970:8).

Efforts to ascertain the origin of everyone in Pashumpampa were resumed in order to be able to differentiate in the distribution of aid between *sobrevivientes* (survivors) and *damnificados* (damaged or injured in the earthquake only). Immediately after the formulation of these categories, an additional referent became attached to these concepts – that of relative deservedness of aid in the eyes of the community or urban survivors or those who ultimately manipulated the distribution of aid. Urban survivors, who had lost "everything" in the avalanche, saw themselves as far more deserving of aid than the peasants who suffered only the effects of the earthquake. In the eyes of the urbanites, there were very few survivors of the city in the camp at Pashulpampa. Most who claimed urban origin were considered imposters. In fact, many rural people had hastened to adopt Yungaino urban identity when possible since they felt, with some reason, that they might be discriminated against in the distribution of aid due to rural origins and non-*sobreviviente* status. In a stratified society, such as highland Peru, aid which is perceived to be distributed along egalitarian lines runs against the purposes of the middle and upper classes, which is ultimately the maintenance of relative class position (Barton, 1970:308–315). Any aid that rural people received was therefore not only undeserved, but dishonestly

accepted in the eyes of urban survivors and any aid that townspeople received was the result of graft and influence in the eyes of the humbler people. However, even within the same class, differential impact and equal aid gave rise to conflict. Verbal and occasionally physical expression of these hostile attitudes did not go unexpressed in the context of camp life in its first six months.

Much of this pattern of post-disaster conflict conforms to patterns of similar phenomena as described in the literature on immediate post-disaster behavior. In the immediate post-disaster situation, there tends to be a heightened degree of social cooperation and unity in initial emergency activities. Groups which would otherwise maintain strict social distance close ranks and cooperate for the good of the totality (Sjoberg, 1962:369). However, once the major crisis has passed, it is common for conflicts within the system to reappear, often in exaggerated form, which may ultimately be symptomatic of incipient change brought about by the disaster (Bates et al., 1963: 113). The disaster has thrown the system of status relationships out of balance as is illustrated in eloquent fashion by the *sobreviviente* woman who complained: "The people of the heights, the Indians, never had anything, so why should they get help? On the other hand, we, the real Yungainos, have lost everything, so we should get more."

The initial efforts of the emergency aid period and many of the continuing efforts for rehabilitation and recovery were in partial violation of the traditional status arrangements and produced and exaggerated tensions and frictions which had already existed within the system. The internal social conflict in which individual and class interests sharply split Yungay society increased throughout the distribution of food, clothing and household articles, finally reaching its pinnacle during the distribution of the two-year provisional housing program. Although there was no clear demarcation between the emergency aid and rehabilitative stages, the rehabilitative system was firmly established when the housing program was implemented some six months after the disaster. The conflict generated by this project represents the final flaring of paramount individual and class interests before the entire population coalesced once again in confronting a further threat to the entire community.

The Peruvian Ministry of Housing organized a plan for two-year provisional dwelling units, measuring 6 by 30 meters, divided into 8 to 10 "I" or "L" shaped rooms for a maximum of 60 residents per unit. The shelters consisted of waterproof composition board walls attached to metal frames with interior dividing walls of ¼ inch plywood. The registration and assignment of the provisional housing caused great dissension in the community. The social workers assigned to the project distributed the housing on an egalitarian first-come, first served basis which immediately conflicted with traditional patterns of social stratification and status preferenciality. The issue was brought to a crisis when a local official of some importance informed the social workers that he did not want any peasants in the encampment and that he himself wished to choose the location of his housing. He was told that he would receive a house where there was a vacancy and that all those people with documents certifying their refugee status would receive a house in similar fashion, whether they were peasants or not. "We are all equal in the eyes of God," he was told by one of the social workers. Whereupon he responded with finality, "We are not equal!" Whenever the social workers indicated the essential equality of all human beings in response to complaints of being located next to people of humbler social origin, the response by urban survivors was invariable. "No somos iguales" (We are not equal) repeated again and again adamantly.

Notwithstanding the uproar and conflict over the housing question, possession and

occupation of a housing unit came to signify the concrete substance of one's identity as a Yungaino. And, despite the bitter protests, a form of housing integration eventually became operative in the camp. The dispute over housing was indeed the last overt expression of serious internal conflict which was to flare in the refugee camp at Pashulpampa for a considerable period of time. The social conflicts and the focus on individual and narrower class interests which had appeared in the period of emergency aid became submerged, if by no means resolved, in confronting the problems which threatened the growing community in the establishment of the rehabilitative system.

THE REHABILITATIVE SYSTEM

The first immediate demographic effect of the disaster, apart from the massive mortality, was to split the surviving population of Yungay into two different camps, Pashulpampa and Aura. With the advent of aid, a sense of competition for these scarce resources developed between the two settlements. When Pashulpampa became known as the aid center for the province, rural refugees flooded the area, threatening to overwhelm the resources that the national government had established there in the emergency period. Consequently, a group of about two hundred people was moved over to a tract of land about one kilometer to the south of Aura. Shortly thereafter another group of survivors were further relocated at a location called Tingua, some 15 kilometers south of Yungay. Thus, there were within weeks of the disaster four separate populations, all eventually claiming the name of Yungay in one way or another. The conflict soon became sharpest between Pashulpampa, by then known as Yungay Norte, and Tingua, whose residents claimed that the government had promised them that the new capital of the province would be established there. The people of Yungay Norte maintained that since they had the majority of urban survivors as well as greater proximity to the old city, they were entitled to be the new provincial capital. Indeed, the survivors, urban and rural alike, were rapidly acquiring a deeply felt allegiance to the site at Yungay Norte. The disaster and the site's proximity to their buried city were important factors in the rapid resurgence of strong community identity. Yungainos were more than aware of the centrality their tragedy had acquired in the general phenomenon of the holocaust. They knew that the name Yungay had become famous, appearing in the major newspapers and magazines of the world after the disaster. The avalanche had made Yungay of all the stricken cities significant in a world context and the uniqueness of their tragedy, for all its horror and pain, created a deep collective consciousness among the survivors in Yungay Norte. The new community carried old Yungay and the disaster, always referred to by them as "*la tragedia*," at its cultural core. The strong community identity, closely linked to their status as victims of a tragically lost community, places the Yungainos along with survivors of other disasters in a pattern of behavior which appears to be cross-cultural (Quarentelli and Dynes, 1976:143).

Ultimately, it was in Yungay Norte that the only major efforts at providing a concrete rehabilitative system were attempted. However, the survivors faced a continuing ordeal in that the rehabilitative system at that time did not guarantee stability or permanence for the settlement. Yungay Norte offered protection from further landslides from Huascaran, immediately to the south, and from Huandoy, immediately to the north. However, the triangular area formed between the avalanche from Huascaran and the steep-sided canyon descending from Huandoy, the site of an avalanche in 1725, was not large; and the authorities speculated that if the capital were established there, it would soon

outgrow the safe area and spill over into dangerous zones.

Eventually, it was projected by the authorities that the new capital of Yungay would be relocated at Tingua. The reaction to this project was immediate and definite rejection on the part of the urban survivors residing in Yungay. Almost immediately within notification of these intentions, a variety of hand-painted signs proclaiming "Yungay Stays Here!" and "Yungay is Reborn Here" appeared on the road leading into camp. Aid personnel attempted to explain at length the need for such a step and declared that all services and institutions of the old city would be fully reconstituted in Tingua, but to little avail. As Quarentelli and Dynes indicate, the community identity resulting from a further exterior threat led to a concomitant hostility toward outsiders (1976:144). Although these outsiders came to assist the survivors, they were seen as insensitive to the practical and emotional issues of the disaster and the relocation problem. The Yungay Norte survivors exhibited a sense of moral outrage that they would be forced to abandon the site of their lost city. Community leaders exhorted the people with warnings of the dangers of abandoning the dead and of faithlessness to the traditions of their city if they allowed it to be relocated elsewhere. "The glorious tradition of Yungay must be carried on here in Yungay Norte or the dead shall have been betrayed. It is our duty as survivors to realize the continuity of Yungay here!" Survivors made common cause with the dead and the past in the creation of an in-group consciousness which could not be shared by outsiders no matter how well-meaning their intentions.

Resistance which began with the core of urban survivors quickly spread to the new peasant immigrants, and ultimately to the peasant hinterlands of Yungay, forming an almost monolithic bloc of opposition to the government relocation plans. Indeed, the mobilization of the immigrant masses in support of the Yungay Norte location became instrumental in the re-assumption of power by traditional elites. Survival as a socio-cultural entity and as the paramount urban center of the province became the *raison d'etre* of the population. The first organized response, apart from the hastily painted signs, took the form of a town meeting which acquired such a threatening tone that the subprefect called in outside police forces to disband it. From that point on, Yungaino leaders, both formal and informal, began to marshall their arguments and activate the formal and informal channels to influence and power to resist relocation. Yungainos who had reached prominent positions in the public and private sector in the national capital were visited by formally elected delegations of survivors to enlist their support against relocation. Delegations visited at their own expense the offices of the president and numerous ministers in Lima. Within the province the support of the district mayors was solicited and the peasantry was warned that their church and their market were to be taken from them. Public events such as dances, pageants, and kermesses (an outdoor party with food and dancing), were carried out in the dismal environs of the survivor camp to raise money for the cause. The relocation project clearly constituted a challenge and a threat to Yungaino identity and united the badly fractionated population in a common cause to resist resettlement. There was a concerted effort on the part of all the Yungaino leaders to recover all the administrative, educational, economic, religious, and governmental institutions of the old city before the relocation project could be activated.

The general population of the camp, particularly the surviving leaders of the old urban elite, threw themselves into the reconstruction effort with great determination. Meetings were held, responsibilities were delegated and the reconstitution of institutions and services in Yungay Norte was begun almost imme-

diately after the disaster. Such things as market activity, civil authority, religious services, educational institutions and potable water were all operating in the camp within three months of the tragedy. Within a year's time, the camp at Yungay Norte had achieved through their own efforts or through circumstances the establishment of all but one of the major institutions and functions which the destroyed provincial capital of Yungay had possessed. In one year Yungay Norte had become a city of approximately 1,800 people, with a fully functioning local and provincial governmental structure; an active economic life; renewed, if somewhat altered, rural-urban relationships with the peasantry; a ceremonial center for two faiths; an educational center with a high school, two primary schools, and a night school; and a marked sense of purpose and community.

The government, in proposing relocation, had become the new adversary, the new disaster, in the perception of the community. The relocation project, as well as the confusion and administrative difficulties of the aid distribution in the first year in Yungay spawned the bitter refrain, "First the earthquake, then the avalanche... and then the disaster." In effect, the crisis of the disaster had been extended on into the rehabilitation period by the new threat to the integrity of the community. While initially this perceived governmental hostility was attributed to the reconstruction authorities' insensitivity to the Yungainos' plight, many of the more politically sophisticated survivors began to feel that Yungay's traditional association with APRA and its anti-military stance was responsible for the relocation policy [5]. The injection of an ideological component to post-disaster conflict is also a common occurrence in the context of American disasters (Quarentelli and Dynes, 1976:149). The perceived ideological conflict tended to increase the sense of isolation and abandonment which plagued the survivors as well. It must be noted, however, that the hostility almost uniformly expressed toward Peruvian nationals, with the exception of local representatives in assistance and reconstruction work, was not apparent in attitudes toward the many foreign individuals and agencies working in the disaster zone. Expressions of gratitude and praise for foreign assistance, regardless of the ideology of the donor nation, were commonly heard throughout the area. In the American context, gratitude and praise is also the reward of local workers while state and national disaster aid organizations are often criticized for their efforts (Quarentelli and Dynes, 1976: 148). However, the sense of international brotherhood engendered by the massive foreign aid after the Peruvian disaster is not likely to find an American parallel. In the international disaster aid network, the United States is always and exclusively a donor nation.

In no sense would it be unreasonable to attribute the rapid growth and recovery at least in part to the threat posed by resettlement. The threat of relocation by governmental entities, definitely perceived as outsiders, stimulated a remarkable sense of common purpose which was demonstrated time and again in solidarity and cooperation on projects relating to reconstruction and reinstitutionalization of the provincial capital of Yungay. The goal was to confront the government's resettlement project with the *fait accomplis* of a re-established and firmly rooted provincial capital with an equally rooted and determined population. Although it took them more than two years, they succeeded.

RE-ESTABLISHMENT OF A REGULARIZED COPING SYSTEM

Once the battle against relocation had been won, the population of Yungay Norte, now known simply as Yungay, was assured of survival as a socio-cultural entity. However, even though this societal goal has been achieved,

the sense of a common destiny and fate because of the tragedy of the disaster, still inspires considerable social unity in support of community projects. The call for a glorious future to match the glorious past of Yungay will still awaken considerable cooperative efforts on behalf of the community. However, with the assurance of survival of the community, the individual and interest group concerns of daily living have become the major motifs of social interaction and organization. The community is by no means a normal highland city and perhaps it never will be because of the unique tragedy which it has suffered. The city is still struggling to reconstruct itself some eight years after the disaster, but it struggles with the assurance that it will persist through time as a city. It suffers perhaps more severely than others from serious internal problems relating to processes of social change put in motion or exaggerated by the disaster. New permanent housing programs have aggravated social relations once again and land and commercial interests are also riddled with conflict as an essentially new and untried population attempts to cope with realms of experience made available by mortality induced rapid social mobility. This rapid mobility has stimulated new and bitter competition with the interests of traditional elites and has sharpened individual expressions of class differences. The focus of social identification has returned again to the individual as he attempts to reconstitute and rebuild his own personal community and future. In short, once the community was assured of survival, people could attend to individual interests again.

The Yungay experience, while unique in many respects, confirms the finding of other students of the social aspects of natural disasters that the time phases of a disaster and its aftermath, although difficult to demarcate accurately, are characterized by varying patterns of social identification and interaction (Wallace 1957). The patterns alter in relation to the problems facing both individuals and society during the lengthy processes of recovery and reconstruction. During the immediate and long-term contexts of the crisis the population of Yungay fragmented and coelesced a number of times around specific problems crucial to the survival of both individual and society. The separation and coincidence of individual and societal concerns at different times became crucial to the survival of both. The Yungay case demonstrates the importance of understanding the shifting foci and modes of social identification for the study of individual and societal adaptation to the severe crisis of natural disaster, both at impact and in aftermath.

NOTES

1 This article is a version of a paper presented at the 76th Annual Meetings of the American Anthropological Association on December 2, 1977 in Houston, Texas. The collection of data on which this article is based was carried out with the survivors of the Yungay avalanche and rural refugees in 1970–71, 1974 and 1975. The author resided in the tent encampment and later barracks city from October of 1970 to September of 1971. In addition, another trip was made to Yungay in November–December of 1971 while working for the Peru Earthquake Relief Committee. The methods used in gathering the materials for this study included the traditionally anthropological approach of participant observation supplemented by a number of other techniques. Open-ended, rather free form interviews were held with several hundreds of the Yungay camp residents. A formal questionnaire was administered to 68 (of a total 447) heads of households. Another questionnaire on community organization was undertaken throughout the entire province with 43 of the approximate 70 communities. In addition, a basic census of the Yungay camp was carried out in April of 1971 as well as a brief census of the Yungay market participant community. Subsequent research of a follow-up nature was undertaken in the summers of 1974 and 1975. Support for the initial research period was provided by the Midwestern Consortium for International Activities. Support for the subsequent research trips came from the University of Florida and the Society for Health and Human Values respectively.

2 In fairness, it must be pointed out that since the great earthquake of 1970, "the Peruvian government has developed one of the best organized prevention, prepared-

ness and relief systems in Latin America." (Jean-Paul Levy, Chief, Prevention and Planning Section, United Nations Office of Disaster Relief Coordination: Personal Communication, 1975).

3 For additional social and behavioral science material on the great Peruvian disaster of 1970, see Bode (1974, 1977), Doughty (1971). Dudasik (1976, 1978), Janney, Masuda and Holmes (1977), and Oliver-Smith (1974, 1977a, 1977b, 1979).

4 DESCO, Centro de Estudios y Promocion del Desarrollo, Avenida Republica de Chile 741, Lima, Peru.

5 APRA, *Alianza Popular Revolucionaria Americana*, The American Popular Revolutionary Alliance, a Peruvian political party which enjoyed some support among certain sectors of the Yungay elite.

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VOLCANIC ERUPTION AND LOCAL POLITICS IN JAPAN: A CASE STUDY*

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INTRODUCTION

September 1, 1978, marks the 55th anniversary of the Great Kanto Earthquake which killed over 90,000 and injured more than 100,000 in Tokyo and vicinity. In this half-century, Japan has suffered various natural disasters. Innumerable people have been injured or have lost loved ones in these catastrophes. Property damage has been very high. Given these costs, have the Japanese learned from these experiences? Will they be able to cope with future earthquakes any better than they coped with the Great Kanto Earthquake of 1923? Or has the experience of the Great Kanto Earthquake been suppressed by defense mechanisms because it is a memory too horrible to bear, too frightening to allow learning?

The Japanese are said to be very pessimistic about tomorrow but extremely optimistic about the day after tomorrow. Natural disasters, of course, are "the day after tomorrow." Why should the Japanese concern themselves about "the day after tomorrow"? A recent survey undertaken by our committee revealed that the majority of the people in Tokyo are convinced that a major earthquake will hit the city, but only a relatively small number think that they themselves or their families will be casualties [1]. Most people feel that they and their families will be spared. However, the Tokyo Disaster Prevention Conference in 1971 estimated that another earthquake registering 6 or more on the Richter scale as the Great Kanto Earthquake did, would kill or injure some 560,000 people in Tokyo alone.

No two disasters are ever absolutely alike. With industrialization, Japanese ports and harbors are crowded with petrochemical plants and cities with gasoline stations, propane storage tanks, and other highly flammable substances. There are no empty lots in residential areas for residents to run to, and the streets are clogged with cars. The Fire Defense Agency predicts more than 700 fires if a Great-Kanto-Earthquake-class earthquake hits Tokyo today. Furthermore, stricken cities can suffer from the unexpected, as in the recent Sendai earthquake when a number of lives were lost under crumbling concrete block walls.

Nor can we disregard the role of mass media in a modern society such as Japan. The information broadcast on radio and television can facilitate smooth evacuation and alleviate an-

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**Author's Note:* This paper is part of the report by the Mt. Usu Volcano Study Team of the Disaster and Information Study Committee (led by Professor Keizo Okabe of the University of Tokyo). The members of the Study Team are: Hirotada Hirose (Tokyo Woman's Christian University), Osamu Hiroi, Yoshitomo Watanabe, and Takashi Muto (University of Tokyo, Institute of Journalism). The author would like to thank Professor E.L. Quarantelli for his comments on an earlier draft of this paper.

xiety. Sometimes, however, there are unexpected negative effects, as in the great anxiety and dysfunctional behavior caused by misleading reports on the Izu-Oshima earthquake in January of 1978 [2]. Over the past year, our group has followed the social, economic, and political impact of the Mt. Usu eruption in Hokkaido in early August, 1977. This volcanic eruption affecting small towns on Japan's northernmost island is in many ways an excellent model for disaster-study research. While the small town resembles a big city, the variables involved affecting behavior are fewer and more visible. Using this model, we would like to explain the nature of this natural disaster's impact as a first step toward an analysis of the social impact of natural disasters in general. This article reports on some preliminary impressions from an analysis of part of the data from our study.

CHARACTERISTICS OF THE THREATENED TOWNS

Mt. Usu is an approximately 730 meter high active volcano at the center of a 7.8 kilometer wide strip of land between Hokkaido's Uchiura Bay and Lake Toya. We say "approximately 730 meters" because the underground magma keeps pushing the mountain up and it is impossible to tell exactly how high the mountain is at any given time. The area severely damaged in the recent eruption includes the town of Abuta to the west, Daté city to the south, and the town of Sōbetsu to the east (the amount of damage, see Table 1). We will focus on these three communities and show how the volcanic eruption became woven into local politics.

Daté has a population of approximately 34,000. The main industries are scallop cultivation, ranching, and agriculture. The city is also an active commercial center, with several major shopping areas. The farms in the area average 3.5 hectares, which is large for Japan, and grow various vegetables for markets in Sapporo, Tokyo, and elsewhere. On the whole this is a very affluent agricultural area. In recent years, the community has also developed as a residential suburb for nearby industrial Muroran. Politically, Daté is rather conservative. In the 1976 election, for example, the conservative candidate for governor won 10,541 votes, while the reformist got only 8,139 votes. Conservative candidates won even more strongly in the city council election.

TABLE 1

The Amount of Damage of the Suffering Districts [a]

Losses incurred	
Agriculture	$ 59,275,000
Forestry	64,490,000
Housing	17,995,000
Fisheries	7,485,000
Rivers and roads	3,355,000
National railways	3,080,000
Others	2,775,000
Total	$ 158,455,000

[a] Figures have been rounded off in thousands of dollars using a conversion rate of $ 1.00 = ¥ 200.

Abuta is politically and economically divided into two distinct sections: Abuta-Honcho and Toyako-Onsen. Abuta-Honcho on Uchiura Bay thrived on herring and sardine fishing before World War II, but these industries have now been entirely replaced by scallop cultivation. In the hinterland behind the busy coastal streets, are expanses of farmland and grassland where farmers produce quality fruit and vegetables, or raise (through highly mechanized operations) dairy and beef cattle. Per-family farm income here is much higher than the prefectural average. Politically, the area is a stronghold of the Japan National Railways

and other local labor unions, with an orientation to the left. Of the town's total population of 13,000, about 60% live in the Abuta-Honcho area. About five kilometers from the center of town on the southern bank of Lake Toya, is the other 40% of Abuta's population. This area, called Toyako-Onsen, features newly developed hot-spring facilities capable of accommodating about 9,000 guests a day. The largest hot-spring resort in the entire prefecture, it contributes more than half of the town's total tax revenues of three million dollars. Unlike Abuta-Honcho, Toyako-Onsen is politically conservative. Indeed, Abuta-Honcho and Toyako-Onsen contrast in almost every respect. One is economically supported by agriculture and fishery, is politically liberal, and has a long history; while the other is a tourist town, is politically conservative, and is newly developed. This schizophrenia makes Abuta one of the prefecture's most contested areas in political matters. In the 1976 gubernatorial election, for example, there was little difference between the 3,726 votes for the conservative and the 3,441 votes for the liberal candidate.

Sōbetsu is a community of only 4,000, a mere half of the population it had when it was a flourishing mining town. With the mines closed, the town is supported by the Sōbetsu hot springs near Abuta's Toyako-Onsen springs. Tourism and agriculture are the town's mainstays. The farms allow a very comfortable living with such cash crops as fruit and vegetables. Politically, it is a firmly conservative district.

THE EVACUATION ORDER

There were around 1,700 earthquake shocks registered in the area around Mt. Usu starting the morning of August 6, 1977, the day before the eruption. The abnormality of so many shocks was clear to all. However, past experience indicated that it would be several days between such earthquake shocks and an actual eruption. Little suspecting that the eruption would come the next day, the three municipalities of Daté, Sōbetsu, and Abuta assumed they had time to activate their evacuation plans.

At 9:12 a.m., August 7, as if to emphasize all of the previous day's earthquake shocks, Mt. Usu erupted, shooting smoke 12,000 meters into the air and spewing out rock and ashes. Volcanic rock and ashes were carried by northwestern winds and damaged farms, orchards, and pastures on the southern and eastern sides of the mountain.

Surprised, the three municipalities nevertheless established their Damage Control Headquarters immediately after the eruption. About one hour after the eruption, at approximately 10 a.m., these headquarters sent out city hall and fire department sound trucks to issue an evacuation order to residents in endangered areas. Sōbetsu issued an evacuation order first to the Shōwa-Shinzan area where volcanic rocks the size of baseballs had fallen, then to the private Sankei psychiatric hospital, and then to the Chōnichi-en home for the elderly. Daté issued an evacuation order to the Kaminagawa area, where considerable ash had fallen, and asked for a halt to bathing along the beaches in the Usu area. Abuta issued an evacuation order to the Izumi-Irie area, which had had heavy mud slides, and an "evacuation alert" to Toyako-Onsen. However, there were some problems with the "evacuation alert" because the fire department mistakenly presented it as an evacuation order, leading quite a few residents to flee to the opposite bank of the lake.

In the afternoon, there were three additional small and medium-sized eruptions. Because they were smaller eruptions and volcanic activity appeared to be subsiding, the evacuation orders were cancelled toward evening, except for Sōbetsu's Shōwa-Shinzan area, Daté's Kaminagawa area, and a few other areas.

August 8 was overcast in the Mt. Usu area,

marking quite a change from the previous day's clear skies. Mt. Usu, which was quiet in the morning, erupted twice again lightly after midday and then strongly at 3:30 p.m. The rocks and ashes were carried by southeastern winds over Toyako-Onsen, where they rained down on the town, the fist-sized chuncks of pumice breaking roof tiles and window panes alike. The surface of the lake was quickly covered with pumice and accumulated ashes 30 centimeters deep. Pumice and volcanic ash kept falling intermittently until dusk. Rain from the thunderstorms which developed in the evening made the ashes heavy and sticky. By this time, most of the tourists and residents had fled.

When the eruption hit Toyako-Onsen on the afternoon of August 8, the town manager was at the Toyako-Onsen branch of the Abuta town office. His first action was to order the residents in endangered areas to evacuate. The evacuation order was issued for the Konomi housing complex, which is only 1.5 kilometers from the crater and which had a lot of ash fall. The order was also given for part of the Izumi-Irie area. According to officials at the Toyako-Onsen station of the Nishi-Iburi fire department, both communications and evacuation were made extremely difficult by the falling pumice and ashes.

STEPS TAKEN BY ABUTA'S TOWN MANAGER

The town manager had done some disaster planning for Toyako-Onsen. Just the previous afternoon, he had designated Toya-mura village on the opposite side of the lake an emergency refuge and had decided that residents could use sightseeing boats for evacuation. By the end of August 7, most tourists had already left the town, half the residents had voluntarily evacuated, and the town manager had sightseeing boats ready to evacuate the remaining residents. However, pumice that fell on the lake immobilized the boats, closing that evacuation route. Also, since the town manager was giving orders and instructions on-the-scene in Toyako-Onsen, he lost contact with the Abuta-Honcho town office and thus had to guess at the timing of the Toyako-Onsen evacuation order.

The dangers posed by the immobilization of the sightseeing boats, however, were averted when the 23rd Regiment of the 7th Division of the Self-Defense Forces (SDF) cleared one lane of Route 230 of its wet-cement-like rain-soaked volcanic ash. What if the route had not been cleared? The town manager is reported to have said: "They should never be told they're trapped. If you tell them to stay home because they're trapped anyway, they'll do anything to get out. Panic must be avoided at all cost – even if I have to lie to them."

Officials at the Toyako-Onsen branch town hall who had contemplated having to move out on ash-laden Route 230 were relieved when the road was cleared. In a questionnaire filled out by the residents of the four worst-damaged areas (Toyako-Onsen, Izumi-Irie, Sōbetsu-Onsen, and Kaminagawa) a very large majority of residents stated that they felt the SDF had performed most reliably [3].

The poor timing of the evacuation order was mitigated by two factors: SDF help and the fact that the eruption did not affect Toyako-Onsen severely enough to inflict devastating damage. This second factor especially enabled the town manager to say: "This evacuation is going to be proven unnecessary. Judging from the volcanic activity so far, the residents' lives are in no danger. They'll be safe if they stay inside, since all we have is ashes and pumice falling. But if we don't order an evacuation, I suppose the town will be faulted for not having done anything."

A manufacturer who serves as Chairman of the Tourism Association said: "Everybody here was so upset. The women started crying and the supervisory people, not knowing what else to do, had all they could do just to

calm them down. It looked as though the somma would collapse and I thought, for a moment, that even the lake was in danger. It was pitch dark, smoke was pouring out, and rocks were raining down. What with the lightening and all the rumbling, I was afraid that the somma would split."

The town manager decided to issue an evacuation order about half an hour after midnight on August 9, and this was officially announced at 6:20 the same morning. It rained so heavily that day that a Heavy Rains and Flood Warning was also issued. By the time the evacuation started at 7 a.m., 1,700 people had gathered. Their destination was Abuta-Honcho, across the mountain. Fifteen SDF transport vehicles and five chartered buses went back and forth carrying people, completing the evacuation by 9 a.m., two hours later. About 100 residents, including inn owners, refused to be persuaded by the police and fire departments and stayed in Toyako-Onsen.

AFTER THE INITIAL EVACUATION

The police were in a less enviable situation than the SDF. In fact, the police did play a major role in maintaining order, but the people did not rate their performance very highly on our questionnaire. The main reason for this poor showing on the questionnaire was that the police policies were basically in conflict with economic interests. The Daté police were in charge of the affected areas. With the support of other police departments from around the country, they maintained policemen on 24-hour duty from the first eruption until November 14 to control traffic, to prevent crime, and to ensure the safety of those who chose to stay behind. When the Mt. Usu eruptions gradually showed signs of subsiding, residents found life as refugees boring and inconvenient, and calls for the evacuation order's rescission became louder as the tourist season ebbed away near the end of August.

The evacuees were housed at such public institutions in Abuta-Honcho as Abuta Elementary School and Abuta Junior High School. Much help was provided. The SDF and the Japan Red Cross supplied blankets. The telephone company installed toll-free telephones so that people could communicate with one another. NHK donated television sets. And the Abuta-Honcho housewives cooked for the refugees. Thus, the refugees were relieved of some immediate problems. Life at these institutions, however, was not pleasant. It was very noisy, and there was no room for people to stretch out. People had only one blanket and the hard floor on which to sleep. Fatigue soon set in. Many complained of insomnia and headaches, others of heart or stomach ailments.

Negative comments abounded in the replies to the questionnaires that we sent out: "I was at my wits' end with the worry and boredom." "It was so cramped. I never want to do this again." "It was all so sudden. I didn't have time to bring anything with me. All I had was a groundcloth and an SDF blanket. My back ached, and there were many nights when I couldn't sleep." "I only had one blanket under me and another over me. It was terrible." "I couldn't sleep for worrying." "It was impossible to feel at home there."

In order to cope with the developing situation, the Usu Eruption Evacuees Association was formed to strengthen solidarity among the evacuees and to facilitate group activities of their own. Committees and subcommittees were established at each refuge site, with about 20 people in each subcommittee. It was not until October 20, 73 days after the volcanic rains had first fallen on Toyako-Onsen on August 7, that all evacuees went home and the places of refuge were closed.

In the days between the initial evacuation and the lifting of the evacuation order much happened. Mt. Usu was quiet on August 10 and 11. August 12 and 13 saw one eruption each, with minor ashfalls and little damage to

Toyako-Onsen. There were still frequent earthquake shocks around Mt. Usu, and the Sapporo Meteorology Station warned of the danger of another eruption, but the danger seemed past to the displaced citizens. Once the fears of eruption had closed, evacuees started worrying about their houses – houses which now stood abandoned, their windows broken by the pumice rains and their roofs covered with ashes. Responding to their wishes, the town of Abuta allowed those evacuees that wanted to look around to go home for an hour on August 12. Three days later, this was extended to three hours to give people time to sweep ashes off their roofs and clean their rooms of pumice and ashes.

Fearful of possible danger, the Hokkaido and Daté police were cautious about letting ordinary citizens back into Toyako-Onsen. However, the Abuta town manager effected a de facto and gradual retraction of the evacuation order, with the one- and three-hour visits the first steps in a gradual lifting of the order.

SITUATION SPECIFIC TO TOYAKO-ONSEN

The prefectural government and the police were consistently more cautious than was the Abuta town manager. At his September 6 press conference, for example, the Governor said that it was still impossible to rescind the evacuation order, since Mt. Usu still had to be watched carefully. The Daté police also said any rescission would be premature, and that they hoped that a calm assessment was made of the actual situation.

Article 60 of the Basic Law for Disaster Policy assigns local mayors the responsibility of issuing evacuation orders. In fact, however, while responsibility is assigned, there is no authority given to enforce an order. Unless it is coordinated with police traffic control, it cannot have much effect. Yet the town manager spurned the advise of the more cautious prefectural government and police on the evacuation's duration. There were several reasons for this.

One reason, of course, was his concern about the evacuees' worry, boredom, and sleepless nights. But the main reason seemed to be pressure from Toyako-Onsen's inn keepers and souvenir-shop owners. The longer they stayed closed, the less they earned. Inn room cancellations mounted, and the tourist-service industry faced bankruptcy unless the evacuation order was rescinded and the area declared safe. On August 18, ten days after the eruption, the Toyako-Onsen Tourism Association pressed the town manager to rescind the evacuation order and to try to open up the town again as a resort area.

Yet the prefectural government and police did not see the issue that way. Their attitude was epitomized by the chief of the Daté police department's saying: "The main reason no lives were lost was that we lucked out. We were just lucky – in every way. We'd have been lost if the eruption had been a little earlier or later; or if the winds had blown directly to Toyako-Onsen. In every way, we just barely escaped the worst. There was a festival the night before, and estimates are that there was 50, 70, or even 100,000 people in Toyako-Onsen at the time. But the winds blew to Sōbetsu, and all the people in Toyako-Onsen took shelter. Then, after everybody was out, the smoke blew into Toyako-Onsen. We were just lucky there – almost too lucky... If people who live there die in something like this, that's one thing. But if people come to visit because we have told them it is safe and then they die too, that is something else again."

PRIORITY GIVEN TO THE ECONOMIC CRISIS

Had the Abuta town manager been anyone other than the person who occupied the position, rescission of the evacuation order would likely have been much delayed, placing

Toyako-Onsen in a considerably different situation. However, the town manager was an eloquent speaker and a man of action. He was just the man to exercise administrative and political leadership in the affected areas.

As already mentioned, the Governor and the police had expressed reservations about an early rescission of the evacuation order. Thus even if the town manager wanted to rescind the evacuation order, it would be impossible to restore the area to normal, let alone attract tourists to the area, unless he could persuade the police to remove the traffic barriers which they had erected in accordance with the Road Traffic Law and Article 76 of the Basic Law for Disaster Policy.

The situation was further complicated by the actions of another group. The Volcanic Eruption Early Warning Group of university professors and officials from the Meteorology Agency and the Science and Technology Agency who had banded together for volcanic studies, to coordinate information, and to monitor eruptions reported after an on-site survey that Mt. Usu was still dangerous and could erupt any time.

The town manager was asked about this some time later by a reporter for the *Muroran Mimpo* newspaper.

Reporter: "I think the most dramatic moment was the decision to rescind the evacuation order. It is generally said to be easy to issue an evacuation order, but most difficult to rescind it.. I hear you said you were prepared to commit *hara-kiri* if anything went wrong after the order was rescinded."

Town Manager: "Heads of municipalities should always be prepared to commit *hara-kiri.* We obey the dictates of conscience and do what we think is right. If we are wrong and the people suffer as a result, then we should be prepared to atone for the error. If you can't accept the responsibility, you shouldn't accept the position... The thing that made it a difficult decision was that the shop owners and inn keepers wanted an early rescission and their employees did not want to go back if it was going to be dangerous... So to avoid even the appearance of an arbitrary decision from on high, I had them organize the Evacuees Association and discuss the issues thoroughly. And I listened to what they had to say" [4].

On the one hand, the town manager asked the police to gradually relax the traffic controls, and on the other he had the evacuees organize the Association. As a result, he was able to work out a compromise allowing for an hour at home first, then three hours, then for the daylight hours beginning August 23, and finally rescission of the evacuation order on September 7. Daté and Sōbetsu followed suit. The police were thus pressured by the town manager and the shop owners and inn keepers who protested that delays would ruin the tourism industry. It is clear that the situation was viewed primarily as an economic crisis and only secondarily as a threat to the public safety.

TOYAKO-ONSEN REVIVED

The evacuation order was thus rescinded. There were, however, exceptions. For example, residents of dangerous sections such as the Konomi housing complex, elderly people, families with invalids, and those who had no immediate way of making a living, were not immediately allowed back. It was the socially disadvantaged who stayed longest at the refugee sites. As a precaution, the town of Abuta designated 20 reinforced concrete buildings as emergency shelters and organized a Citizens Protection Committee.

Prior to September 7, about 900 people, including those that owned cars, had gradually come back to Toyako-Onsen. Another 400 returned when the evacuation order was lifted in its entirety on September 7. However, the total rescission was of symbolic significance in that it was an official declaration by the town manager that Toyako-Onsen was "safe".

With rescission, community life returned to Toyako-Onsen. However, at this stage, no tourists were allowed in yet. All roads leading to the town had been blocked by the police since the August 8th rock- and ash-fall. Accordingly, the town manager had to repeatedly ask the Daté police to relax the traffic controls after September 7. On September 10, the Toyako-Onsen Tourism Association and 13 other organizations held a Citizens Rally to end the livelihood crisis caused by Mt. Usu's eruption. The rally was attended by 2,000 residents, including evacuees, and it was reportedly quite critical of the police traffic control (NHK, 1978).

It was two weeks after the rescission of the evacuation order that the police lifted their traffic controls. It took that long because the Daté police, although sympathetic to Toyako-Onsen's difficulties, put their priority on tourist safety and demanded that Toyako-Onsen's anti-disaster measures be improved first. In response, Abuta came up with an anti-disaster plan including the Citizens Protection Committee, escape routes for guests, etc. On September 22, they held an "evacuation drill." Impressed with these anti-disaster measures, the Daté police relaxed the traffic controls the following day, September 23.

Let us look at the questionnaire findings. In both Toyako-Onsen and Isumi-Irie, there were far more respondents who approved than disapproved the issuance of the evacuation order. Yet concerning its rescission, the vast majority felt it came too late. For example: "It took too long. The professors slowed this up with their timid reports." and "They were overly cautious. It could have been rescinded earlier." At Toyako-Onsen, we were often told that lifting the evacuation order was more difficult than issuing it. The questionnaire results bear this out clearly, as there was considerable citizen dissatisfaction over the timing of the order's rescission.

When an evacuation order is issued due to a typhoon or flood, the evacuation lasts two to three days at most. But such limited duration evacuations are impossible in the face of incessant earthquakes or an unpredictable volcano that might erupt at any moment. On the other hand, people cannot stay away from their homes indefinitely. Fear of eruption and attachment to the home are two forces pulling in opposite directions, yet the people finally resolved this in favor of going home. This was shown not only by the fact that many of our respondents felt that the order's rescission came too late, but also by the strong demands that the order be rescinded and traffic controls lifted despite the warnings of the prefectural government and police.

AFTERMATH OF THE ERUPTION

The Abuta town manager frequently says: "Toyako-Onsen suffered 50 million dollars in damages, but got 150 million dollars worth of free advertising." Advantage was taken of some possible positive aspects of the disaster, which others have since sought to emulate.

After the eruption of Mt. Usu, the political situation in Abuta underwent a major change. The town manager got maximum political mileage out of this once-in-a-lifetime chance. Although a few residents did call him dictatorial or fascist, he was regarded by the majority as a very reliable leader. Some even consider him a future candidate for governor. The traditional political enmity between Abuta-Honcho and Toyako-Onsen dissipated, albeit temporarily, in the face of an emergency that called for solidarity. In the subsequent election for town manager the entire town, including the labor unions, supported the incumbent making it the first uncontested election in 20 years.

One of the questions on the questionnaire asked residents to evaluate the contribution made by the head of their municipality and to compare the contributions made by the

different mayors and town managers. In response, residents of Abuta thought that their town manager did very well, better than the rest. Residents of Sōbetsu gave their town manager a passing grade but they said the Abuta town manager had done more to Abuta residents than the Sōbetsu town manager did for Sōbetsu. Likely, Daté residents thought their mayor did very well but that Abuta's town manager had done even better.

The Abuta town manager gained the near-unanimous support of the town council as he listened to the people and sympathized with their desires. In 1978, he opened a Museum of Volcano Science and a Pheasant Park as new tourist spots in the Lake Toya area. He has also used the volcanic rock and ash that fell in Toyako-Onsen for landfill in part of the marsh to create promenades around the lake. Moreover, he has applied for a government subsidy under the Special Law on Volcanic Eruptions to build new sewerage facilities so that a projected 3.5 million tourists a year will not pollute the lake. If all of these plans work out, then fortune and misfortune will have simultaneously occurred and Lake Toya may be revived as an outstanding tourist resort.

There are, however, problems. For one, because the ground is settling, several water pipes break every day in Toyako-Onsen alone. What does this portend? What does the July 15, 1978 eruption, the largest since last November, tell us? What of the sloppy ash slides which killed three after heavy rains on October 24? The danger is still there. Even if 80% of Mt. Usu's energy is already released as the seismologists say, it is not yet an absolutely safe mountain.

DISASTER FORECASTING AND PUBLIC POLICY

Fear of generating panic is one of the main reasons people in positions of responsibility hesitate to issue an evacuation order when natural disaster threatens. It was to avoid panic that the Mexican government hesitated to sound the alarm in the Rio Grande flood (Clifford, 1956). When Florence was on the verge of being flooded, the local Italian authorities saw the danger of panic as greater than the danger of floods, and no alarm was issued (Quarantelli, 1977).

This course of action may be justifiable when the threat is extremely local and panic is judged the greater danger, but it is inexcusable when there would be major damage over a widespread area. Instead, the government hesitates for other reasons – mainly political and economic – to issue an alarm for such area-wide disasters as earthquakes or volcanic eruptions. Particularly in a large metropolitan area, delay can be fatal, yet the losses from a commercial stoppage also are enormous. In Japan, activities that might cause secondary disasters are required to stop operation when an earthquake alarm is issued, but it takes enormous amounts of time and money for petroleum complexes and steel mills to get back to normal after a shut-down. Traffic stoppages would inconvenience residents by reducing the flow of food and daily necessities into urban areas. Discontinuance of gas service would also be an inconvenience. There are countless such examples.

The other main problem is that the present state of art does not enable us to forecast major earthquakes or volcanic eruptions as accurately as we do floods, tornadoes, and typhoons. Accordingly, there is a very good chance of false alarm. Those in authority must weigh the risk of a false alarm against the risk of exposing their community to a major disaster. The Abuta town manager faced the same problems. Like any reasonable official, he wanted to delay the alarm as long as possible and to rescind it as quickly as possible. In order for us to check this administrative propensity and thus to minimize the damage inflected by a disaster, we felt it necessary to establish the following principles:

1. *All news is good news.* We have to establish the principle that all relevant information is being given to the public. At the same time, we have to improve our communication network so that the information is not distorted in transmission. The mass media play a particularly important role. Mass media must be able to sense and to respond to the citizens' information needs.
2. *Disaster-prevention should be second nature.* The struggle to protect citizens from disaster is, in a sense, a state of war. Therefore, adaptive disaster-related behavior must become second nature if we are to prevent disorganized and uncoordinated responses and to alleviate political and economic confusion.
3. *Objective criteria for alarms should be established.* We must establish a system under which an alarm or evacuation order will be issued if the estimated loss from its nonissuance (expressed as a function of the total losses from the disaster times the probability of its occurrence) is greater than the loss (political and economic confusion) from its issuance. The main variables in this system would be the probability of damage, the size of the damage, and the political, economic, and social conditions prevailing where disaster is expected. Considering the wealth of natural and social expertise at our command, such criteria are more than overdue.

NOTES

1 This survey by the Disaster and Information Study Committee in January 1978 questioned 1,093 Tokyo-residents adults, men and women, on natural disasters.
2 The Izu-Oshima earthquake hit on January 14, 1978. Four days later, Shizuoka Prefectural government released an "aftershock report" calling for alertness to the possibility of residual tremors. Yet this report, which went out on television and over the Propane Gas Dealers' Association's communication network, was mistaken for an earthquake alarm by the people. See Okabe (1979).
3 This was a mail questionnaire survey sent to 200 people in each of the areas asking them to evaluate the degree of damage, the governmental response, the evacuation, and other pertinent aspects.
4 See the *Muroran Minpo* newspaper, evening edition, June 12, 1978.

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NATURAL DISASTERS AND ECONOMIC DEVELOPMENT: INTRODUCTION

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In many rural areas of industrial countries and over much of the Third World, profound socio-economic transformations have taken root. Disasters that occur within these regions tend to foment changes already underway, and even on occasion initiate change, by creating a situation of abundance within hardship. Acute resource scarcity instigated by the destructive agent elicits a torrent of aid. Heightened local dependence on external support enlarges the incentive of administrative agencies and organizations working under their aegis to participate in the long-term planning of community affairs. Such intervention derives also from the relatively sudden, dramatic revelation of chronic overall privation or the highly skewed distribution of power and riches that provided the impetus for development policies prior to impact. Precisely how these imputs affect community stability and growth depends on such factors as government's ideological commitment to eradicate the social and political processes weakening local resistance to crisis, the bureaucratic and budgetary constraints governing the state's ability to deliver on its promises to rebuild, the importance of the region in the broader national context, and the capability and willingness of local leaders to seize on the disaster for pressing home long cherished social reforms. Moreover, to the extent that they can influence the distribution of bounty generated by the disaster, so local interest groups may follow courses of change they had charted out before the crisis.

It must also be remembered that catastrophes can traumatize governments as well as local communities. In natural disaster settings especially, owing to their typically region-wide scale of devastation, the administrative apparatus is apt to absorb tremendous stresses by virtue of its direct involvement in crisis management. Where established procedures, policies, programs and bureaucratic structures fail under stress, novel approaches to problem solving which contribute to organizational modifications in state or local government may emerge, and these changes in turn stimulate economic development. The metamorphosis of colonial administration in India attests to just this kind of relationship between disasters and development.

The disaster itself may be an immediate or indirect outcome of radical development programs. Widespread ethnocide and pauperization afflicting native Amazonian populations because of state and multi-national efforts to exploit the natural resources lying in their homelands illustrates a direct link between disasters and development. Investments in green revolution technology made by wealthier neighbors is gradually destroying the economic buffers that great masses of monsoon belt dwelling peasants have depended on traditional-

ly as security against recurrent flooding and drought. The overcrowding into mountain zones by subsistence farmers whose original lowland plots have been expropriated for use by large land development concerns or over-taxed, under-capitalized, or divided into hopelessly small fragments has led to deforestation and concomitant erosion of fragile highland soils. The improvident use of these marginal lands accordingly is creating unprecedented flood and landslide hazards. These are only a few of the many different kinds of more circuitous, albeit significant, associations between disasters and development.

It is clear that disasters today are potentially greater in magnitude and frequency than ever before owing principally to rapid socio-technological changes that are dramatically restructuring *cum* destabilizing social and physical environments on a global scale. Yet, regrettably, it is not possible to ascertain with any fine precision just why it is that modernizing pressures either trigger disasters or well up in their wake. Perhaps the biggest stumbling block interfering with the scientific study of disaster causality is the fact that the problem is so colossally complex. Disasters, by definition, involve the complete makeup of entire communities, be they towns, cities, or larger social units. To reach the taproots of disaster genesis one must fathom not only the "routine" workings of a given social system but, with equal rigor, detect, measure and monitor its interactions, intensified by crisis, with systems of other systems. In lesser developed countries it is not unusual for these transactions to telescope out from isolated rural provinces to the international community. Obviously, any exercise of this kind, if it is to make the best use of available scientific methods, is stupendously difficult, particularly when the troubled system is as elaborately organized as a nation-state.

No doubt some simplification will be necessary initially to isolate out primary factors constituting the disaster–development equation. Unfortunately, the trend in research to date has been either to ignore altogether developmental processes in social systems by focusing on roles, individual cognitive processes, or formal organizations, such as police and fire departments, operating within disaster contexts, or by lumping different empirical instances of disaster together as special instances, or epiphenomena, of global development tendencies. Marxist attempts at explaining disaster vulnerability among Third World peasant communities as an inevitable product of the economic exploitation engendered in class-stratified capitalistic states exemplifies this latter approach.

In-depth empirical field studies focused either on one or both of the organizational domains through which disaster and development processes converge are exceedingly rare. The primary unit of analysis, in one, is the community, while the other comprises segments of government bureaucracy involved directly in local disaster genesis. Both systems will have to be taken into consideration, regardless of the point of departure chosen, for neither process occurs within an administrative or a local community vacuum. Where resources permit, the scope of investigation should be broadened to encompass more of the larger regional system that comes into play or a widened spectrum of participating state or international agencies. Even a small critical mass of a dozen or so such studies will add enormously to the difficult task of building a system of testable theories accounting for variations in disaster causality and coping across a broad spectrum of societies and with respect to a variety of development situations. Most of the following papers are based on the *in situ*, social system oriented research advocated here, and they touch on numerous issues that should stimulate future disaster modelling.

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INTELLIGENCE, RESILIENCE AND CHANGE IN COMPLEX SOCIAL SYSTEMS: FAMINE ADMINISTRATION IN INDIA

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INTRODUCTION

This paper is a very preliminary first step in the direction of utilizing disaster research to build theories about resilience and change in the organization of social systems. Analysis of this scope, if it is to take shape, must proceed by reducing these systems, in their staggering diversity, to a few modal types, or paradigms. It is preferable that all models undergo examination through the prism of a single disaster type, at least initially, to ensure a meaningful basis for comparison. Famine [1] is the only hazard/disaster documented in considerable socio-economic detail and across an array of societal types, though systematic famine related research itself is very sparse. The gaps within this literature have thus far limited the range of social systems available for analysis to band societies, tribes, and nation-states. A literature search has yet to turn up usable ethnographic materials on chiefdoms and kingdoms [2].

Social structural, technological and ecological differences notwithstanding, the societies surveyed exhibit two distinctively different ways to organize against famine threats. One adjustment mode is diacritical for band-tribal systems. I designate both mode and system as "traditional". Nation-states, referred to hereafter as "complex" systems, display yet another approach to famine control. The terms "system" and "society" shall be applied interchangeably when associated with the traditional/complex dichotomy. They should further be understood as denotative of administrative organization. "Administration" will be employed in a general sense to mean the most inclusive set of institutionalized arrangements that the system provides for making public plans and policies.

Famine data for India (1858–1968) will be marshalled in developing an argument which runs as follows. In a number of significant ways, complex systems tend to cope with hazards/disasters less successfully than traditional systems. Enhanced fitness is attainable however provided the troubled system resolves on certain approaches to problem solving typifying those enlisted by traditional systems. This reorientation process entails organizational change and leads to toned-up resilience in thwarting future famine assaults.

India is a logical candidate for analysis. Several narrowly spaced famines and famine scarces which crowd into her recent history are dutifully recorded and archived. Documentary materials combine with solid fieldwork to form some first-rate efforts relating famines to organizational change in public administration. This careful attention to the course of Indian famine is especially rewarding, for it is doubt-

ful that natural disasters have influenced the structure of any other modern complex systems quite so profoundly. I might note in passing that this exercise departs from most current societal disaster analysis addressing social change in stressing the complex system's place in regulating rather than in fostering disequilibria.

FAMINE CONTROL IN TRADITIONAL AND COMPLEX SYSTEMS

Societies gripped or threatened by famine absorb enormous organizational stresses. It is in the nature of traditional systems to obviate large-scale challenges to public order attendant on acute scarcity through the retrenchment and atomization of communal decision making. Territorial units accordingly disaggregate, interaction among them relaxes, or personnel associated with residental groups disperses. Famine, in short, constricts the boundaries and possibly dilutes the intensity of administrative activity.

These very centrifugal tendencies fostering resilience cannot be tolerated in complex systems similarly perturbed, as they work against the fabric of society. The complex system boasts an elaborate network of territorially dispersed, functionally specialized institutions serving a large, heterogeneous population. It stands to reason that the nation-state, unlike its traditional counterpart, perceives its presence in terms of something more than a discrete population, an assemblage of like parts. *It recognizes itself rather as constituting a discrete system.* The complex society proceeds from this *weltanschauung*, this premise of unity, by coming to the rescue of component sub-populations wracked by crisis. A doctrine of obligatory charity serves to activate an organized flow of resources transferred from the whole to its weakened parts. The traditional system though is not so structured as to route local problems through global channels by formal procedures.

Quite obviously then it is incumbent on the complex system to counteract separatist tendencies inhering among constituent organizations under stress, especially those minimally of the scale of local communities and bureaucratic divisions. It attempts to do this, so as to bolster its resilience, through a regime of administrative intensification. Supervisory agencies facing the spectre of famine expand the scale of their operations, their line and field staffing, their information gathering/processing capabilities, the domain of their services, and their willingness to innovate. Herein lies a cardinal point of difference distinguishing the two systems under review. Based in part on this discussion I now frame a short list of propositions that tie into an argument guiding analysis of the Indian case materials.

1. Famine, as envisioned in traditional societies, originates from relationships between people. Nature merely sets the stage for misfortune or is finessed into doing so by willful human agents. The locus of disaster causality in complex societies is shifted from the social system per se to technology in particular, and nature's role achieves considerable weight. And so famines appear no longer as extensions of everyday transactions among men but instead come to represent radical breaks in associations formed between men and their habitats.

2. Famine management in traditional societies is approached not as an organized effort required of all population components but exists rather as a problem to be resolved by affected groups themselves. Complex societies regard failure experienced by one unit as related to the functioning of a much broader system of units and accordingly treat local disturbances through population-extensive programs of action.

3. Complex systems move toward a state of administrative intensification under conditions of famine stress, while the traditional system copes within a progressively constricted field of collective decision making.

4. Traditional societies conceptualize famine

etiology within an encompassing social systems frame of reference, but do not, cannot and need not organize to cope beyond the boundaries of specific stricken groups. Complex systems, as noted, undertake population-wide efforts to aid disabled subpopulations. And to do so they employ cognitive models homed on a very limited range of system-disrupting factors. Or, posing the contrast in still another way, in one case a broad base of information passes through a relatively narrow organizational field to resolve a problem of diminishing complexity (by virtue of point 3). In the other instance, the organizational field is vast, the knowledge base narrow, while the problem is crescive.

Behind each contrast postulated resides a property germane to crisis management, and indeed to decision making per se. The essential ingredient is "intelligence". As the societal decision circuitry varies cross-culturally, so do arrangements devised to generate and transmit intelligence. How systems manage disaster will correspondingly depend in large measure on administrative constraints governing the production of high quality intelligence [3]. Intelligence will signify here the summoning of information for the purpose of delimiting a problem's boundaries. This matter of problem circumscription is what will be referred to as the cognitive dimension of intelligence. In so much as intelligence meshes through an interpretive sieve, it also has an evaluative aspect. Not only must a crisis problem be defined and the data mustered for solving it assessed, but techniques advancing such operations have to be brought under close scrutiny. So intelligence evinces an instrumental facet. I want to infer from the preceding chain of argument that traditional systems are more likely to possess high quality intelligence available for handling famine stress than their complex counterparts, for the following reasons.

1. The traditional administrative apparatus is relatively simple in the sense that few decision making steps and information producing units intrude between domestic groups, their resource base and public leadership. Intelligence requirements stemming from organizational considerations accordingly are fewer.

2. Intelligence requirements are fewer and simpler in yet another way. The traumatized system short-circuits oppressive demands on intelligence by cutting away layers of communal decision making. This scaling down and streamlining of organization makes for greater parsimony of intelligence.

3. A socio-centric fix on disaster genesis allows beleagured traditional societies fuller insight into social system factors productive of famine causality and control. And so the system enters into a rapidly deteriorating situation equipped with a fuller understanding of where it stands at any given moment.

4. Traditional societies gear up for famine by tapping into reserves of accumulated experiences that retain their value from one famine crisis to the next. The great staying power intelligence exhibits in these systems accrues largely from the fact that resource management practices and administrative organization over time change very gradually. The more mutable administrative arrangements characterizing the complex system will tend partially at least to superannuate existing intelligence.

5. The traditional system can better protect itself through precautionary planning because it possesses a more effective intelligence generating capability.

INTELLIGENCE

It will be convenient to organize the Indian materials around three intelligence parameters integral to famine mitigation.

(a) *Predictive intelligence* brings into play the detection, recording and interpretation of warning signals emitted at each stage marking a state of escalating crisis. Such operations will be certain to falter if they cannot establish benchmark data against which to measure progressive deviations in the values of in-

dicators diagnostic of famine causality and impact. Nor will stress detectors serve their prime purpose unless sensitized to disparate adjustments undertaken by assorted vulnerable groups and so gauged as to differentiate among numerous chronic and acute causes of risk. The data must be standardized for collation and comparison with information derived from still other distress tracts and prepared for rapid and efficient transmission to appropriate authorities. Intelligence of this kind buffers the system against failures of foresight.

(b) The system can minimize the risk of muddling through future disasters by reviewing thoroughly the results of decisions enacted to deal with the symptoms and root causes of famine within the zone immediately affected and repercussions such operations have on those system components not directly traumatized. Auditing defects and achievements in the existing scheme of controls should devolve on qualified individuals or commissions of inquiry and lend itself to efforts at revising guidelines, recommendations and regulations, where necessary. This *ex post facto* pattern of learning in serving as a deterrent against potential crisis is what I term *retrodictive intelligence*. Such intelligence, if flawed, can instigate failures of hindsight.

(c) The society must further obtain continuously updated readings for keeping tabs on results its risk reduction strategies actually achieve. Warranting surveillance here are the productivity of particular projects (e.g. poor houses, soup kitchens, movement to frontier well complexes) and the adequacy of organizational arrangements devised for running them as planned. Steering operations require that project personnel and supervisory staff be conversant with instructions pertaining to technical operating procedures (how, when and where to activate and maintain the project and who shall draw benefits from it); performance standards applicable to all personnel; and criteria for determining their adherence to these standards. Moreover, instructions for procuring aid must be extended in a suitable manner to targeted welfare recipients in order to make relief work. Measures expedited to ensure this kind of vigilance can be termed *operational intelligence*, which if wanting, may result in failures of control.

Control is a necessary complement of intelligence. By control I mean premeditated action enforcing a plan or policy. How well a system copes with stress cannot be ascertained in the final analysis if the interplay between these two elements is ignored. This is a tall order for a short paper, and so I confine discussion to intelligence alone. In skewing the angle of analysis thus, my remarks concerning information channels by which grain rationing abuses or slipshod railhead to warehouse grain transport methods are detected, say, will sidestep the policing operations worked out to contain specific violations. Or I will refer to nutritional, health and geological surveys without bothering to indicate the programs they lead to. But even inquiry delimited in this vein should not vitiate the case being made for using famine settings as windows into processes promoting resilience and change in social systems.

INDIA 1858–1908 [4]

Famine Causality

India is a predominantly agricultural country. Until quite recently the acreage benefiting from large irrigation works was very limited. The food production system was almost totally at the mercy of the summer and winter monsoons. Vicissitudes in the phasing of the rains created periodic food shortages. Yet only fourteen famines are on record between the eleventh and eighteenth centuries, and these were fairly restricted in area. During the British East India's reign, between 1765–1858, however, "the country experienced twelve famines and four 'severe scarcities'," and by 1860–1908, "famine or scarcity prevailed in one part of the country or other in twenty out of the total of forty-nine years" (Bhatia, 1967: 8).

With the *Pax Britannica* came a sharp downturn in India's resistance to agricultural shortfalls that eroded the quality of rural life. Contributing to this trend were a rigid and burdensome system of land assessments and revenues, the burgeoning of ursury and landlordism, decline of cottage industries and retarded industrial growth, and government's unwillingness to regulate commercial enterprise. Rapid population growth and several closely spaced droughts hardened the pejorative impact resulting from these tendencies.

Land revenues financed a host of undertakings that enabled government to fulfill its responsibilities as a colonial entity. These included the provision of support for British soldiers stationed in other parts of the empire, for the Anglican Church, and for the governance of its own domain. Disbursements for famine relief programs and for investments in irrigation projects and the railroad system later enlarged its fiscal burdens. Taxes, especially during scarcity seasons, severely depleted agricultural surpluses traditionally enjoyed by the subsistence farmer as a hedge against privation.

British commercial hegemony exerted a stranglehold on indigenous industry. With the laying down of roads and rail lines, cheap machine made imports flooded rural markets. Few artesians could match the prices brought by foreign goods nor reproduce items that replaced their own. Unfair trade agreements granted British merchants further upset local industrial viability. Moreover, vested interests abroad, in raising the spectre of ruinous foreign competition, went to great lengths to suppress any prospects for an industrial revolution in India. Lancashire industrialists, for instance, lobbied successfully against overseas textile mill construction and blocked the Indian Government's hopes of abolishing import duties on Lancashire products. Throughout the latter part of the century British exports were exempted from customs levies and transit duties, though Indian goods exported to the motherland absorbed heavy duties. India was eventually reduced to exporting raw materials while it saw its own potential as an exporter of finished products stifled. Also affecting rural life was the conversion of vast stretches of farmland to commercial use in order to expand production of such export products as indigo, tea, cotton and sugar. Acreage available for domestic food consumption subsequently shrank and vast territories became food deficit zones during bad drought years.

The trends just cited substantially reduced modal per capita land holdings. Artesians commonly practiced part-time agriculture to make ends meet. With the collapse of small-scale manufacturing and the absence of suitable employment options, vast numbers of craftsmen fell back on the land as small holders or share croppers joined the growing ranks of drifting day laborers. Urban industry, still in its infancy, was unfit to accommodate large numbers of job seekers. On this point Bhatia has a penetrating observation to offer

> . . . in India the normal economic process was reversed. In England and the other European countries in the nineteenth century, labor was released from agriculture to provide wage labor to the expanding economies; in India, the manufacturing industry threw out labor to be absorbed in stagnating agriculture (1967: 22).

Mounting pressure on shrinking agricultural resources dovetailed with the unregulated commercialization of land sales to separate the peasant from the soil. In pre-colonial India, outsiders rarely got opportunities to buy up village lands. Colonists, however, introduced the concept of landlordism. Land assumed a market value, was freely transferrable and generated profits through rents. Outside investors could now gain a foothold in the village domain by offering to buy out or extend loans and credit to the peasants forced to sell their land or mortage productive property to pay taxes and purchase food during famine years.

Landlords and money lenders advanced credit and loans often at extortionist rates of interest. Bhatia notes that;

> after making payment to the landlord and the state, and meeting the current expenses of cultivation, what was left for the [farmer's] produce of land was to fill the coffers of the money lender (ibid.: 57).

The judicial system abetted usury by making debt bond renewal occur at short intervals and by diligently prosecuting defaulters. Government did not take much initiative in prevailing upon money lenders to relax credit restrictions, to suspend interest payments, or to lower interest rates during famine periods. Authorities were quite content to side-step a potentially enormous administrative task by letting the private sector handle credit transactions. Nor did the state care to intervene in landlord–tenant affairs. Not until the turn of the century were any serious official attempts made to prohibit arbitrary rent increases.

Land usually passed from farmers to non-agriculturalists who were typically urban landlords more concerned about getting rents than in fostering efficient use of land, labor and farm equipment. This state of affairs surely did little to stimulate agricultural productivity. Sharecroppers, tenant farmers, wage laborers and small holders who were deterred from enjoying the fruits of their labors were hardly prepared to experiment with agricultural improvements.

Famine conditions were closely linked to market forces, pushed by an expanding mercantile class, that generated prices catapaulting foodstuffs beyond the reach of many citizens. Government left the grain trade pretty much to the devices of middlemen. Subsequent hoarding, wild speculation and wholesale export of supplies away from distress tracts greatly inflated food prices. Time and again traders were exporting wheat and rice from a needy region while government would be importing it. It was not until the Bengal famine of 1943 that firm price controls and state monopoly of private trade came into force during food emergencies. Nor was the price situation alleviated by government grain shipments abroad. Indeed, wheat was India's largest export commodity until 1914. Government was a culpable agent on still other fronts. Imperfections riddling the administration of relief transmuted inconvenience into misery for many. I consider this issue shortly.

Famine Management

The imperial government dealt with famine and food scarcity largely on an ad hoc, trial-and-error basis between 1858–1878. Non-official organizations were suppressed for fear they might spawn entire classes of welfare malingerers. Gratuitous relief was thought not to be the responsibility of government, and public works programs were still few and poorly organized. Government's role in controlling disasters had yet clearly to be articulated. The relationship between tenancy statutes, the behavior of grain markets, employment elasticities and other interrelated factors figuring into the famine question were understood only partially and vaguely. Nor were the principal sufferers of famine properly identified or the measures needed to relieve distress and prepare timely schedules for precautionary action worked out carefully. Moreover, nothing approaching an adequate ground plan for administering relief had yet been devised.

The first nation-wide Famine Commission was formed in 1880 to rectify these problems. The commission's deliberations resulted in a Provisional Famine Code, framed by the central administration, which would serve as a model for helping provincial administrations formulate their own codes. Each province possessed a certified code by the end of the decade. These documents made sweeping recommendations for strengthening state and local administrative relief operations and they dramatized inherent linkages between famine policy and larger issues surrounding rural development and political reform. It was stipulated that the codes would be revised whenever a famine revealed in them any serious defects. The codes in fact underwent revision following each successive famine.

Detailed attention to predictive intelligence gathering techniques, such as village level agro-economic and cadastral surveys, the collection of vital statistics, weather reports and so forth, or the steps government took to monitor the working of its relief programs (operational intelligence), are considered only very superficially in the historical studies that cover the era. In getting around this problem, I consider the cognitive dimension of predictive intelligence alone, that is the orientation displayed by administration in familiarizing itself with the extent and causes of famine stress. I proceed by describing several legislative and technological accomplishments furthering disaster control in as much as they derived and promoted predictive intelligence operations. And though the monitoring and reviewing of operational intelligence cannot be detailed here, owing to the spareness of available information, I do describe administrative structures evolved to accommodate such functions.

a. Predictive intelligence

In waging campaigns against disaster, the government had first to identify potential famine communities. By the third decade of its rule, the imperial government could specify the most risk-sensitive population segments and their special needs from among a vast array of tribes, castes, classes and religious sodalities. By 1900 all famine codes incorporated relief provisions tailored to alleviate misfortunes apt to arise among orphans, artesians – particularly weavers – *purdanashin* women, hill and jungle tribes, and small-scale farmers and landless tenants. District officers presiding over scarcity tracts were expected to assess the status of all such groups within their jurisdictions, though it is unlikely their enquires followed uniform and rigorous guidelines or were supervised systematically from above. Moreover, the Famine Commission of 1901 put forth a territorial system classifying victims for purposes of administering relief:

> In the case of an early local and isolated calamity, relief should proceed from the particular to the general, i.e., field to field enquiry should be made and suspensions should follow the results of such enquiries while in case of widespread crop failures, i.e., general estimates of homogeneous tracts or groups of villages or larger territorial areas should be made and upon these estimates uniform suspensions should be worked out (Srivastava, 1968: 282).

Tax remission-worthiness in the first case was to be determined by village surveys encompassing all resident homesteads.

Government also got more insight into disaster causality. By the 1880s the theory that famine essentially derived from work shortages shifted to the conviction that the precipitating cause instead was one of food scarcity. This complemented a deepening concern that famine and famine relief were undermining village integrity. Keeping villages intact as units of production was expressed as sine qua non in all famine codes. Several steps were taken to preserve the economic viability of the village community. Small village-level public and private works came to be favored over large, distantly placed centralized projects. The early colonial policy approving emigration during emergencies was replaced by gratuitous relief measures and village aided public works schemes intended to discourage population movement. Remote cattle relief camps had been set up formerly to handle fodder scarcity. With the framing of the codes, the government began seeking methods for growing fodder locally or for importing it. And legislation was enacted granting jungle tribes proper access to adjoining forest preserves during famines.

By 1910 the government had shifted several degrees nearer to recognizing the essential connection between famine and chronic food scarcity. Official anxiety over the poverty issue is mirrored in numerous ammendments and revisions in successive famine codes. The Land Improvements Act of 1883 and the Agricultralist's Loan Act of 1884 are among the most important pieces of legislation enacted in this area. Both documents served to improve rural economic conditions through year-around

assistance programs. Government was ill-prepared and ideologically adverse to preempting the moneylender as the prime agent of rural credit. Despite official intransigence on this score, the act of 1884 allowed poor farmers government loans for seed and cattle purchase on easy terms during normal times and advances for meeting subsistence needs during famine. Regrettably though the loans usually turned out to be too small and poorly timed. The Land Improvement Act aimed at furnishing generous loans that would give big landowners the impetus to capitalize their holdings – viz. by having wells dug and irrigation channels constructed – thereby stimulating employment opportunities for the legions of destitute.

The Land Revenue Resolution of 1902 sought the reduction of rural indebtedness through famine phase revenue recisions and reductions. Various provinces passed tenancy and rent acts during the '80s. Many of these, through ammendation in the early 1900s, extended occupancy rights to certain classes of tenants and interdicted landlords from raising rents arbitrarily. Several provisions were drafted prohibiting permanent alientation of land from farmers to entrepreneurs. A revitalized Famine Relief and Insurance Fund, ± 1881, guaranteed funding for famine relief and public works projects. The many charitable relief funds and trusts sanctioned by government, that sprang up around century's end, became conduits providing disaster victims money, blankets, food and seed grain concessions. Moreover, the Cooperative Credit Societies Act designed at the recommendation of the 1901 Famine Commission laid the groundwork for the country's first rural credit cooperatives.

Government's perception of the famine problem still remained blinkered on a most critical front – the grain market – by a steadfast obedience to classical economic precepts. Controlling prices, regulating interstate and transnational transport, restricting profiteering, requisitioning, building reserves and storage facilities, and formulating rationing schemes were programs in the domain of foodgrain policy not entertained seriously until the Bengal famine climaxed several decades later. Accordingly, the food distribution process did not rank prominently as an issue mooted in various famine inquisitions.

In subscribing to the moral and fiscal scruples blended by political economists of the likes of Adam Smith and J.S. Mill, government was slow to appreciate the ultimate assets accruing from non-official relief organizations. In them was seen the hidden hand of welfare dependency. This repressiveness eased somewhat during the 1880s, and several such organizations started up in famine-prone provinces by 1900. But government's reservations still lingered on as evidenced by the absence of official efforts to exploit invaluable grass-roots knowledge acquired by these organizations or to utilize their operating procedures as models upon which to build stopgap intelligence pipelines between the village and district headquarters. Several decades were to pass before official and non-official efforts would unite.

b. Retrodictive intelligence

Central and provincial governments appointed special commissions of enquiry following every famine. The commissions scrutinized documents prepared by officers superintending local relief works, and site visits might be made by way of augmenting information presented in these reports. Reports were reviewed against the backdrop of existing codes. In this manner the codes could be revised and updated with the passing of each new crisis. Task force recommendations transcended immediate calls for perfecting famine relief policy. Rural indebtedness, food production, industrialization, transportation, public health, the bureaucratic organization bridging center and periphery, and land ownership all came up for deliberation repeatedly. Measures proposed and blueprints implementing them were packaged together.

There is no mistaking that retrodictive famine intelligence enshrined as it was in these codes acted in fomenting major procedural and institutional reforms in imperial government. And it brought numerous involved issues surrounding citizen's rights and government responsibilities into constantly sharper focus.

c. Operational intelligence

The famine codes were a springboard initiating the overhaul of administrative structures revealed by a disasterous event as creaky and ineffectual. I touch on only a few intelligence-related organizational innovations highlighting this era. It is remarkable that disaster affected provincial administrations could undertake radical steps to rectify inept emergency phase performance by a wholesale revamping of public institutions. Such was the case when the Bengal Government failed to come to grips with the devastation wreaked by the Orissa Famine of 1866. On the central government's investigation of this matter, Misra notes

> The entire issue of inquiry boiled down to this: how was the government of Bengal to be strengthened so as to enable it to deal with any state of emergency and the extended function of such a state? Was it possible through a council form of government and a separate legislature, or through a Lieutenant Governor vested with executive legislation . . .? (1970: 268).

He goes on to observe that

> The story of the formation of Assam into a separate province is thus significant in that it shows how the failure of the government of Bengal in the Orissa Famine lay at the back of the whole of its administrative reforms of the 1870s. The very creation of the province proceeded against the background of that disaster (ibid.: 274).

One such reform enlarged the authority District Officers (DOs) exercised over the several ministerial extension offices housed in their districts. With regionally centralized famine administration came an increasingly decentralized approach to famine control on the national level. And indeed, the district or division evolved as the linchpin for public administration, irrespective of famine conditions. The famine codes crafted in the 1880s ushered in another advance bolstering local famine administration. Each district was divided into "circles" arranged to facilitate gratuitous relief to villages, to investigate and report on economic conditions observed among residents, and to evaluate relief measures. Circle organizations was to be activated upon an official declaration of crisis. Its head, the DO or Divisional Commissioner, was invested with a staff of circle inspectors responsible for visiting constituent villages, weekly, filing reports with the DO, and bringing village leadership into orbit with administrative programs. Village leaders were expected to assist civil servants with the administration of relief and the maintenance of law and order in their communities. The circle system came widely into force by the turn of the century. But it did not really jell in most areas for some decades to come.

The famine codes of 1880 fostered a breakthrough in food administration profoundly enhancing India's food production in the years ahead. A separate department of agriculture was recommended with field divisions at the provincial level: "This measure was proposed as a means of relief from famines." (Misra, op. cit.: 123) By the early 1900s, all provinces had operating branches. The Department was envisaged initially as a primary clearing house for demographic and agronomic statistics, these to be used as tools for forecasting and relieving famine distress. It was to collect, analyze and report through routine tours of village inspection all aspects of food production. District authorities were to be apprised of the contents of these documents and instructed to work closely with agricultural officers during famine sieges. Organizational intelligence was further boosted with the establishment of agricultural experiment stations, colleges and demonstration farms in the first few decades of this century. And finally, the codes were directly behind the expansion of roadways, rail networks, and large-scale irrigation projects.

The era of virulent, province-wide famine outbreaks virtually ended by 1910 [5]. Far fewer people died from starvation related causes, forfeited productive property, or resorted to migration because of famine than in the formative phases of colonial rule. Advances in administrative intelligence operations were certainly not the only remedial factors at work, but they did dilute considerably the severity of famine problems. Yet there was still much progress to be made here. Government did not usually declare a state of famine emergency until serious damage had been done, and disaster compensation was still very inadequate on several accounts. In many regions vigorous prosecution of emergency relief guidelines and tightly knit village-to-district chains of command enabling such action, through the circle system for instance, had yet to materialize. No less significant was the very limited headway made in eradicating the chronic poverty underlying the country's susceptibility to catastrophe.

THE BIHAR FAMINE 1966–67 [6]

Hail storms and rainfall scarcity affecting much of Bihar during 1965 and an erratic southwesterly monsoon the following year severely reduced crop yields over much of Bihar, the second most populous state in India. Prices and emigration were already on the upswing by June 1966. Rains during the following seasons failed and in April 1967, a state of famine was officially declared. Before the drought had run its course, some 47.5 million persons in 89,000 villages covering 41 districts were affected. Extensive hunger notwithstanding, widescale death, disease, migration and property losses were averted, largely through effective government intervention.

a. Predictive intelligence

Government began gearing up its intelligence maneuvers as early as June–July 1966. A nutritional survey was made in sample villages situated within the zone of peril. Questionnaires revealed that dietary conditions in the countryside were deteriorating noticeably. Another survey showed that houses were being mortgaged under stress. As scarcity intensified, random surveys of municipal dispensaries pointed to a sharp rise in such diseases as TB, syphillis and dysentary. Several social research institutes conducted economic reconaissance studies. The Bihar Relief Committee and the District Consultative Committee organized their own fact finding missions in the fall. The latter met with several research teams to hammer out a comprehensive plan of action, which was to come in handy later on. Two teams sent by the central authorities made early on the spot assessments and their findings were responsible for a blockwise relief program. The Finance, Food/Agriculture and Planning ministries arrived in October and delivered advise for putting district administration on sounder emergency footing. And control rooms were set up at various district headquarters later in the year to identify "danger signals of drought" delineated in terms of yearly and monthly rainfall and crop acreage over the previous ten years, crop yields since 1954–55, monthly price trends for the past three to four years, crime rates under famine conditions, statistics on migration of agricultural workers taken at three railroad stations, and sales recorded for land sold or mortgaged under duress. General socio-economic background data for villages, blocks and districts were also collected and analyzed. The progression of food scarcity in Bihar was closely monitored throughout the emergency.

b. Retrodictive intelligence

A famine evaluation seminar was held in October 1967 following the end of the famine emergency. Eighty-five delegates attended representing 25 voluntary and government agencies. Many recommendations for perfecting relief programs in future famine crises

emerged from these proceedings. The National Committee on Drought Relief also ran evaluation workshops. Field agencies in cooperation with the Tribal Research Institute undertook block-level inquisitions, "to assess the working of development relief programs and to institutionalize the lessons of the famine in order to avert a similar crisis in the future" (Singh, 1975: 56). Many committees and agencies that met to review the effectiveness of famine control programs spoke to the larger issues of agrarian reform and economic development. For instance, the All Party Conference of October 1967 addressed moneylending, rural income polarization, wages, tenancy laws, irrigation and a host of other pressing issues the famine disclosed. Central authorities acted rapidly on a plan to investigate the irrigation potential of selected districts

> Later a reconnaissance of soil types was launched; a comprehensive blockwise survey of the potentialities of soil conservation and minor irrigation and of cropwise inputs followed. This survey constituted the groundwork of the masterplan for the development of this backward region in the light of the experience gained during the famine. This masterplan was ready in December 1968 (ibid.: 135).

c. Operational intelligence

The famine codes designate district administration as the bulwark behind official disaster management policy. I briefly describe this structure because it provides the scaffold supporting operational intelligence operations. District bureaucracy in Bihar is organized hierarchically. At its apex is the district officer (DO) whose responsibilities take in the supervision of land revenue collection and the administration of scheduled tribes and castes. As chief development officer the DO oversees technical department activities related to economic development. Among the agencies participating in such programs are public health, community government, public works, and district supplies. As district magistrate the DO is the highest local official enforcing law and order.

The next descending administrative layer, the sub-division, is a replication of administrative structure at the top. Sub-divisions parse into blocks. Palamau was subdivided into 25 such units at the time of Singh's study. Each block falls under a Block Development Officer (BDO) who superintends programs carried out by extension officers working in such areas as animal husbandry, agriculture and village level administration. A circle inspector handling land revenues, and a medical officer, are among the BDOs lieutenants. The Block Officer's duties correspond to those entrusted to the DO and the sub-divisional officers, writ small. The block encapsulates a network of circles (ca. ten per block). This lowermost echelon of development administration comes under the supervision of a Village Level Worker. Two *panchayats* (local elected bodies) ordinarily constitute one circle. Ten to twelve *panchayats*, normally presiding over a population of 5,000 each, form one block.

A great battery of measures called for by the famine codes to create suitable operational intelligence were translated into action through agencies of many kinds. And many protective steps not included in the codes came into being. On the block level, the BDO was required to get a sounding on the changing status of economic opportunities for all households in circles under his supervision, to file reports on household surveys conducted by his staff, and to disseminate within the villages intelligence concerning the location, persons eligible to benefit from, the wage rates, and the task structure of relief works. The BDO had also to put himself at the disposal of fact-finding missions dispatched to the field by assorted relief committees, and he had further to.

> visit each village in his circle once a week or as often as the district office may direct; to test, by frequent personal inspection, the list of persons in receipt of gratuitous relief; and to see that relief is being distributed to them timely; to forward the weekly return in form ix and to ascertain that relief has been distributed in the manner prescribed (ibid.: 63).

Apprising superordinates of any evidence of noteworthy upturns in sickness among persons or livestock and conferring with veterinary and medical officers about appropriate remedial actions, and keeping continuously updated records for water, fodder and seed reserves were among the numerous other responsibilities entrusted to this officer.

Circle officers were also saddled with a heavy load of assignments. Maps had to be drawn showing the location of all relief projects and statements prepared that indicated for each village the population composition and the number of indigents, agricultural laborers and children under fourteen years of age. Checks had to be made for ensuring that all preadolescent children received milk rations from distribution centers, that all indigent persons were in possession of red cards, that fair-price shops got their quota of foodgrains, and that all eligible families were being presented with the opportunity to obtain agricultural loans, and so forth.

The famine codes did not supply guidelines for coordinating decision making among administrative bureaus and between the latter and non-official agencies: "coordination in times of distress was an uncharted area" (ibid.: 68). And so the District Consultative Committee, the District Development Committee and the District Relief Committee were activated early on to work out methods for institutionalizing such coordination. No focal organization which would meet the challenges of articulating the planning and program implementation for voluntary agencies existed in the codes. The Bihar Relief Committee was constituted in 1966 to subserve this end. It met every Tuesday from January to October 1967 to decide on matters ranging from the distribution of free gifts to grain storage and transport arrangements. The Bihar Relief Committee evolved a highly complex structure patterned after the pyramidal blueprint of the district administration.

District level coordination came about through: weekly or fortnightly meetings among sub-divisional officers; the BDO's monthly meetings; the District Coordinating Committee's quarterly meetings; weekly meetings between the chief engineer from the Public Health Engineering Department and representatives from emergency water supply organizations. In addition, the DO's coordinating committee (attended by the BDOs) convened once a fortnight, and the Technical Officer's Coordination Committee scheduled fortnightly conferences. Sub-divisional officers met regularly with individuals representing non-official organizations, and the sub-divisional coordinating committee held weekly meetings with the BDOs. This proved a vital link in the intelligence chain. The BDOs met weekly with circle officers and fortnightly with staff coordinating committees. The later worked out to be a critical channel of communication with remote field agencies: "It helped to explain the latest instructions on famine relief, assess the situation, and prepare reports and returns" (ibid.: 70).

The district level coordinating committees complied a list of 33 instructions, geared to ginger up famine relief operations, which

> . . . fixed personal responsibility and threatened disciplinary action if the functionaries did not produce the results within the given time. While these instructions set the tone and the perspective, the functionaries also needed to be trained and 'indoctrinated' in relief. In order to give a sound grounding in relief matters, the coordination committees were particularly activated to explain, reemphasize, [and] clarify the instructions to the farthest agency. This was done regularly, often by an officer deputed from the headquarters (ibid.: 71).

Later in the year a cabinet level relief coordinating committee formed and subsequently arranged to meet weekly for the purpose of making high-level decisions covering all aspects of famine control. This body consisted of ministers from departments participating in the crisis.

Administrative self-policing took many forms. Block level officers held prompt enquiries into complaints: "A remedial cell set up at the district office functioned around the

clock" (ibid.: 73). Flying squads consisting of private and district relief agents operated the block, sub-division and district levels. These reconnaissance units made surprise visits to relief installations by way of checking up on their performance. To keep the population informed, district staffers circulated handbills describing available relief programs and a public relations department was formed to distribute pamphlets to do likewise and to hold weekly press conferences.

Numerous other miscellaneous steps were taken for beefing up operational intelligence gathering. More supply inspectors were assigned to grain warehouses and block distribution points as relief operations reached full stride. Efficiency was imparted to the grain transport process through a blockwise system of checks

> . . . dates were fixed for transporting of grains from subdivisional to block godowns depending upon the capacity of the latter; responsibilities of supply officers were fixed and rigorously enforced . . . Preparations for the movement of grain would start as soon as the stock in block godowns dipped below twenty-five percent of the normal needs. At the blocks, tight schedules of the movement and lifting of foodgrains from the block godowns to fair-price shops or other distribution agencies were laid down and enforced rigorously (ibid.: 93).

Fair-price shops were pivotal in arrangements made for foodgrain distribution. A ten point program was devised to monitor their stock of grains, prices, quantums of rations provided per family and many other kinds of information. Dwindling water supplies in some districts moved authorities to dispatch geological field teams to locate areas of water scarcity. Lists and maps of villages compiled by block staff provided a starting point for these teams. Finally, the important role played by student volunteers and voluntary organizations should be stressed.

SUMMARY

A series of large-scale famines accompanied British rule in India. Early development administration was not set up to mount effective relief campaigns and it was saddled with a very imperfect grasp of Indian food scarcity problems. Yet the government made remarkable strides within a mere generation in its efforts to mitigate acute food shortage, and it achieved some modest progress in chipping away the structural causes of this problem. Indeed, only one major famine flared up after 1909 despite the numerous crisis alerts sounded by several states. The sharp decline in famine outbreaks during this century is attributed by the sources in no small measure to more effective disaster abatement planning.

The provincial famine codes became central to administrative famine fighting strategy. The codes supplied a major impetus to the intelligence operations already discussed, and they ensured arrangements for committing information so acquired to 'institutional memory', and for institutionalizing programs to monitor famine hazard indicators on a permanent basis. Moreover, it was through the codes that shadow disaster relief administration evolved. This emergency system, activated when crisis appeared imminent and shut down once the declaration of famine was officially withdrawn, made for an extraordinary degree of decentralized decision making.

The district officers and high ranking ministry field staffs, at least in Bihar, were entrusted with supervising many important relief operations. The DOs had the leeway to delegate numerous routine responsibilities and many emergency tasks to lower echelon staff. Under these provisions, high ranking district officials could focus more fully on urgent supervenient duties. This diffusion of authority, all the way down to the village level, and the planned coordination of village staff, community leaders, and representatives from cheritable organizations, served to concentrate administrative decision making close to the grassroots level, thus individuating it more than ever before, village by village. This dispersion of administrative resources, even though carried

out within a largely centralized framework, was functionally comparable to the traditional pattern of hazard/disaster response.

The codes were steeped in the premise that famines arose because of human failures and could be thwarted by the judicious manipulation of institutional controls over people and food. This recognition of famine as a social process was a critical factor shaping official emergency preparations several months before the government declared a state of disaster in Bihar. Yet had India not suffered badly through many earlier famine crises, and had she not reacted by instituting remedial procedures and organizational changes in her bureaucratic machinery through, among other things, improved intelligence operations, it is probable that famine would have been much more prevalent during this century then in fact had been the case.

NOTES

1 Most students of famine agree that this phenomenon essentially is a matter of extreme food scarcity that, for whatever reason, is manifested by starvation, malnutrition and death on a massive scale. Moreover, large-scale property losses are characteristically associated with famine.

2 The propositions set forth in this section derive from analysis of ethnographic studies of the Gabra (Kenya/Ethiopia), the Ik (Uganda), Australian Aboriginals, Turkana (Kenya), South African Bushmen, and from economic histories of Czarist and early Soviet Russia, colonial and republican India, pre-revolutionary China, potato blighted Ireland during the late 1840s, and northeastern Brazil over the course of the last one hundred years. The Tikopia corpus is the only chiefdom-level account of drought/famine response that is at all detailed, but it has little to say about pre- or early colonial adjustments. However, Spillius (1957) does suggest that dispersion of the population to other islands seems to have been the most commonly adopted expedient for relieving pressure on shrunken food reserves following the action of a natural disaster agent. This would conform in general outline with the traditional system pattern of coping.

3 "High quality intelligence", a term borrowed from Wilenski (1967: viii–ix), signifies intelligence which is clear, timely, valid, reliable, adequate and wide-ranging.

4 The principal background materials for this section are Loveday (1914), Misra (1970), Bhatia (1967), and Srivastava (1968).

5 I would be remiss in not mentioning the Bengal famine of 1943 (cf. Knight, 1954; Mukerji, 1965). The only major famine to visit India after the first decade of this century, it resulted in as many as 1½ million deaths and massive land divestment. A set of anomalous circumstances forced this setback in what was otherwise a progressively more effective system of food crisis safeguards. Of major importance was was the country's involvement in WW II and, almost simultaneously, the administrative disarray accompanying its move to the threshold of independence. When the war broke out, India was a farrago of some dozen semi-autonomous provinces, each with its own prime minister and cabinet, and hundreds of independent princely states.

Bengal was a chronically food deficient rice growning region. A series of droughts and a cyclone combined with entrenched rural poverty in triggering extensive provincial food shortfalls. The food situation became cause for alarm with the fall of Burma, India's chief supplier of rice. The Bengal government was inadequately poised for crisis. It was the least cureaucratically evolved of all the Indian states, particularly at the sub-district level. The absence of village-level revenue staff and poor articulation between circle and village governance precluded a timely and well organized flow of local intelligence to district headquarters or a workable plan for village relief. The Bengal government complicated matters by stubbornly refusing to accept central advise and assistance and allowing party factionalism to sabotage the concerted planning needed to regulate grain trading. The absence of uniform, country-wide price controls, procurement policies and rampant, inflation causing price-fixing, also set the stage for famine.

The Indian grain trade fell under permanent state control towards the end of the war. By compelling the Bengal government to initiate controlled procurement of stocks backed by requisitioning, license wholesale dealers, install rationing machinery, and rigorously enforce all such measures, in part through military assistance, central government succeeded, belatedly, in conquering the famine.

6 The following account leans heavily on Singh's (1975) definitive study of Palamau province. Other materials drawn on in preparing this section suggest that the administrative pattern of response described for Palamau was probably typical for most other parts of Bihar (cf. Berg, 1971; Gangrade and Dhadda, 1973; and Central Institute for Research and Training in Public Co-operation, 1969).

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DROUGHTS, FAMINES AND THE EVOLUTION OF SENEGAL (1966–1978)

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INTRODUCTION

Since 1966, the Senegalese economy has experienced a cycle of fluctuations initiated ostensibly by droughts undermining agricultural outputs and affecting the demographic balance of several important regions. I would like to show, however, that recent socio-economic disruptions commonly attributed to climatic failure in Senegal have in fact resulted from the combination of drought and, less visibly, neocolonial economic policy. These forces have fused so as to enlarge pauperization and with it the decline of village level self-sufficiency. I want to examine how, in the Senegal case, political and economic institutions mediate climatic inputs and in so doing reduce the prosperity of those who work the land. What will be indicated in particular is how the logic operating in Senegalese capitalism has allowed the government and outside interest groups to profit from this situation.

CURRENT VIEWS AND SOCIO-HISTORICAL ANALYSES

The Sahelian droughts have become a fashionable topic for discussion among scholars and journalists. Fundamental questions bearing on the roots of the disaster have been brought forward and technical solutions have sprung up from everywhere (Giri, 1976), but serious historical and empirical studies have been very few (cf. Lallemand, 1975; Salifou, 1974; Santoir, 1976). On the whole, research has concentrated on single, isolated problems such as the evolution of pastoralism, the cash-crop economy, relief operations and water supply policies. In fact, global analyses that present the political and social constraints transforming drought into famine are so few that one suspects researchers and policy makers, experts and journalists of conspiring in a kind of cover-up plot.

It will be helpful to begin by summarizing principal theories about disaster causality that prevail in the enormous literature on African droughts. Three different lines of analysis can be discerned.

(a) An advance of the Sahara syndrome is postulated to derive from irrational human behavior promoting deforestation and subsequent soil erosion. Unfortunately, this argument fails to address the process bringing land-use practices into conflict with nature. I have in mind particularly the modern doctrines about politico-economy which may be antithetical to traditional management practices (Reboul, 1977).

(b) Production crisis theorists reason that because intense droughts create famines, they reveal weaknesses inherent in the local food

production apparatus. Indigenous ingenuity is called into question. The basic weakness in this premise is that it disregards the fact that indigenous economies have evolved to meet the needs of subsistence cultivators, but traditional agriculturalists must now produce cash crops for export as well, leaving them in want during drought years. The fact that food must be imported during crop failure creates the false impression that the economic institutions of these farmers are inherently incapable of supporting them during crises. (Comité Information Sahel, 1974; FAO, 1976).

(c) According to social crisis theories, food shortage is a concomitant of population pressure. Famines occur because there are too many people to be fed, not because of any food shortage. Once again, social factors are forgotten, particularly those depriving persons of existing surpluses. I would include here exorbitant food prices or lack of agrarian employment options. Added to this would be the insufficiency of infrastructure by which food from surplus areas is channeled to deficit districts.

The arguments I have just sketched have been employed as a rationale legitimating national and international meddling in economically backward portions of least developed countries. For the deleterious consequences of droughts/famines to be understood, the activity of these supra-local forces must be taken into consideration. I will now try to describe the role that drought has played in the origin of social alienation and exploitation, using as my example, the Senegal.

THE SENEGAL

French colonialism in Senegal has a long history associated with the production and export of peanuts (Amin, 1973). Indeed, the peanut industry has given rise to many national institutions. These include peanut production cooperatives, a state managed marketing board, rural councils, and a host of agricultural agencies and related industries (cf. Schumacher, 1975). Tied into these developments have been the rise of muslim brotherhoods and economic stimulation of central Senegal, the Peanut Basin. Prodigious growth of the Peanut Basin has led to underdevelopment in other regions, for instance the Senegal River Valley, which was until the beginning of the 19th Century, the most active and developed part of the Senegambian international economy (Curtin, 1975). I will elaborate on this important point further on in the paper.

Senegal is unique among francophone countries in Africa in having a highly developed system of markets and cooperatives and a free, multiparty election system. These factors are related to the international strategies revealed by the post-drought situation. I proceed by examining the evolution of the agricultural system and the changes in the framework of economic and political institutions. I then attempt to assess the relations among various institutional levels brought into focus by the droughts.

THE EVOLUTION OF THE RURAL ECONOMY

In 1964 Senegal asked the Société d'Aide Technique et de Cooperation (SATEC), a French rural development agency, for assistance in promoting the modernization of Senegalese peanut production. This plan was intended to compensate, by a 25% increase in production, the losses caused by suppression of French price supports. SATEC was eventually replaced by the Senegalese run Société de Developpement et de Vulgarisation Agricole (SODEVA). SODEVA's operations, though limited to the Peanut Basin, applied to a spectrum of programs ranging from rural literacy to credit facilities for the purchase of cattle. The SODEVA structure was soon considered the most reliable agricultural institution established in the Peanut Basin, and for that matter anywhere in the Senegal.

SODEVA has become a major factor in agrarian policy change. Large, specialized regional agencies have replaced the former complex, inefficient pyramid of institutional subdivisions concerned with rural problems. Each agency operates in one region and concentrates on a range of production activities and carries out a number of programs, including large investment projects on the Senegal River or the employment of village level technical advisors in the Peanut Basin. This new approach to rural development came into full operation during and after the droughts of 1972–73.

Though SODEVA was unable to attain its economic objectives pertaining to levels of food production, it did change the role of state intervention. The National Peanut Marketing Board was reformed. Within the first dozen years following independence, SODEVA completely modified the structure of development institutions. Peanut producers were still at the center of rural development strategies, but they were no longer the only peasants to benefit by an institutional network. Farmers in other regions of the country were being advised and organized within special programs for production in rice, cotton, fruit and other produce. But in practice, many programs fell short of targets envisaged by the five year plans. Crop diversification had been called for but with little progress. In some cases little could be done to alter plant ecology without the introduction of irrigation. And in other cases, peasant resistance to change and bureaucratic insensitivity coincided. The only significant achievements here were in millet production. In contrast, peanut production declined in the post-drought years. Crop specialization followed a regional pattern without attendant integration through an internal market structure. This facilitated black marketing in periods of crisis and so for some converted drought into famine.

Second, this new institutional framework entailed an uneven pattern of regional development: large, internationally financed irrigation projects on the Senegal River geared to food production; State controlled commercialization of small peasant producers and an elite of important farmers and traders (cf. Dubois, 1971; Copans, 1978); and multinational enclaves for foodstuffs (BUD) or cotton (Compagnie Francaise des Textiles). This situation has produced a patchwork economy made up of various competing economic structures (Copans, 1978; Atlas National, 1977). Fragmentary economic growth threatens to stimulate further regional specialization pitting agricultural workers against peasants and state or multinational operators against individual cash-crop producers.

THE MEANING OF REGIONAL DIFFERENTIATION

Three kinds of regional settings corresponding to forms of capitalist organized production can be distinguished. These consist of: regions where production for the external market is secondary and where social changes are minimal; regions almost exclusively devoted to cash crops and organized on a peasant basis; regions where agro-business is becoming or is going to become efficient and based on "free" agricultural laborers.

The first case, where food production levels are adequate, applies to the eastern and southern parts of Senegal, where drought has had the least effect. The populations in these regions have not been overtaken by drought, at least not so far, because they have experienced little intense economic change and because correspondently, they have been able to buffer themselves from environmental perturbations by maintaining grain surpluses and by preserving traditional land management practices.

The central regions are devoted largely to the cultivation of peanuts and millet. The agricultural system has been subject to technical and administrative inputs for a long time. After attempting to induce broadscale changes in the countryside, SODEVA has begun to focus on the most important producers, urging the devel-

opment of subsistence crops and the protection of the environment. But this strategy, based on large land ownerships, financial backing from outside and more or less unpaid labor has provided little relief for the mass of peasants whose means are very limited.

It is noteworthy that the ranching solution to livestock production follows the same principles of intensification, concentration and salaried work as in the agricultural sector. Ranching schemes have been advocated for some time by international experts but to date they are still modest, taking up only 25% of the breeding budget. So far, as recent droughts have demonstrated, only the State or important entrepreneurs, not the average pastoralist, have gotten the opportunity to engage in such programs (cf. Marches Tropicaux, 1978: 416–417; 464–67). The only coping strategy really practicable by the ordinary mixed farmer has been to revert to millet and this has proven inadequate in dealing with food shortage. The other solutions are migration to cities and to "new" lands.

The drought has accelerated a process imposed by colonial and post-colonial capitalist domination. This trend has resulted in the dispossession of the producers' means of production on the one hand, and the emergence of pronounced socio-economic differentiation on the other. What seems to be evolving is the appearance of an unorganized and heterogeneous *kulak* kind of group clearing the way for itself through a discouraged and alienated peasantry.

The third kind of region is represented by the Senegal River basin. It was associated with a highly developed trade system until the beginning of the 19th century. With the peanut boom it has become pretty much an underdeveloped region, evidenced in part by large-scale labor migrations to Dakar and to Europe. The existence of this "free" labor force, the potentialities offered by a large, modern multi-dam irrigation project, and the absence of specialized production have favored the agro-business industry. What will probably occur is that the River Valley will produce foodstuffs on an industrial scale for the internal market but probably also if not more for the external market. Thus, ironically, the areas stricken by drought will be exporting foodstuffs, consequently impoverishing the peasant and converting him into a hired worker on his own land.

These structural changes within the agricultural system suggest that the only response to the drought has been more technical input, more money, and more social differentiation. Even in the case of foodstuff production, Senegal's dependency is increasing. It seems likely that self sufficiency will be obtained at the expense of autonomous economic development. Moreover, the social disruption introduced by agro-business implies a disappearance of the peasant's knowhow. The farming sector will be submitted to the agro-business way of dealing with drought or risk a drop in world market prices and corresponding unemployment.

POLITICAL CHANGE

The fact that droughts contribute to economic underdevelopment does not imply that they produce a significant social and political change automatically. The important crisis Senegal had to deal with in 1968 and 1969 was not solely attributable to drought. The 1970–71 peasant disturbances were related to the state policy on debts and the price of peanuts. And the almost yearly student uprisings since 1966 have had little to do with a revolt against the deterioration of the conditions of living. Whereas in other Sahelian countries political factors have been tentatively related to the famines, it is difficult in the case of Senegal to single out a direct causal relationship (see Ormieres, 1975).

The political setting of Senegal is the proper framework within which to interpret the effects of drought. In this regard, the State has been able to control the distribution of aid. Coming after the 1968–71 period, the govern-

ment was careful not to cut its ties with the peasantry. The international aid was of course more beneficial to the state budget and to the various sorts of private traders and intermediaries than to the small farmers. Here again it is necessary to focus on political and administrative changes which have not been a result of the droughts, but which are nevertheless understandable as a means of deterring any kind of social crisis that could be triggered by, among other factors, future droughts.

Administrative reform began in 1972. Today, most of the peasant populations of the Peanut Basin have been integrated into this new system which introduces representativeness at the village level. The rural councils of the different levels – arrondissement, department, region – promote a kind of generalized cooptation of the real 'elites'. The State is not only delegating its authority, it is seeking consensus and political backing at the grass-roots level. These councils are mandated to develop village and community projects of general interest, and they are supposed to administer their own budget. By adding a local-level structure based on election to the state control apparatus that ends with the village headman, the dominant groups can ensure a more institutionalized but apparently self-managed control of the peasants. This reform functions within the new multiparty representation.

Senegal has again embraced multipartism. This so-called democratic overture arose out of the need to prepare for a successor to Senghor, the democratic justification for the Socialist Party to become a member of the Second Socialist International, and a dispersion of centripetal forces (rule and divide). This political current is also a new vehicle for expressing ideological discontent. It might turn out to be a dangerous experiment and that is why Senghor today advocates a strong western military intervention in Africa (cf. *Newsweek*, June 1978). The French army has a military basis in Senegal. It is for the moment in full operation because of the French intervention in Mauritania and Chad. This has had an indirect effect on national politics. And one must remember that the modernization of the Senegal Valley is a joint project (OMVS) with Mauritania and Mali, and perhaps French Guinea, as well.

Rural reform, multipartism, and French military presence are the decisive elements of the new political frame operating in post-drought Senegal. The years 1977 and 1978 were bad ones in terms of agricultural production and of prices for phosphates on the world market. The State has thus far managed to divert the populace's attention from these problems or has discouraged them from expressing their profound personal discontent.

LESSONS AND PROSPECTS

General conclusions can be drawn concerning the social evolution of Senegal over the last ten years, of which the drought/famine is one element (FAO, 1976; Labonne, 1976; Berg, 1975). Social, regional and national differences and inequalities have increased. The urban-rural distribution of income is becoming more skewed. The transfer of resources from agricultural production to the State budget is accelerating. This situation will continue and thereby guarantee a stepped up rate of ecological crises in the future. That yields of the most important cash crops are steadily declining is officially conceded. Agricultural imports account for a third of the total value of imported goods. Peasants, migrants and urban unemployed, the parties who have undergone the greatest deterioration in living conditions, have not mustered any concerted political greivances. There have been various forms of resistance to the economic exploitation accompanying drought, such as non-payment of taxes or cooperative debts, abandonment of cash-crops and disinterest in public events. But events can be measured the other way around, that is by assessing the consequences of the new economic and political decisions.

The impact of the drought, by provoking a fall in cash crop production has also endangered the present level of resources of the state and of the dominant groups that operate it or benefit from it. It is for this reason that changes have been proposed and implemented. In fact, since 1973 the drought has benefited those sectors of Senegalese society that had the means to react to its effects, particularly traders and bureaucrats. By implementing administrative reforms, by channelling political discontent into a limited electoralist strategy, by proposing to expand the cash crop system to subsistance production and therefore renewing and enlarging the socio-economic basis of surplus extraction, the Senegalese State has laid the basis for an alternate development strategy within the same imperial system (Feder, 1976).

I would like to stress that this renovated strategy was defined in its general orientation before the 1972–1973 droughts and that it is far from being completely operational. The international situation is the fundamental reason why the older orientation remains unchanged and why the new one is only in the early stage of implementation. French capitalism is incapable by itself of promoting a modernized Senegalese economy. The level of investments implies an international financial backing and inter-imperialist contradictions and conflicts have developed very sharply. The fuel crisis and inflation have considerably enlarged the costs of the Senegal Valley projects, the ranching and the agro-industrial operations.

Imperialist interests were not keen to invest in a country which lacked the administrative and economic sophistication necessary to absorb and make profitable large productive investments. In making these investments absolutely necessary for nutritional and social equilibrium, the droughts have justified imperialistic tenets and put the Senegalese dominant group in a position for activating reform and change. But the ultimate decisions have not been made yet and these political considerations may not work out.

I would like to suggest the following conclusions. First, technical solutions to the drought such as integrated rural development schemes, the increase of food production, and an internal market network were proposed before the droughts made them necessary. Second, international economic forces have been more decisive than climatic vicissitudes in initiating this new strategy. And third, the interimperialist contradictions are such that this strategy has not yet really taken off.

HISTORICAL MATERIALISM AND ECOLOGY

In focusing on the structural impact of international economy and the laws of underdevelopment economy and dependency, I may have given the impression of having ignored the environmental processes behind drought and famine. But I cannot distinguish in the abstract or even statistically the effects of imperial domination and those of changes in the natural environment. They thoroughly dovetail. I have remarked elsewhere (Copans, 1978):

> We can no longer separate the natural phenomena and the necessary political translation of its effects . . . Social exploitation works out partially through the mechanisms of natural evolution: our object is located at the very place where the relations between man and nature mask the more subtle forms of exploitation of man by man.

We must view the recent period as a specific historical situation, that of the setting up of neocolonial institutions. The droughts have drawn attention to the fact that if they are to stay in power, the dominant groups must be able to reproduce the material foundations of their power and authority. Therefore productive forces have to be controlled or adapted to the needs of the relations of production and to the stabilization of their reproductive processes. This control must not be disrupted by natural perturbations. In fact, the international economy is more endangered by the political and economic incapability of the dominant classes to react to such hazards than by the

social movements provoked by those who have been totally dispossessed.

Droughts may be seen as a useful warning that the form and level of Senegalese productive forces have been changed too little, for instance in not meeting urban food needs, or too much, *viz*. the erosion created by monocropping. To maintain the actual level of State and imperial revenues and profits, exploitation must increase. The process of dispossessing the direct producers will continue on a larger scale. Though the drought has not created this historical development it has accelerated it.

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THE ETIOLOGY OF HUNGER: THE EVOLUTION OF FAMINE IN A SUDANO-SAHELIAN REGION*

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> The evidence now before us – of a world which can produce automobiles, television sets, etc., at a greater speed than the increase in population, but is simultaneously menaced by mass starvation – is disturbing.
>
> *N. Georgescu-Roegen*

The crisis generated by a famine, or indeed any disaster, reveals the inner dynamics of social and economic systems. From this perspective, it is noteworthy that those who cultivate the land in the Third World are also those to suffer in times of dearth. Town dwellers and urbanites continue to eat during periods of severe food shortage at the expense of rural producers who starve to death. An explanation of this paradox lies in the condition, genesis and reproduction of inequality among rural classes, and thus famine in the underdeveloped world becomes inseparable from those processes of "development" and "modernization" which embrace and transform village production systems. This article will analyze these relationships in a Sudano-Sahelian region of West Africa in northern Nigeria. It consists of two discrete parts: first, a description of famine in the social context of the pre-colonial period and the subsequent changes wrought by colonial domination; and second, an analysis of the dynamics of contemporary famine at the regional and village levels using two case examples from 1972–1974.

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FAMINE IN NINETEENTH CENTURY HAUSALAND

The basic unit of production in the nineteenth century was the household, perhaps embracing sons, clients and slaves in an extended domestic structure in which the householder organized production and distribution and paid taxation (Hill, 1977; Shenton & Freund, 1978). Households were often subsumed in communities controlled through the agency of village heads whose responsibilities extended to land sales and village adjudication. A proportion of the peasant surplus was expropriated by a ruling class in the form of either labor, grain, or cash. The office holders had tenure over "fiefs' given by the Emir, though they usually resided on private estates worked by slave, client and hired labor. They could also demand corvée labor from villages within their territorial jurisdiction. Slave labor, though crucial to the functioning of the large estates operated by the ruling class, was not a dominant characteristic of the productive system. Craft production and petty commodity production, generally

emanating from within the household structure, was conversely a widespread phenomenon throughout Hausaland. The State controlled the means of coercion, provided protection for the peasantry and traveling merchants, organized large scale labor projects and acted as a guarantor in times of need. Within this social formation, the nature of seasonal scarcity and famine assumes a historically specific character.

Disasters generally, and famines in particular, are not new to Hausaland. In the nineteenth century, crises of under-production occurred in which basic biological requirements could not be fulfilled – usually as a result of famines, disease, locusts or warfare – and are well documented in the historical chronicles. During the middle of the eighteenth century, moreover, a disastrous series of droughts and related epidemics which spanned a twenty year period, struck the northern savannas from Senegal to Somalia producing economic disarray, mass evacuation for the Sahel, ethnic and no doubt monetary redistribution and presumably a dissolution of the large slave estates. It is even suggested in the Kano Chronicles that famine was instrumental in the evolution of the State itself. Superimposed on the pattern of major climatic disturbances were epicycles of more frequent but localized drought and food shortage occurring perhaps in the order of once every seven or eight years and usually regional in character. Between the Jihad in 1804 and the multi-year drought in 1913–14, it appears that the savannas were relatively free of an internal disaster of the scope and magnitude associated with the famine of the 1750's.

In view of the regular variability in precipitation regimes and corresponding fluctuations in food availability, it is not surprising that Hausa communities had historically derived strategies to cope with drought and food shortage (Watts, forthcoming). In tandem, these coping mechanisms constituted for a large proportion of the peasantry a type of moral economy in which a safety-first principle, a right to subsistence and the norms of reciprocity and redistribution were all paramount (Scott, 1976).

(1) Response to Drought. The existence of a precarious environment has given rise in many peasant societies to a subsistence ethic predicated upon a safety-first or risk aversion principle. In practice this might involve a plethora of locally adapted cereal varieties, a preference for the consumable versus the marketable, or reliance on historically established planting and intercropping strategies. Throughout much of nineteenth century Hausaland, the peasant economy conformed in large measure to this rough archetype. The basic agronomic strategy consisted, as it does today, of the intercropping of sorghums and millets, each characterized by contrasting moisture requirements. At a higher level, this complimentarity was supported by, in some locations at least, a complex orchestration of microenvironments involving variations in spacing, moisture availability, and soil type, all of which were joined through complicated sequential patterns of decision-making dependent upon the onset, character, and duration of the rains. Such adaptive programs could be supplemented by other drought resistant crops like cassava or the resort to foraging, collecting and hunting. In this way, agricultural diversity and agronomic variation bred a sort of systemic stability.

(2) Response to Food Shortage. The subsistence ethic was also expressed through social activities and institutions which functioned as, among other things, guarantors of a minimum food supply. Fundamental to the preservation of a measure of self sufficiency was, of course, storage which permitted the long term constitution of reserves sufficient to cover seed requirements and grain during the period of preharvest hunger. The closure of household granaries during the post harvest period often

corresponded with the departure of adult males on dry season migration frequently as corvée labor on State sponsored (defense) projects. During the wet season itself, when seasonal food shortages peaked, hardship could be partially alleviated by participation in communal work parties and short-distance migration making use of the variation in the onset of the rains and hence in the timing of planting, weeding and harvest. Central to the subsistence ethic, however, and to the moral economy in general was the "logic of the gift". This was a vital redistributive mechanism in the peasant economy (Raynault, 1975).

Kinship and descent groups served to spread risks and to insure collective security. The non-Muslim Hausa clan segment functions precisely to this end:

> [The segment] has but one function: when the grain stores of one household are exhausted, its head may borrow grain from another [segment] household and repay that grain at harvest without interest (Faulkingham, 1971:123).

At an ideological level, the redistributive ethic was reiterated through a Muslim dogma which saw gift-giving as obligatory for the rich and the office-holders. At another level, other formal institutional mechanisms incumbent upon the ruling elite served to free resources from the rich to the peasantry. The communal work group was a case in point in which foodstuffs were released during the critical preharvest period (Raulin, 1964). A rather more elaborate instance was the institution of *sarkin noma* (lit. king of farming), described by Nicolas in Kantche (Nicolas, 1966) who is elected by virtue of his capacity to produce in excess of 1000 bundles of grain. In essence, it is an attenuated variant of the North American "potlatch" in which prestige is accrued through the ceremonial distribution of resources. The office of *sarkin noma* entails on the one hand a redistribution of foodstuffs through the harvest festival and on the other it is:

> .... the ultimate defense against famine: when the grain in any gida is exhausted, the residents may obtain an interest free loan of grain from the S. noma's bins, to be repaid at harvest (Faulkingham, 1971:81).

In a society predicated upon hierarchical relations between rulers and ruled, it is hardly surprising that the upper echelons of political authority in nineteenth century Hausaland were expected to act as the ultimate buffers for the village level redistributive operations. The responsibilities and obligations of the village heads were quite clear in this respect and when their capabilities were over-ridden as, in cases of extreme seasonal hardship, the next level of the hierarchy, the fief holder, was activated. In Katsina Emirate, for example, the district heads often kept grain at several centers throughout their district and frequently in villages where they may have acted as patron to a number of clients. These graduated responses terminated with the ruling elite, which used the grain tythe for central granaries employed to redistribute surpluses during famine periods (Smith, 1967:112–115; Palmer, 1911).

In this fashion, responses to food shortages were graduated with respect to time and depth of commitment (Slobodkin & Rapoport, 1974). The early responses tended to be shallow and reversible – perhaps the sale of livestock or familial loans – and the later ones less flexible, perhaps culminating in widespread dislocation through permanent out-migration or even death. All this is not to suggest a Rousseauian pre-capitalist bliss, a glorified peasant life somehow optimally adapted and ultra-stable. As Beach (1977) has shown for the Shona in an ecologically similar region in Central Africa, the historical record is littered with references to famine and it is clear that the response system was totally over-ridden in some instances. Rather, I simply wish to suggest that the indigenous society could institute various individual and collective practices, some of which are still extant, which permitted a

margin of security. But, as I hope to show, in different historical circumstances this margin can be radically transformed.

FAMINE DURING THE COLONIAL PERIOD (1903–1960)

In contrast to the static view of African history which sees the pre-colonial epoch as simply "traditional," it is clear that Hausaland during the nineteenth century was dynamic, changing and developing commercially. Long before the advent of the British colonial armed forces, northern Nigeria had been subject to the penetration of British capital. From 1903, however, many of the economic changes wrought by mercantilist expansionism were intensified and codified, so to speak, and radical transformations effected which gave famine, and food shortage generally, a new dynamic.

The new colonial administration sought, through taxation, to divert as much of the surplus formerly extracted by the ruling elite to their own coffers. Taxes were reorganized but for the most part remained at the same level and in some cases revealed sharp increases to compensate the declining revenue of the elite (Watts, forthcoming). More traumatic, however, was the enactment of a tax in cash not grain which was effected in 1910. Not only did this undermine the *zakkat* based grain reserve but determined the penetration of a generalized modern currency into indigenous economic systems. Furthermore, taxation had profound and direct implications for hunger itself. First, unlike the indigenous Hausa fiscal system, colonial taxes were regular, reasonably predictable and *rigid*. The inflexibility accordingly took no account of the realities of Hausa life among which were late rains, poor harvests, seasonal hunger, and a precarious environment subject to perturbations such as locust invasion or epidemics. The severity of colonial taxation contrasted sharply with an indigenous system which the latter thought far from being innocent of extortion, made an attempt to graduate taxes according to existential circumstances (Palmer, 1908). Second, the *timing* of tax collection assumed a colossal importance. This was especially the case throughout the principal cotton-growing areas where annual taxes were gathered prior to the cotton harvest. The rural cultivator was thus left with little choice but the sale of grains when prices were lowest or alternatively became vulnerable to the clutches of the moneylender. And third, the taxation system was inseparable from the colonial policy of the extension of commodity production and cash cropping into the countryside. It is quite clear in this respect that in northern Hausaland, that groundnuts were the principal taxpaying crop. This perhaps goes a long way to explaining the apparently "irrational" behavior of a peasantry which produced more groundnuts when the commodity price had actually fallen. More generally, of course, the "groundnut revolution," particularly in the close-settled zones, meant a decrease in the area devoted to foodstuffs, increasing subjection to the vagaries of the world commodity market and the ever present threat of indebtedness at the hands of middlemen. It is precisely in this way that the nature of seasonal hunger changed both in terms of its dynamics and the predicament of those who find themselves suffering from its effects. The net result tended to be that seasonal hunger on a local or regional scale devolved into fully-fledged famine, as was the case in 1913–14, and set a precedent for the colonial period generally.

Despite the commercial setback of the 1913–14 famine, the groundnut revolution picked up momentum and became emblematic of the subsequent expansion in the produce trade. Through this process of commoditization and the increasingly important role which money came to acquire, it is hardly surprising that the new forms of indebtedness

arose. This is especially so in the case of the co-evolution of the *'yan baranda* system and the cash-crop economy. The *'yan baranda* constituted the lower orders of the export crop buying hierarchy, receiving cash advances from European firms via their buying agents. These sums were in turn lent directly to the producer who pledged his crop to the agent. The interest on such loans was frequently in the order of 100% and for the producer at least was the initial step into a cyclical debt trap. It is precisely in this manner that urban and merchant capital penetrated the countryside and illuminates the way in which a domestic unit is drawn into an external merchant network. As Shenton and Freund so nicely put it,

> the most successful traders stood at the apex of a hierarchy of credit and clientage that rested on the shoulders of village middlemen, living in the interstices of a colonial economy dominated by the European firms (Shenton and Freund, 1978:13).

The deepening involvement with commodity production and cash crops naturally impinged upon the social organization of agricultural production itself. Claude Raynault (1975) has shown how, in the groundnut zone of Niger, this has taken the form of the dissolution of traditional estates, an escalation in land sales and the generalization of hired farm labor. Changes in the sociology of production were coupled with the profusion of imported commodities especially cloth which articulated with the cycle of rapidly inflating prices for ceremonial exchanges on the one hand, and the chain of indebtedness on the other. Stresses consequently were imposed upon the corporateness of the rural world. The old responsibilities and obligations became less binding, communal work groups largely disappeared and the extended family became less embracing and hence increasingly incapable of buffering individuals in crisis. In the densely settled areas, the extreme land shortages heralded larger food deficits and heightened vulnerability to seasonality. The household showed the first signs of fission and collective security had lost its original meaning. The old universe no longer possessed its intrinsic reality; social and familial solidarity appeared to be dissolving and the gift lost its original significance. As Wolf (1969) has put it, the peasantry were torn from a social matrix of kin affiliation and obligation and for whom the existential problem of subsistence became suberservient to marketing behavior. In short, the social nature of the subsistence system and the qualities of the moral economy were severely ruptured. Reciprocity and solidarity and hence the nature of inequality itself had changed.

The general point I wish to make is that after 1903, the margin of security for the Hausa peasantry came under siege. The Colonial Administration, only too aware of the dangers of over concentration on cash crop commodities, a heavy tax burden, and the spectre of starvation, tended to be ambivalent or to overestimate the resiliency of the peasantry. The outcome was, in contrast to the previous century, that Hausaland suffered from three major famines in 1913–14, 1927 (1931 in much of Niger) and 1942 despite the fact that climatic variability became less crucial in the actual genesis of food shortage.

Hopefully, I have managed to convey the dynamic and historically contigent character of disasters such as famines, and hence how fallacious it would be to glibly assume that hunger is simply an outcome of a Malthusian demographic trajectory or of a malevolent environment. In the final section I will attempt to analyse the changed circumstances of the contemporary period, and specifically the 1972–74 famine in northern Nigeria using village level data.

THE 1972–74 FAMINE: TWO CASE STUDIES

The following is, in very abbreviated form, an analysis of the current food situation based on village level material from Katsina and Daura emirates. These data (taken from Watts, forthcoming, and Ahmed, 1976) pertain to the most recent famine. I will try to show that a combination of population growth, the decay of many redistributive mechanisms and wider political-economic changes have dramatically lessened the margin of security for the poorer peasantry. In practice, this means that the flexibility and capacity to respond adequately to hunger is tightly circumscribed and the effects of famine are subsequently magnified to the extent that some households are incapable of rebuilding resources to pre-famine levels. I will argue that in many cases this fundamental dilemma assumes the form of a cyclical poverty-debt trap.

The climatic data indicates that precipitation throughout the north of Nigeria tended to be below the 1930–1960 means for both 1972 and 1973, the annual total for 1972 and 1973 were 18.69 and 17.36 inches respectively. The growing seasons were correspondingly slight and for 1973 fell to 80 days. (This figure is 40% below the norm.) Naturally, annual totals tend to mask the important intraseasonal variations which are of much greater import for the farmer, and give little feel for the enormous spatial variability in the rainfall pattern. Significantly in this respect, the 1969 total was, in fact, less than either 1972 or 1973 and was not characterized as a year of particular hardship. Nonetheless, it is clear that 1973 was a bad year as reflected in the crop yield data. In Rijiyar–Tsamiya (Daura Emirate) yields were estimated to be 50% of normal and in Sabo (Katsina Emirate) between 25 and 30% of a good year (although both figures are considerably less than the official State Government projections). The harvest reduction for 1973 was unquestionably related to the lack of seed. The mediocre 1972 harvest, soaring cereal prices on local markets, and the soporific response of the government adversely affected output. Corresponding to the poor production figures was a much more important temporal pattern of grain prices. During the early months of 1972, both Daura and Katsina regions report millet and sorghum prices of approximately $ 100 per ton; by January 1973 the figure had risen to $ 180, and by July 1974 was in excess of $ 250. In isolated markets, prices well over $ 300 per ton had been reported.

In both Sabo and Rijiyar–Tsamiya the graduated sequence of responses to drought and eventual food shortage conformed to a similar pattern. Generally, the initial reactions were shallow and gradually over-ridden by deeper and in some ways less reversible responses. The onset of drought tended to be met with a battery of agronomic mechanisms such as changed planting schedules, cropping patterns and cultigen varieties and in some instances simple moisture preservation techniques. However, the mediocre harvest in 1972 meant that many granaries were bare by the dry season. In most cases, households attempted to cope locally, principally by selling their labor power, and livestock, pursuing various crafts and making extensive use of substitute foods. It was the failure of the rains in 1973, nevertheless, that heralded real disaster. By this time the poorer households had sold most livestock during the previous year, the labor market for local employment was grossly over-supplied, wages fell, and even for those able to find employment the cereal inflation meant a radical transformation in the terms of trade against them.

During the 1972–74 period in Rijiyar–Tsamiya, 2/3 of the cattle, 3/5 of the sheep, 2/3 of the goats, and 1/2 of the donkey population changed hands. As a broad pattern, 80% of the households sold labor, 60% sold livestock and fodder, and 35% sold manure or firewood. The development of chronic hunger,

however, necessitated more drastic strategies. Principally this meant a resort to loans in cash or grain for village traders, the pledging or outright sale of farms, or, ultimately, outmigration. In Sabo village, just over 30% went into debt while for Rijiyar–Tsamiya the corresponding figure was 26%. Land transfers are notoriously difficult to trace, but it appears that 8% of total community holdings were sold to the wealthy village elite of Rijiya and 17% were pledged. Figures for Sabo are 4% and 10% respectively. In both cases, out-migration was not a major option. No families from Sabo migrated; in fact, several youths from Niger actually migrated to the village. However, twenty or so males left to take up menial laboring tasks in a local administrative center. It is clear that the different economic strata within the two villages responded in rather different ways. The poor resorted to the sale of livestock, pledged farms, incurred debts, borrowed grain at usurious rates of interest and attempted to sell their labor. The rich bought livestock at deflated prices, purchased the scarcest resource of all, namely land, on their own terms, in some cases sold grain in a seller's market, and, as irony would have it, supported horses and donkeys as others waited for the slothful efforts of the State relief organizations.

The Nigerian Federal and State Governments mounted a relief program in response to the reports of severe food shortage. While it is clear that the amounts of grain distributed were large (0.145 million tons), the problems confronting provisioning were almost insurmountable. On the one hand, the effort was late from its inception and faced enormous logistical and manpower difficulties. Inequities and "irregularities" in the distribution procedures were well documented, storage was deficient, decision-making was overcentralized and, perhaps inevitably, there was an overreliance on local tax records in lieu of proper statistical and demographic information. On the other, these constraints pale into insignificance in light of the magnitude of the populous actually at risk. A population of between 8.1 and 10.4 million faced starvation. The relief budget was only about $ 60 million (van Apeldoorn, 1977). In practice, therefore, the famine victim's direct relief benefit was minimal, in the order of 13 kilograms of grain for the "average victim" in Kaduna State for the 1973–74 period. In Rijiyar–Tsamiya the total grain relief during 1974 lasted barely one week, and for the entire two year duration, Sabo District, with a population of over 168,000 received a total of 6000 bags.

Clearly, then, throughout the north, the burden of famine was born in large measure by the peasantry themselves. This is all the more remarkable – although the long-term implications are less heartening – in view of the demise of some aspects of the moral economy outlined earlier, most particularly the decay of redistributive norms and the buffering roles of descent and communal work groups. More crucial for our purpose, however, is the general feeling among many disaster victims that the 1972–74 situation was not a case of genuine famine in the sense that the great famines of the past, the *babban yunwa*. Rather, they feel that the tragedy was largely man-made. In Sabo village, the claim frequently reiterated was that the suffering was created by grain traders manipulating a below average harvest, a proposition that was paid testimony to by the fact that unlike 1913–14 when people had money but no cereals, 1973 was characterized by availability of grains (albeit at grossly inflated prices) but a shortage of cash.

Naturally, the growth of population has contributed to food and self-sufficiency problems. At the end of the nineteenth century, for instance, Sabo district contained much uncultivated bush, but by 1978 farmland is extraordinarily scarce, and almost impossible to buy, while the population has at least doubled since 1951. To a certain extent, these pres-

sures have been offset by a sort of Geertzian involution through the application of more manure to farm plots which as increased productivity per unit area. Here, too, however, access to manure is closely correlated with wealth and, despite the ubiquity of small livestock used principally as investments against calamity, it is the poorer farmers who suffer. Rural inequality, in other words, is reflected in the inflexibility of some households such that they cannot or are prevented from responding adequately to stress. In conclusion, I would like to discuss briefly three facets of the political economy of Sabo village which partially explain the vulnerability of certain sections of the community to climatic variations, their inability to respond to food shortages, and the enormous difficulties associated with reconstituting their households in the aftermath of famine.

(1) The Grains Trade

The poor peasantry who have to make use of the credit network suffer with respect to the grain trade by virtue of having to sell grain at harvest time either to cover dry season ceremonial expenses or to repay debts. Thus, not only is the peasant selling cheap but he subsequently buys dear with money borrowed at usurious rates from grain dealers who have bought grains cheaply after the harvest. Participation in the credit network, for the poor at least, often has a permanent quality particularly if debt repayment is confounded by poor harvests. In this way, an initial loan agreement may escalate over a period of several years into land pledging, mortaging and possibly outright land sale.

(2) Incipient Landlordism

One of the principal ways households heads attempt to alleviate the attenuating circumstances of preharvest scarcity, especially in view of the historical decline in rurally based crafts, is through dry season irrigation. Here, too, chronic land shortage has prevented access for a large proportion of farmers and, unlike the upland farms, landlordism and farm renting is much more common. In the case of irrigation, which swells enormously when the millet harvest has been poor, almost 50% of the plots are rented. This phenomenon is not simply indicative of rural differentiation along lines of relative wealth but rather expresses new kinds of relationship. Patronage and kinship naturally color landlord-tenant relationships but in many cases are relatively impersonal and transitory. Interestingly, the payment of rent, in which the tenant pays the landlord a proportion of the produce, is frequently denied and is conceived as a "borrowing" agreement. Those of the poor who can gain access to irrigation tracts seek to overcome seasonal shortages through rental but at risk of compounding their indebtedness. This tends to be the case because debts can be repaid with the peasants' *labor-power* during the wet season. The result is that immense scheduling problems are created which frequently culminate in the debtor postponing his own planting and weeding activities.

(3) Monetization, Ceremonial Obligations and Inflation

In a situation in which collective security has been undermined, it is not unusual to discover that many farmers enter into exchanges with the capitalist economy in order to develop and ensure economic security. The development and security of the household, which consists of the reproduction of the domestic relations of production, takes three forms: (i) the extension of the household to generate the necessary labor-power, (ii) the creation of alliance through marriage and ceremonial exchange, and (iii) the production of commodities and the sale of labor to purchase the necessary manufactured goods and marriage goods. In this manner obligatory

ceremonial expenditures, assume great social importance at the level of the household but are now extraordinarily expensive in relation to the annual income of the poor. Marriage for example, which cost $ 2–4 at the end of the nineteenth century and $ 4–10 in the early 1940's, had inflated to $ 120–160 by 1966–67 and had topped $ 700 in Sabo in 1978. Indeed, currently the *annual* ceremonial expenses such as naming ceremonies and gift exchange are usually in excess of $ 100 for the middle peasantry.

Furthermore, in a society in which biological life-cycle is pre-eminent, it is clear that during middle age the householder could easily face marriage expenses which over an eight or ten year period could, at current prices, exceed $ 3,000. These expenditures frequently necessitate large scale borrowing, and it is perhaps not too surprising that one of the principal motives for land sales and pledging is to cover marriage expenses. Insofar as these ceremonial expenditures are characteristic of the dry season, they weaken the peasant's resistance to seasonal vagaries and contribute to further indebtedness.

The position described for Hausaland is clearly not unique and is generalizable to other West African regions. The dynamics of the food situation in the Sahel, for example, especially the land scarce regions, can be illustrated by the work of Wilhelm in Upper Volta. Wilhelm (1976) describes the heavily populated Mossi plateau country south of Ouagadougou where maize, millets and sorghums are grown for subsistence with groundnuts, cotton and tobacco providing the cash income. The harvests no longer guarantee self-sufficiency in foodstuffs and the smaller peasant households purchase proportionally more than the wealthier counterparts. The poorer households are, in fact, characterized by a greater likelihood of distress sales immediately following harvest when prices are lowest. Such sales are usually motivated by the need to fulfill tax requirements and repay debts. The repurchase of cereals later in the dry season when prices are often artificially inflated. Broekhuyse's (1974) study of the Mossi plateau shows that 50% of farm revenues is spent on taxation and ceremonial obligations and that roughly the same amount was spent on repurchasing millet and sorghum. The somewhat fictional grain surplus is bought by merchants from Ouagadougou whose provisioning dominates the reallocation of surplus and which supplies the countryside from urban stocks during the dry season. Surplus is simultaneously extracted through coterminous networks of grain trade and credit which, in situations of calamity such as drought, ultimately results in the loss of land, out-migration, or, at best, clientage.

The general picture of food systems in the Sahel would, therefore, indicate that the grain traded through indigenous marketing systems is not a "surplus" in the biological sense of that which would be required to feed a domestic group, but rather represents that part of the harvest which the farmer is obliged to sell in a monetized economy. These sales invariably necessitate later repurchase prior to the new harvest at inflated prices. Inequalities are thus generated between those who are forced to sell and rebuy and those capable of buying and storing as required. The marketing system is parallel to a credit system which exploits seasonal variations in production and cash requirements. The farmer who is only just self-sufficient at best, may require cash for millet or ceremonial or taxation expenditures and will borrow from the grain merchant using the upcoming harvest as collateral. The merchant therefore "buys" cheap and sells dear and the poor peasant has little choice other than to do the obverse. Government intervention in the grains trade has apparently only accentuated the power of the private traders over producers and increased the negative role of the market probably because it has failed to appreciate the connection between the credit and marketing networks.

CONCLUSION

Famines are pre-eminently social crises. Following Marx, crises can be seen as instances in which the internal dynamics of systems are thrown into sharp relief. In pre-capitalist situations, this is frequently manifested as an underproduction of use-values which contrasts with a peripheral capitalist situation characterized by an overproduction of exchange values and the limited development of the relations of production. This view has much in common with recent studies on the relationships between famine and dependency theory but such abstract formulations often neglect the fact that the proper locus of study is the functioning of the productive and distributive system at the local level in historically specific circumstances. Until development programs acknowledge this particular facet of the etiology of hunger, the attempt to lift the poor peasantry from potentially disastrous situations will be doomed to failure. Four years after the Sahel famine, during which time the aid budget has increased enormously, the region is as vulnerable as ever as the 1977–78 season shows. In this respect the aid programs are as much a disaster as the plight of the peasantry themselves.

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THE PARADOX OF PERMANENCY IN A RESETTLED NEW HEBRIDEAN COMMUNITY*

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INTRODUCTION

Although a widespread and common phenomenon, resettlement has only recently become the subject of comparative anthropological study. Reviewing some of the theoretical implications of resettlement studies in Oceania, Silverman (1977: 8) concludes:

> The ambiguous, the uncertain, the unstable, the testing and revision of old and new forms in new and old contexts, the rising to structural prominence of features that may have been secondary under other conditions – here may be the rule, not the exception.

This statement refers to a response that is common among resettled peoples in their exploitation of altered circumstances: to experiment and innovate, to highlight or play down existing cultural elements, to mold a new identity or else cling to the old by maintaining ethnic and cultural boundaries (cf. Barth, 1969). Whatever coping strategies are adopted, cultural transformations that result are the outcome of a dialectic involving continuities (the culture carried with the migrants) and change-inducing elements in the new setting. The nature of the on-going synthesis depends on a multitude of factors, but several invariably loom large: the migrants' history of mobility; the role of outside agencies in the relocation and its aftermath; the strength of commitment to traditional values; contact with and changing perceptions of the homeland; the dynamics of interethnic contact in the new environment; and the relative weight of economic and non-economic factors in the migrants' self-assessment.

All these factors are relevant to the case study that follows [1]. It begins with a brief description of the setting, then a summary of the relocation and later migration of the Maat people is provided. Their adaptation to a new environment is described, and reasons are suggested for their "drift into permanence". Fear of sorcery in the homeland is posited as a major factor influencing outmigration and in making the migrants reluctant to return home permanently. Social changes in the last decade are outlined for both Maat and southeast Ambrym, and their implications for the position of the Maat people are discussed.

THE SETTING

The New Hebrides is a chain of tropical high

*This paper is based on fieldwork carried out on Efate and Ambrym in 1966–67, 1969, 1973 and 1977–78, for a total of 25 months. Research was supported by the University of Oregon (1966–67), on a grant from the National Science Foundation (1973), the University of British Columbia (1969), the Australian National University and the National Institute of Mental Health (1977–78). I wish to thank my wife, Dr. Myrna Ewart Tonkinson, for her constructive criticism of the paper.

islands in the southwestern Pacific; its population (ca. 100,000 in 1978) is more than 90% Melanesian. The country is unique in being a condominium, jointly administered by Great Britain and France since 1906. Difficulties in reconciling two different brands of colonialism led inevitably to government by benign neglect, until comparatively recently. The islands are susceptible to earth tremors and hurricanes, and three of them have active volcanoes. Although damage from earthquakes is minimal, volcanic eruptions can seriously affect surrounding areas with lava flows or ashfalls, but rarely cause deaths. Hurricanes pose the most serious threat, since they periodically wreak havoc and leave a trail of destruction and sometimes death in their paths.

The southeastern area of Ambrym Island is the homeland for the people who are the subject of this paper. The inhabitants of southeast Ambrym (ca. 1400 in 1978) live in fifteen villages; their fifty square miles of land is cut off from the rest of the island by a 2000 foot ash-plain. This separation is reflected in their possession of a distinct language and in cultural differences between themselves and the rest of the Ambrymese. Although it lacks sheltered anchorages, southeast Ambrym's fertile soil and gentle topography favors its inhabitants.

Traditionally, people lived in small patrilineage-based hamlets scattered throughout the bush, and they practised swidden horticulture at a subsistence level. Communities were interlinked by complex webs of kinship and friendship, but feuding was common. The arrival of Christianity in the 1890s spurred the formation of villages, each of which had a head chief assisted by lineage headmen. Each community was a law unto itself, with decision-making power largely in the hands of adult males who met informally in their ceremonial men's houses. Contacts with whites and later conversion to Christianity led to a complete collapse of traditional rituals, rapid disappearance of many material and nonmaterial cultural elements, cessation of fighting, the arrival of a few white traders and the beginning of cash-cropping. The entire area was nominally Christian by about 1930, but contact with the outside world remained sparse.

ASH-FALLS AND FORCED RELOCATION

In eleven months between 1950 and 1951, one of Ambrym's two volcanoes ejected massive quantities of ash. Severe ash-falls had occurred in southeast Ambrym previously, but this was the worst and most prolonged in memory. High altitude countervailing winds dumped large amounts of ash in the southeast, turning day into night and eventually defoliating all the vegetation. Life became uncomfortable, and 300–400 people left southeast Ambrym to wait out the ash-falls elsewhere. Among the majority who remained, there was no panic since they knew that they were in no serious danger. Despite food shortages, they managed to cope adequately and were heartened when the ash-falls began to abate in October 1951.

Unfortunately, this was when the colonial authorities ordered the evacuation of west and southeast Ambrym, without consulting the local people. Even worse, the relocation site they chose was Epi, an island feared by Ambrymese because they believed its sorcery to be even more powerful than their own. Dire threats were necessary to persuade the southeast Ambrymese to move. Officials crammed 701 people onto an 80 ton vessel, which then had to make a risky six-hour crossing to Epi. The Ambrymese were angry at their forced relocation and therefore made little serious effort to establish themselves on Epi; they did not intend to stay there long.

A few weeks later, true disaster struck in the form of a severe tropical hurricane, which devastated houses, gardens and plantations, and killed 114 people. The relocation site was worst hit, and 48 Ambrymese died; the sur-

vivors were left with only the clothes they wore. Some went to join relatives who had gone to Epi to work on plantations after the ash-falls had commenced. Those lucky enough to obtain rides went back to the homeland, and the inhabitants of one of the homeland villages, Maat, migrated south to Efate. In the following two or three years, most southeast Ambrymese drifted back home, to replant their gardens and await the regrowth of their sole cash crop, coconuts.

BACKGROUND TO THE MAAT RESETTLEMENT

Four Maat men, including their chief, assistant chief and teacher-catechist (southeast Ambrym's most forceful and controversial personality) ran afoul of some of the older traditional chiefs and the local white traders in 1949. They were arrested early in 1950 and sent to jail in Vila (the capital, on Efate) on fabricated charges of inciting cargo cult activity. A later court hearing found that their major crime had merely been an excess of Christian zeal, and they were released from prison. They remained in Vila, mistakenly believing that they had been exiled from Ambrym for three years. They obtained work on a nearby plantation and sent for their families. These and other people who came from Ambrym during the ash-falls told of the adverse conditions there, so the leaders decided to summon the remaining Maat villagers to Efate. A French planter had offered them a deal: a village site, some building materials and access to garden land, if they would become his exclusive labor force. Knowing that Ambrym would not recover for at least a couple of years, the leaders agreed and the planter's boat went and collected the remaining villagers from Epi shortly after the hurricane.

COPING WITH A NEW ENVIRONMENT

Although they had moved 100 miles from Ambrym, the migrants had little difficulty in making a satisfactory adjustment to life on Efate. They named the new village Maat, after their homeland village. The old and new locations share similar physiographic, biotic and climatic characteristics, and no radical change in adaptive strategies was necessary to deal with Efate's physical or social environments. Efate was already familiar to almost all the adult males, who had worked there during World War II, and all spoke Pidgin, the country's *lingua franca*, so they could communicate easily with their new neighbors. The latter were fellow Presbyterians, so the bonds of shared religion helped bridge the cultural gap between the rural newcomers and their more sophisticated peri-urban neighbors. The freedom from outside interference that the Ambrymese had enjoyed in the homeland continued on Efate. Their Hebridean neighbors gave assistance when needed, but otherwise left the migrants to their own devices. Because their move from Epi was a private arrangement, officialdom in Vila largely ignored them, as had been the case in Ambrym, so their strong sense of independence remained intact. Efate was a new experience for most women, whose poor command of Pidgin hindered communication with strangers. However, when not working as a group on plantations, they remained in the village so their contact with outsiders was minimal. This had always been the case, and men had long been the more mobile sex, so the old patterns of mobility and interethnic contact remained structurally analogous after resettlement. A major difference between old and new was the physical isolation of the migrants from their congeners in the homeland, but communication channels remained open and they were able to stay fairly well informed about life in Ambrym.

THE DRIFT INTO PERMANENCE

The people of Maat had signed no contracts

with their employer, so they were theoretically free to return to Ambrym at any time. By 1954 the homeland had recovered and most of the population was back there. Both the Ambrymese and the migrants regarded their absence as temporary. But the Maat people were now well established on Efate and faced a difficult choice: to return and reestablish themselves in Ambrym, or linger and enjoy the fruits of their labor. There was no shortage of reasons for staying on. The new village and gardens represented a large investment in effort; they had a steady cash income from copracutting, which was done on a piecework basis that allowed them ample time for gardening; their children were in schools far superior to those in Ambrym; they had an excellent freshwater supply, which was lacking in the homeland; and so on.

No public meetings were held to discuss their situation and future plans, so the decision to stay on was never formally made. Their stated intention was unchanged: to return permanently to Ambrym "sometime soon". In 1954, their employer sold the community 100 hectares of undeveloped land for garden use, and promised to repurchase it in the event of their return to Ambrym. In 1961, conflict between the villagers and their employer finally led to a major crisis: he threatened them with eviction unless they purchased the land and coconuts they had hitherto exploited without cost. The planter tried unsuccessfully to pressure the government into making a cash loan to the villagers. Officials proposed an alternative: relocation elsewhere on Efate, but this was rejected by the villagers.

Throughout this crisis, the Maat people never seriously considered the alternative of a return to Ambrym, despite their grave doubts about being able to raise what was to them the enormous sum of over U.S.$ 10,000 in only two years. Teams of men went and cut copra on Maat land in Ambrym, many southeast Ambrymese donated money, Vila area friends and coreligionists assisted with gifts and loans, and they were finally rescued from failure by a small government loan. Some of the homelanders who helped were men who had settled at Maat. Donations from those still in the homeland were motivated partly by bonds of kinship and sentiment, but there was another motive: Maat had by this time become a welcome haven for them when visiting Vila. They were assured of somewhere to sleep and eat, and could remain as long as they wished. The people of Maat continued to assert their intention of returning permanently to the homeland. Most adults did make several return visits, and some built houses and cut copra there, but they eventually returned to Efate [2].

SOCIAL CHANGE: THE FIRST FIFTEEN YEARS

Describing Maat Efate in 1967, it was still more accurate to talk in terms of continuities with Ambrym rather than change. Physically and culturally, Maat more closely resembled southeast Ambrym villages than those of its Efate neighbors. The migrants had replicated major features of the old sociocultural order and still identified strongly with Ambrym. Many of the changes that had occurred were also evident in the homeland; e.g. the relaxation of certain kinship observances, the abandonment of some taboos, an increasing focus on cash-earning activities, and so on.

There were also notable differences between the migrant and homeland communities. Maat had a much higher growth-rate than any of the homeland villages and now numbered about 200 inhabitants. Its birthrate was higher and infant mortality rate much lower than those of southeast Ambrym. Its numbers were swelled by the continuing presence of longterm southeast Ambrymese residents and by short-term visitors (who comprised 10–20% of the total at any given time). Since 1960 many men had become wage laborers in Vila. Per capita income and expenditure were much greater than

in Ambrym, and living standards were higher, but the migrants were not yet investing heavily in housing, furniture, vehicles, etc. It cost them more to live near Vila than in Ambrym, since they incurred expenses (e.g. taxi fares) that were non-existent in the homeland. Yet the fact that they spent almost 40% of their income on foodstuffs indicated changing tastes rather than necessity, since their gardens kept them well supplied with traditional staples.

A major change had occurred in land tenure. In Ambrym land was owned by kin-based groups, but at Maat the land that they had bought was communally owned, and most of their gardens were on land belonging to their employer and neighboring villages. A person established usufructory rights to Maat land simply by clearing and planting a garden. There were no disputes over land, coconuts or boundaries at Maat, whereas in Ambrym these were a major source of tensions and conflict.

One notable difference in social structure was the large number of men who lived uxorilocally at Maat. These comprised some 30% of the total of married man, whereas in Ambrym the number of men living in a village other than their own was negligible. In Ambrym, the major corporate social groups other than church organizations were the family, hearth group, patrilineage or "small name" and the village. (In most villages the "small name" is a named residential area, most of whose male inhabitants claim membership in the same patrilineage.) At Maat there was much greater emphasis on community-wide financial responsibility for education and for marriage feasts than in Ambrym, where they remained the responsibility of kin-based groups. But the situation was reversed with respect to communal work-parties: wage work prevented many Maat men from participation most of the time, so individually organized, small work-groups were becoming more important. At Maat the nuclear family boundary was becoming more distinct, and the "small name" had less significance as a corporate group than in Ambrym. The village, however, assumed greater importance at Maat as a social boundary, since it separated the migrants from non-Ambrymese neighbors and other outsiders. There was greater interethnic contact than in Ambrym, particularly among urban workers and young men, but the lure of Vila was still not strong and villagers spent very little time there outside of working hours.

SORCERY AND OUTMIGRATION

Maat villagers in 1967 expressed general satisfaction with their lives, but still felt a strong attachment to the homeland. When asked to compare the two locations, most men and women said they preferred Ambrym. When then asked why they chose to stay in Efate, their reply was almost always the same: there was too much sorcery in Ambrym. It seems likely that the notion of Maat as a permanent home crystallized as they became convinced that no sorcery was occurring at Maat. Pointing to the large numbers of children in the village, people contrasted this with the situation in Ambrym where, they claimed, sorcerers were always killing children. The fact that the Maat people made good use of the medical facilities readily available in Vila was never mentioned as a factor in this important change. In the new village the potential for conflict was greatly lessened by the removal of land, coconuts and pigs as potential sources of trouble, and since migration there had been no serious conflicts with their congeners in Ambrym.

Virtually all Ambrymese believed in the reality of sorcery and feared it. No one ever admitted to practising it, though many men were suspected, and it was regarded as the major cause of death. However, people did not live in constant fear of it. There were times and situations of high risk, so they took care not to expose themselves unnecessarily to attack. Pondering this negative aspect of life in Ambrym, the people of Maat had their disquiet

fueled by an almost continuous inflow of bad news – accounts of sorcery attacks, accusations, threats, near misses or alleged hits – relayed from the homeland by visitors or in letters. As a result, their perception of sorcery's significance in Ambrym was gradually distorted. It now seemed to them that there was much more sorcery than before, and the homeland had thus become a very dangerous place to live.

They knew that they were not the only people who believed this. An additional 450 southeast Ambrymese (30% of the total) were at that time living away from the homeland, and most who stayed away for long periods had no plausible economic, medical or educational reasons for doing so. Many had fled because that their lives were in jeopardy from sorcery attack, and many had taken their families with them. Their absences from Ambrym lasted anywhere from a few months to many years. But like the Maat people, all those interviewed asserted that they would eventually return home.

SOCIAL CHANGE: 1967–1978

Maat's population has grown steadily from 200 to 325, and it is now a much larger village than any in southeast Ambrym. Long-term non-Maat Ambrymese residents still comprise almost one third of the population [3]. Physically, Maat has lost its Ambrymese appearance, with cement and iron dwellings replacing all but a few bamboo and thatch structures. Suburbia has spread close to Maat, with whites and other Hebrideans now living close by; some patronize the village stores, and several whites employ Maat people in and around their houses. A growing shortage of garden land has led to the exploitation of the land purchased in 1954 (but long ignored in favor of plots much closer to the village). Some undeveloped Maat land remains, and as yet no conflicts have arisen over it; but there are indications that as land pressures increase these may arise.

The proportion of the male workforce now employed in and around Vila has risen from 64% to 85%, and of females from 10% to 64%, and the number of men and women who now cut copra regularly has declined considerably. Since wage labor yields much higher returns than copracutting, total income is now proportionately greater. Only rough estimates are possible, but since 1967 per capita income has risen more than three-fold (U.S.$ 11.30 per month to U.S.$ 38.25), despite a 62.5% increase in population. Even when inflation is taken into account, real income has risen appreciably, and the solid subsistence base provided by their gardens remains. The dozen or so youths and young men who are unemployed cut copra on occasions, but prefer less demanding garden work if they cannot find jobs in the town. Some of the more affluent villagers, whose employment restricts their gardening time, have begun employing these young men on a daily basis and pay them cash, whereas before people who assisted others in their gardens worked for food only.

Villagers owned two vehicles in 1967, thirteen now, so there is less reliance on Vila taxis than before. A few other high cost items have appeared, such as houses built by outside contractors, kerosine refrigerators, generators, motor mowers, and a great many more sewing machines than in 1967, and many people have invested considerable money in house construction. They spend little on interior furnishings, since the separate kitchen remains the focal point of social life in most households, just as it is in Ambrym. It appears that a much greater proportion of income is now spent on housing and vehicles than in 1967. The proportion spent on foodstuffs has remained high, and the contribution of garden foods to their diet may have declined a little. Everyone still grows subsistence crops, though many wage workers find it difficult to devote as much time to gardening activities as formerly. Rice and bread are even more firmly established as staples, and

much more fresh meat is now eaten.

With many more people now working in town and many neighbors living quite close to Maat, the villagers have a greater amount of contact with outsiders. One consequence of this is a considerable increase in intermarriage with non-Maat people. The larger number of men marrying outsiders is a reflection of two factors: a greater amount of interethnic contact, and a persistent shortage of women within the Maat community, caused principally by a pronounced excess of male births over female [4]. Partly because there are more outsiders married into the village, Pidgin is heard more often than before, but southeast Ambrymese remains the first language and there has been no diminution of a strong sense of identity with Ambrym. Many young people who were born and raised on Efate have visited the homeland, and they consider themselves "man Ambrym" as well as "man Maat Efate".

The villagers are currently attempting to resolve the longstanding problem of a nonfunctioning chief and village council. In preliminary discussions about how best to restructure their system, the Maat people pointedly rejected the models of their Efate neighbors in favor of one drawn from the homeland. The proposed solution is to have village "small names" select representatives to the governing body. It has been noted that these divisions have declined in importance as corporate groups, though they have remained an integral part of the ideational culture of the villagers. The proposed system accords more closely with the realities of social structure and political alignments within the village.

MAAT EFATE AND SOUTHEAST AMBRYM IN 1978

According to the villagers, there is still no sorcery in Maat Efate. But in southeast Ambrym, too, its alleged incidence has declined almost to zero. In 1973, local church leaders mounted an evangelical campaign in a headlong assault on sorcery in southeast Ambrym. For the first time, its alleged practice had become a subject of public discussion, following the deaths of two prominent chiefs who were reputed to be sorcerers, and a court case in which many people testified to the District Agent against two of the area's chiefs, who were found guilty of profiting from people's fear of sorcery. The well organized and powerfully led campaign struck a responsive chord in the Ambrymese, who pronounced it an enormous success and claimed that the presence and power of the Holy Spirit had crushed the powers of evil for all time. The atmosphere during and after the campaign was one of great relief and euphoria (Tonkinson, n.d.). Parents ceased using the threat of sorcerers to discipline children; in four months on Ambrym (1977–78) I never heard this once common admonition. Two deaths in 1977, and a third early in 1978, resulted in widespread rumors of sorcery. The response of the area's leaders was to hold court hearings, identify the sources of the rumors and castigate the culprits, and invite the alleged sorcerers to publicly defend their good name. The contrast between southeast Ambrym in 1967 and 1978 is striking. Anxiety about sorcery has abated dramatically, and there is consequently a much greater freedom of movement within the area, but no departures occasioned by fear of sorcery.

Convincing evidence of this transformation came early in 1978 when a second evangelical campaign was mounted in southeast Ambrym. Although rumor-mongering was attacked in a few sermons, the topic of sorcery was conspicuously absent. The campaign's aim this time was to revivify people's faith and their commitment to the church. Church leaders and laypersons alike asserted than anyone foolhardy enough to have retained possession of magical paraphernalia would eventually fall seriously ill as the power of the objects turned against them, and they would die if they did not then destroy the objects.

There have been other important changes in the homeland in recent years. There is now a "development society", founded by a well educated southeast Ambrymese who is the area's resident pastor. Funded largely by grants from a foreign charitable organization, it aims to exploit the area's unused natural and human resources, provide practical on-site training for school-leavers, and decrease local reliance on imported goods and on copra as the sole cash-crop. Much has already been accomplished with volunteer labor, and several projects are under way.

The quality of elementary education in southeast Ambrym is now better than that received by the Maat children on Efate; this contrast is recognized by most Maat people. Besides new schools, new clinics have led to a rapid improvement in health levels, although as yet there are no doctors or hospitals in the area. Most villages now have cooperative stores (some of which own vehicles), whose range of merchandise is slowly improving. Copra prices have been high for some time, so there is no shortage of cash among the southeast Ambrymese, but expenditure on material goods other than basic necessities is very much less than in the Maat Efate community. The frequency of shipping to and from southeast Ambrym has increased, but as yet there is no airfield. If one is constructed, as currently promised, and the country's internal airline schedules regular flights, the pace of development should further increase. It would also facilitate mobility: the journey to and from Ambrym by boat is extremely uncomfortable, and the ordeal deters many would-be travelers.

Developments in southeast Ambrym have been closely monitored by the absentees, who in December 1977 numbered 950, which is about 40% of the total number of people belonging to southeast Ambrym. Some 60% of the absentees have been away from the homeland long enough to be considered "permanent" expatriates (even though many of these people still say that they will return to Ambrym sometime). Some absentees have made trips back to Ambrym to see for themselves, and some among them have resettled on a permanent basis. But to date no significant exodus from the town areas has taken place. Maat Ambrym had a population of eight in April 1967; in April 1978 it was 36, and there is still frequent movement between the old and new villages. The difference between values, behaviors and life style in the homeland and in Maat Efate is not yet great enough to cause significant problems for those villagers who move from one milieu to the other. Most of those living on Efate still regard the homeland as a vacation or working holiday spot rather than as a permanent home. Some of the more affluent Maat Efate men are talking about the possibility of making business investments in Ambrym. Even for those lacking capital, the homeland is an attractive place now that the alleged practice of sorcery seems to have abated. Those who return would have their own land and coconuts, and the freedom and leisure of self-employment in a bountiful land.

The residents of southeast Ambrym say that they do not know for sure what is delaying the return of the absentees, except for those who lack sufficient land and coconuts in the homeland, and for some of those who have bought land and built substantial houses on it. Most residents think that with sorcery no longer an inhibiting factor, many of the absentees should by now be coming back, and that *no one* who came back would be unable to subsist in Ambrym since there are always people willing to let others use some of their land and coconuts for little or no payment. It seems clear that whatever the present circumstances and perceived needs of the absentees, many of them are having to reassess their relationship to the homeland.

CONCLUSIONS: THE PARADOX OF PERMANENCY

Schwimmer (1977) asks if the study of a nonrecurring event, such as a volcanic eruption, should interest anthropologists only if it is paradigmatic of some social law. To the Ambrymese, an ash-fall is a recurring event, so their reactions to this phenomenon are conditioned to a large extent by prior knowledge and experience. However, each such event is inevitably different from all others and sets into motion a unique concatenation of actions and reactions whose specifics are not amenable to prediction. In attempting to study natural disasters, particularly, anthropologists are confronted with social process seemingly run amok. Their attention is invariably drawn towards chance occurrences that influence the course of events in the aftermath, and towards the role of certain individuals as change agents. There are no social laws to be generated at this level of analysis, and it is here that the chances of comparability are slight. If abstractions can be made from raw data concerning the individual and unique, then at some higher level both the enabling forces and the structural consequences of nonrecurring events may prove comparable. As Silverman (1977:7) notes, ". . . we may find them to be recurrent as we enlarge the scale of analysis [of resettlement studies] to a colonial system or a regional mobility system."

The following discussion is intended to show that attention to both micro- and macro-levels is essential if a balanced assessment of the Ambrym case is to emerge. The southeast Ambrymese people's perceptions of crisis and of Epi as a place to live were shown to be almost totally at variance with those of the colonial authorities. The Ambrymese believed that they were being forced *into* a crisis situation, not *out* of one. By its actions, the government was indirectly responsible for the tragedy that so soon overtook the evacuees. The total experience served only to reinforce the people's already negative stereotype of "government" and its agents as detrimental rather than beneficent in their effect.

The initial study of Maat was one of ten similar studies of relocation in Oceania. Although success is very difficult to measure, a comparison of these studies strongly suggests that from both emic and etic viewpoints the Maat resettlement is among the most successful of them all. It is coincidentally the one where government agencies played the smallest role – except in the initial relocation, which was a disastrous failure. Prior experience in their isolated homeland had engendered self reliance and taught them to expect nothing positive from either colonial power. The government played no part at all in their migration to Efate, so they were not anticipating assistance from that quarter, and were not disappointed when none was given. They remained strongly self reliant and did not develop feelings of dependence on government agencies, in marked contrast to some other resettled communities whose forced relocations had long and painful aftermaths (cf. Kiste, 1974, 1977).

To explain why the Maat villagers ended up on Efate instead of back in Ambrym, both chance occurrences and the role of particular individuals are of major significance. Had the Maat leaders been less forceful in opposing the status quo in southeast Ambrym, they would not have been removed to Vila and jailed. Had the French District Agent who originally tried them not misinformed the leaders that they were under exile from Ambrym, they may well have gone home instead of sending for their families. Had the evacuation and hurricane not occurred, those remaining in Ambrym may have decided against joining the rest in Vila. It was the teacher-catechist, who had been the homeland's most influential change agent, who convinced the hesitant Maat villagers to buy land so that they would have a haven outside Ambrym in the event of future ash-falls or hurricane damage.

After a few years on Efate, the villagers came to view their situation there as one of

safety from sorcery, which was an excellent reason not to return home. Their continued presence in Efate was perceived very differently by outsiders, who gave what were to them logical economic reasons for this: the Maat people remain because ash-falls spoil their livelihood in Ambrym and it is a dangerous place; the lure of the town and its amenities is too great for them to resist; they are assured of a cash income because there is always work available, and so on. On the rare occasions that they did intervene at Maat; e.g. during the land crisis, government officials threatened a forced repatriation to Ambrym when the Maat people rejected their suggestions. There is little doubt, however, that the officials were mindful of the value of the migrants as a convenient labor force, since southwest Efate has a great many white-owned plantations.

In his concluding comments on ten Pacific resettlement studies, Lieber (1977:387) notes, "In every instance reported in this volume, resettlement has contributed in some important way to the maintenance of the colonial system." He also suggests that because of their labor needs, colonial systems needed to keep part of the indigenous population mobile in order to maintain themselves. It is also true that changes consequent upon contact with colonizers impel the colonized into greater mobility as they develop new needs and wants. In the Maat case, a mutually beneficial business arrangement was involved. Mutual gain of this kind motivated the system of circular migration that evolved in the New Hebrides however heavily the scales of exploitation may ultimately be tipped in favor of the colonizers (cf. Bedford, 1973; Bonnemaison, 1974, 1976). The fact that a degree of mobility was intrinsic to traditional Melanesian society must also be considered with respect to a people's preparedness to migrate and their ability to adapt to different environments (Chapman, 1969). The history of mobility of the Maat people was definitely a positive factor in their successful adaptation to Efate.

Since they initially regarded their presence in Efate as a temporary sojourn, the Maat people made no concerted attempts to assimilate into their new social milieu. An awareness of their lack of sophistication compared to their neighbors, and of the reputation among Hebrideans everywhere of Ambrym as *the* home of sorcery, may well have inhibited interethnic contacts. But the migrants maintained their identity as southeast Ambrymese and set about replicating major features of the old order in the new locale. In several ways, however, they took the opportunity to experiment and innovate as they established their "new" community. Although they maintained strong ethnic boundaries, they did fulfil their communal obligations to church and educational bodies in the local area. In all, they considered that they had made a good social adjustment in Efate. They showed little interest in borrowing cultural forms from their neighbors, and the significant social changes that they effected were based largely on home-grown models. The important transition from kin-based to communal responsibility for certain purposes is a case in point. Many resettled communities have communal forms of organization in their early years, sometimes in response to crisis, or as the result of a significant widening in the contextual scope of an already existing organizational form. At Maat, when the villages decided to fund educational and marriage feast expenses communally, they were seeking improvement and equity (Silverman, 1977:7). They wanted to ensure that all children had their education funded regardless of parental income levels, and they wanted to prevent marriage feasts and reciprocal gift-giving from becoming an arena for status enhancement. In a related move, village leaders limited bridewealth payments, and discouraged the practice of sister exchange, which was common in Ambrym, because it sometimes involved coercion (Tonkinson, 1976).

The necessity for cooperation and unity in

such communal activity may have constrained divisive tendencies and antisocial activities such as sorcery through self-reinforcing positive feedback (Lieber, 1977:370). More important in this respect would have been the change in land tenure practices in reducing the potential for conflict at Maat. After the land crisis passed, an inactive village government contributed to a decline in communal activities, and the education funding scheme lapsed. But the decline that was occurring in communal work-group activities was also caused by the men's steadily increasing commitment to wage labor, and concomitant strengthening of the nuclear family as a corporate unit.

The paradox that is signaled in the title of this paper arose from the Maat villagers' changing perception of the homeland resulting from their physical separation. They had replicated major physical and cultural features of Ambrymese life on Efate, yet with respect to the presence-absence of sorcery, a vital distinction existed between the two environments – so Maat was and yet was not an Ambrymese village. In consequence of this changed perception of the homeland, a second paradox was generated: there was a weakening in their conviction that their absence from Ambrym was temporary, yet they continued to deny that their resettlement was permanent, and this denial was shared by their congeners in the homeland. Maat thus was and was not a permanent village. As long as Maat continued to serve a useful function for the southeast Ambrymese as an urban refuge, the homelanders never provoked a confrontation with the Maat people over their continued absence. For their part the migrants renounced none of their land rights in Ambrym, and enough of them made return visits to justify the homelanders' belief that they would eventually come home for good.

It was easy for the migrants to exploit the ambiguities inherent in their paradoxical situation. Their Ambrymese identity remained strongly intact and they had made no attempts to adopt a more cosmopolitan self-image by abandoning their boundary-maintaining behaviors. Although their continued absence from Ambrym was indeed a conspicuous communication, it was never a negation of identity and did not therefore precipitate schism with Ambrym. By maintaining contact and bonds of obligation and responsibility with homeland kin and friends, they demonstrated their continuing commitment. Having abetted the migrants by helping them purchase land, the homelanders at the same time professed not to understand why the Maat people remained away and attributed this to mild craziness on the part of the migrants. The homelanders were thus indicating their own ambiguity in their attitudes to the migrants.

In conclusion to a paper drafted initially in 1970, I stated, "Efate will remain their home as long as their conception of Ambrym as a place riddled with sorcery continues unaltered" (Tonkinson, 1977:293). Events in Ambrym, dating from the 1973 evangelical campaign, have indeed altered that conception. The villagers I talked to in 1977–78 were agreed that Ambrym has changed and that sorcery really has abated; if there were sceptics, they were remaining quiet. Since then there has been no revival of sorcery fears in the homeland; the 1977 rumors had reached Maat but no one seemed to be taking them seriously. There is thus every indication that the Maat people have lost what has long been for them *the* primary *criterion for contrasting* southeast Ambrym and Maat social orders; and this loss removes a major ambiguity that they had exploited in their rationale for their continued absence from Ambrym.

Movement between the new and old villages will continue, and unless copra prices plummet, the population of the old Maat will probably continue to grow. But Maat Efate will no doubt remain the permanent home of most Maat people. If there is no resurgence of alleged

sorcery in Ambrym – an eventuality that is impossible to predict – the migrants will seek alternative rationales, and these will probably be economic ones. Their investment in Maat Efate is now considerable, and in many respects they continue to enjoy the best of both Efate and Ambrym worlds. It is true that they have opted for wage labor and all that this implies in a colonial situation, and this commitment will never be understood by those living the much freer existence in Ambrym, but the compensation is a steady income that enables them to buy the many things that have become necessities to them. Although the acquisition of material wealth is not yet a major preoccupation of the Maat people, they certainly evince a much greater concern with money and what it will buy than the homelanders. This contrast has in fact long existed as a notable difference in the life styles of the two societies. If both groups openly admit this to themselves and to each other, the primacy of economic factors in contributing to Maat's continued existence would be affirmed. Maat Efate is now twenty-five year old *fait accompli* whose inhabitants remain culturally Ambrymese. Neither its existence nor their identity seem likely to be extinguished in the foreseeable future.

NOTES

1 The Maat resettlement is the subject of a monograph (Tonkinson, 1968), one of a series resulting from a five-year project, directed by Professor Homer G. Barnett, University of Oregon, entitled: "A Comparative Study of Cultural Change and Stability in Displaced Communities in the Pacific." Tonkinson (1977) discusses major implications of the Maat resettlement.

2 In fifteen years to 1967, more than three quarters of the Maat adults visited the homeland. Males made about three trips each and stayed for an average of seven months, whereas women averaged only two trips each for an average duration of seven and a half months.

3 A noticeable drop has occurred in the proportion of short-term visitors from Ambrym: from 16% to 5% of the total. This is probably because more than 250 southeast Ambrymese now live in the Vila area, so newcomers from the homeland have a much wider choice of relatives and places to stay outside Maat than formerly.

4 Between 1952 and 1966, there were 21 marriages with outsiders, eleven of whom were southeast Ambrymese; but in the decade to 1977 there were 31 such marriages, 16 of which were with southeast Ambrymese. Of a total of 52 marriages of Maat people since resettlement, 21 involved Maat women but only twelve of these have gone to live elsewhere. The remaining nine live in Maat with their non-Maat husbands. In 1967 about 63% of Maat people under 16 years of age were boys; in 1978 the proportion was still 59% to 41% girls. So Maat men must continue to find wives beyond the village if all are to marry.

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THE 1970 PERUVIAN DISASTER AND THE SPONTANEOUS RELOCATION OF SOME OF ITS VICTIMS: ANCASHINO PEASANT MIGRANTS IN HUAYOPAMPA*

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INTRODUCTION

On May 31, 1970, a major earthquake struck Peru, affecting an area of some 64,000 km^2, killing as many as 70,000 persons and injuring at least 150,000 others. Landslides buried towns and settlements and damage was into the hundreds of millions of dollars U.S. In the following sections, I attempt to show how the catastrophe has contributed to out-migration of peasant workers from the highland region of Ancash, which was the area most destroyed by the quake, to Huayopampa, a relatively out-of-the-way small and obscure rural community some four hours' drive north of Lima, the capital of Peru. I consider how Ancash migrants have endeavored to capitalize on an economic boom in Huayopampa in order to enhance their prospects for establishing roots in the urban sector, as well as to find an immediate solution to their economic problems due to the earthquake.

THE DAMAGED REGION

The department of Ancash, located on the central coast of the country, occupies both coastal and mountain ecozones. The total area is 36,000 km^2. The 1970 population was estimated at approximately 745,000 persons, and almost two-thirds of the population is rural. Poor peasants constitute the vast majority of the rural sector. They own or rent miniscule plots on which they barely manage to subsist. Huaraz, the principal urban center for the highland region on Ancash had a population of 65,321 shortly before the quake. The department also has a number of towns with populations generally far below the 20,000 mark.

More than 10,000 hectares of irrigated land were rendered unusable because of destruction or damage to irrigation channels. Mudslides completely destroyed crops on both sides of the Santa River, one of the major waterways running through the district. The hydroelectric power plant built on the Santa was paralyzed for five months, leaving several industries without electricity. Moreover, some 1,300 kilometers of road were damaged, the Chimbote–Huallanca railroad required extensive repairs, and the Chimbote steel works were badly damaged. Business losses in Ancash alone were somewhere around $ 13 million.

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The Peruvian government declared a state of emergency for the entire region. Nine days after the tragedy, the government created a quasi-ministry, the Commission for the Reconstruction and Rehabilitation of the Affected Zone (CRYRZA), under the direction of a powerful army general. Two years later, CRYRZA was succeeded by the Regional Organisation for the Development of the Affected Zone (ORDEZA). Whereas CRYRZA was charged with the task of reconstruction and rehabilitation, ORDEZA took on the job of promoting economic development. Because of the urban, Lima, bias of the members of CRYRZA and ORDEZA, they were unable to develop and carry out successfully projects that would have restored and developed the rural regions of the affected area. Their failure indirectly contributed to continued outmigration because of the frustration of the peasants' hopes for a rural renewal.

The State, through CRYRZA and ORDEZA, foreign donors and philanthropic organizations, provided assistance in relocating some of the destitute families and orphaned children, including a program of colonization in Amazonian regions. Many persons, especially single males, migrated to coastal cities to search for temporary employment or even a new place to live (the 1972 census reports a total population of 726,215 inhabitants in the department of Ancash and 279,994 Ancashinos elsewhere). A few young men eventually found their way to the thriving rural peasant community of Huayopampa.

THE HUAYOPAMPA MIGRANTS

The peasant community of San Agustin de Huayopampa is located on the right bank of the Anasmayo brook in the basin of the Chancay River. It is under the jurisdiction of the province of Huaral, department of Lima. In 1975, it had a population of about 500 inhabitants. This is a Spanish-speaking community lacking any recent Quechua tradition. The majority of Huayopampinos earn their living working small peach and apple orchards and supplement their incomes by growing garden vegetables and raising cattle. Huayopampa is a Peruvian peasant community that has successfully made the transition from a subsistence to a market economy in the last thirty years, in contrast to most rural highland communities of the Andes. Moreover, the Huayopampinos have developed strong attachments to two nearby cities, Huaral and Lima. It is in these cities that these farmers sell many of their products, send their children for secondary and higher education, shop and go for medical treatment.

Huayopampa covers an area of 13,924 hectares. It falls into two ecologically distinct sectors, which, in turn, are separated by lands that belong to two distinct neighboring communities. These can be categorized as follows:

(a) The lowerlands, with an area of 4,009 ha., or 29% of the community territory. The altitude ranges between 1,200 meters and 2,000 meters above sea level.

(b) The higherlands, with an area of 9,915 ha., or 71% of the community area. The altitudes of this zone vary between 3,000 and 4,900 meters.

The economic mainstays, peaches and apples, are cultivated in an area of only 260 ha. in the lower zone. Only this part of the territory is irrigated and is worked intensively. No farm machinery is used other than fumigation pumps. Nonetheless, in a good year, each hectare can produce for its owner some $ 18,000.

In the 1950s, a few members of the community with close links to Lima and Huaral decided to introduce peach cultivation to Huayopampa. They had discovered the high price that peaches commanded in the market and the availability of relatively simple methods to cultivate them. These cumuneros became interested in learning through observation the specific ways peaches were cultivated, especially in the Huaral area, so they visited

peach orchards there and talked with the owners. The peach innovators commented that during the first year of their experiment, their fellow comuneros mocked and teased them, but when their trees began to produce and they began to sell the fruit at Lima's market for much higher prices than the traditional products, their fellow comuneros began little by little to replace their traditional products with peach trees.

Until the early 1960s, all Huayopampa land was worked exclusively by Huayopampinos through mutual help or intra-community labor contracting arrangements. Farmers hired outside workers only rarely, and when they did, the farmhands came from neighboring peasant communities. By the mid-1960s, almost all the 150 families of this community were cultivating peaches and enjoying high profits from the sale of their produce. However, they were experiencing labor shortages under this new affluence. The shortages were prompted by the fact that families began sending more of their sons to Lima for secondary and higher level studies, a tradition that dates back to the 1920s (Osterling, 1978). And peach cultivation had high labor requirements. Also Huayopampinos traveled frequently to Lima either for family reasons, e.g., to visit their sons who were in school or for business, especially for sale and collection of payment for their products.

Around 1965, the first Ancashino workers arrived in Huayopampa. Their numbers did not exceed ten or fifteen prior to the earthquake. The majority of post-disaster migrants are single males between 15 and 30 years of age. They number around 200 at harvest time, during May to December, but approximately half return to their home villages for the remainder of the year. This pattern has continued up to the present. Those returning home participate in religious festivities and help out in the fields. Huayopampa is seen by these young men as a training ground where they can migrate temporarily in the order of one to three years; from their Ancash communities, they learn new skills, visit Lima and in general prepare themselves gradually for the eventual permanent move to Lima.

Only five migrants indicated the earthquake as the prime reason for migration to Huayopampa. Most said they were compelled to seek employment beyond their homelands because the earthquake and mudslides intensified traditional poverty in their villages. One might expect that the Ancashino peasants sought out Huayopampa because of its prosperity or because it is located in an area ecologically similar to Ancash. And this proved to be the case, in fact. A preliminary survey revealed over half of the migrants hailed from only three Ancash districts (Pueblo Libre, San Luis and Yauya). The localities were severely damaged. To this can be added the fact that kinship and/or friendship links existed with the earlier Ancash migrants prior to the actual migration of this group of young men. Furthermore, the adventuresomeness of youth gave them the courage to try out a new lifestyle but in an area that would be less of a change from their experience of their original community. Huayopampa has a role to play in this evolving process inasmuch as it serves as a place of initial apprenticeship to an urban existence. It has a rural character, yet it is influenced by and has some of the trappings of urban living.

The Ancashino who settled in Huayopampa before the quake were well received by the community, but their successors encountered difficulties. Dovetailing with the influx of immigrants was a sharp rise in thefts, and these outsiders were the first to be suspected and accused. The comuneros further adopted a condescending attitude toward their guests, one large coastal land owners traditionally reserve for their workers of Andean origin. They were afraid that the Ancashino migrants would become so numerous that they would lose their traditional rights to their lands. Thus, as long as the Huayo-

pampino needed laborers and as long as the young Ancashinos saw themselves as merely visitors in the community, the condescending attitude was not strong enough to discourage and deter the presence of Ancashino migrants. But this conduct did discourage Ancashinos from seeking permanent residence in Huayopampa.

In part as a response to the possible enactment of the Agrarian Reform Law, two types of labor arrangements emerged in Huayopampa, as of 1970. One involves "stable laborers," men who worked exclusively under a comunero who pays a daily wage and supplies room and board. The other entails "free laborers." These are men who have become specialists in some aspect of fruit growing (e.g., pruning, grafting or fumigation). These workers contract themselves out, working for whatever land owner seeks their services. Free laborers earn large sums of money, but they are neither lodged nor provisioned. Huayopampinos have expressed grave concern over the growing numbers of free laborers because of the difficulties of supervising the activities of large groups of alien young men, and because they continuously demand pay hikes for their work.

This issue was brought to the Community General Assembly, and it was agreed that no Huayopampino should contract the service of free laborers nor rent houses to migrant laborers. Hence, the young temporary migrants must now work as stable laborers under the orders of a boss who is responsible to the community for the supervision and control of his laborers. Hence, "free laborers" are now very few, less than ten. These are the earlier Ancashino migrants who had already established themselves permanently with their families.

The above factors help account for the temporary nature of Ancash migration. On the one hand, Huayopampinos appreciate the economic importance of the migrant, yet they regard his presence as a threat which they have attempted to control by minor verbal abuse and stringently regulated working conditions. Ancashinos are conscious that their future is not in Huayopampa, owing to the restricted work opportunities and chances at achieving upward mobility locally. Ownership or even sharecropping of irrigated tracts are privileges not open to the migrant, nor would they be allowed to start small businesses.

In sum, here is a case where a disaster has stimulated modernization and acculturation by forcing some of the victims to seek their fortunes within a labor economy. We can also see that the process of adaptation to new cultural demands is often a gradual one. This particular case also shows that peasants can often be innovative in responding to both indirect specific stimuli such as the earthquake presented.

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SOME CHANGES IN HOUSING CHARACTERISTICS IN GUATEMALA FOLLOWING THE FEBRUARY 1976 EARTHQUAKE AND THEIR IMPLICATIONS FOR FUTURE EARTHQUAKE VULNERABILITY*

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INTRODUCTION

This paper discusses some of the preliminary findings which have emerged during the first year of a three-year longitudinal study of the 1976 Guatemalan earthquake. It focuses on the housing reconstruction process and on changes in house types as they are related to future earthquake vulnerability in Guatemala. While it is concerned with what, at first glance, may appear to be merely a set of physical objects, houses, in reality it deals with the end product of a social process through which these physical objects have been created. In so doing, it examines some of the social and cultural factors which have influenced that process [1].

Housing in any society is a product of the social organization, technology and value system incorporated into the structure of that society. It is also a tool or facility which is utilized by the members of society as they play certain vital domestic roles. Houses are not merely physical objects, and therefore of little interest to social scientists, but they are social objects to which important cultural meanings are attached. Furthermore, the methods by which they are constructed, the materials used to build them, and the form that they take have important relationships to the social organization of society and to the life style of its members.

In societies with advanced technological systems which employ high levels of specialization in occupations, houses are produced by a different set of people than those who occupy them. They are often built using materials which are shipped over vast distances, some of which are not even produced in the society in which the finished house is located. Furthermore, they are acquired and traded, much like any other commodity in the market place. In such a society, a house is more an expression of the ideas and tastes

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of architects, designers, developers and contractors, coupled with the promoters, advertisers, and media experts who manipulate tastes through the mass media than of the ordinary citizens who occupy and utilize them. In contrast, in folk societies, or in so-called developing countries, houses are more likely to be produced by the very people who occupy them, using simple technologies and employing indigenous materials. Under such circumstances they more closely approximate an expression of the values, tastes and domestic organization of their occupants than houses in technologically advanced societies.

The 1976 Guatemalan earthquake resulted in the deaths of over 25,000 people and in injuries to approximately 75,000 others. These deaths and injuries were partially a result of the fact that the disaster occurred at 3:00 a.m. while people were asleep in their homes, most of which had unreinforced adobe walls with heavy terracotta tile roofs. These roofs were supported by light frames which were not securely attached to the structure. Under the stress of the earthquake, the walls collapsed and the heavy roofs fell in on the sleeping victims. Many were crushed. Others sufficated in the heavy adobe dust which engulfed them.

These houses had been built largely by their owners, assisted by village albañiles (builders) using indigenous materials and following an established traditional pattern. Although this type of house predominated, there were other housing forms in use in Guatemala at the time of the earthquake which proved safer. For example, one traditional pattern used cane or corn stalks for a wall material and straw or palm for the roof, the whole structure being built around a wooden frame. Another pattern combined bajareque walls with either a tile, straw or palm roof. Bajareque uses a set of wooden posts sunk into the ground, across which cane is woven to form a lattice-like wall which is then filled in and plastered over with adobe-like mud. Because of their flexibility, and because of their cross-braced wooden frame, these houses withstood the earthquake better than the adobe structures. A few houses were made of cement block and used lamina roofs. These also fared better. The cane and palm houses and those of bajareque were generally considered less desirable than adobe before the earthquake and were found primarily in the more remote villages among the poorer people of the community.

REQUIREMENTS OF A NEW HOUSING PROGRAM

Following the earthquake when it became obvious that a massive housing construction effort would be required and at the same time, it was apparent that the traditional adobe house with a tile roof was unsuitable in a seismic zone, the question on everyone's mind was how to encourage the building of earthquake resistant houses and at the same time meet two severe requirements. First, it would be necessary to rehouse the million homeless people in a very short time to prevent further suffering from exposure. Second, houses had to be inexpensive and built with non-hazardous materials. This latter requirement can best be grasped if it is understood that the average house occupied by people in the towns and villages outside of Guatemala City cost under $ 500 to construct before the earthquake.

Although they incorporated aseismic design features and proved safe in the earthquake, houses made of cane with palm roof or of bajareque had other drawbacks which discouraged their use as replacement housing. Cane walls offer little protection from the elements and are not secure against intrusion. Bajareque and cane houses were associated with lower economic status than were adobe and concrete block. Few houses employed wood. The need was for a house form which would be cheap, easily produced and acceptable

to the people and, at the same time, safer in an earthquake.

In addition to these practical considerations, a number of less tangible factors entered into the decision-making processes affecting housing. First, a number of consultants to the government and to foreign agencies urged that the aid offered the Guatemalan people should avoid creating dependency on donar agencies. Furthermore, it was urged that housing programs permit people to construct similar houses on their own when relief efforts ended. This meant that both design features and construction method had to be within the economic means and within the capacity of local skills and resources. In short, whatever housing effort was to be carried on by outside agencies would have to fit into the technological and economic base and at the same time be aseismic. This, of course, was a tall order, given the severe economic constraints and limitations of the prevalent local house building technology.

In response to the need for housing and in response to these constraints, a variety of housing programs was instituted under general policies laid down by the Guatemalan government's Emergency Committee and later its Committee on Reconstruction. There were two policies of importance to this paper. First, the government decided to divide up the total job of relief and reconstruction among the various domestic and foreign agencies offering assistance by assigning agencies to specific towns and villages where they would have primary responsibility for relief and reconstruction. This meant that each town or village would have a different type of program, depending on the particular agency assigned to it. Second, the government requested that instead of giving away houses or housing materials and other relief supplies such as food, the people should be required to contribute either money or their own labor to help themselves. The argument given was that this would prevent the creation of dependency and at the same time increase the resources available for reconstruction and speed the recovery process.

Several types of agency housing programs were the result of these various considerations. The variety of housing programs is as follows:

1. One style of program distributed free lamina (corrugated galvanized iron) roofing to families who had first constructed for themselves a wooden frame which employed aseismic cross-bracing features. The idea behind this program was to insure aseismic construction by motivating people with the offer of free roofing. At the same time an educational effort was conducted to apprise people of long-run objectives regarding aseismic housing.
2. A second type of program distributed lamina at half price through local organizations, usually cooperatives, to anyone who could afford it. In most cases, the proceeds were then placed in a community fund which was later used to finance reconstruction programs requiring a high labor input. The intent here was to: avoid imposing a housing pattern on the people; obviate the possibility of creating dependency relationships; provide a versatile building material and generate jobs which would keep money furnished through subsidized sales in the community as well as contribute to the reconstruction effort.
3. A third type of program concentrated on providing short-range housing which would serve the needs of people during a four or five year period while permanent solutions to the housing problems were being worked out. Whole houses built using prefabrication techniques which employed local labor were given to people in return for their work in helping to construct them. The idea behind this program was to furnish temporary shelter quickly and to offer it in such a way as to provide a period of time during which planning for permanent reconstruction could take place.

4. A fourth type of program concentrated on building permanent housing constructed according to an aseismic design, usually of steel reinforced concrete block, and arranging for housing loans which would permit people to pay for their houses over a ten to twenty year period at an affordable price. These houses were usually subsidized by the agency offering them to keep the selling price within the limits thought appropriate for the local economy. Their construction often employed the labor of the eventual occupants in a communal building program.
5. There were other patterns which mixed together features of these four types. However, most of the housing produced used one or the other of the dominant patterns.

In the following pages the results of the overall housing reconstruction process in seven ladino communities will be discussed in terms of changes in housing style which have occurred and the implications of these changes for future earthquake vulnerability. Preliminary tabulations reflecting attitudes and opinions of the aid process will also be examined. Before presenting these results a brief description of the methodology employed is appropriate.

BACKGROUND

The data upon which this article is based are the preliminary results of the first phase of a three-year longitudinal study of the long-term effects of the 1976 Guatemalan earthquake. The research design calls for household survey interviews in twenty-five Indian and ladino communities in both heavily damaged and undamaged areas at two points in time. In addition, interviews with key people (formal and informal leaders) in each community are being conducted. These data are to be supplemented by ethnographic case histories of various communities and interviews and documentary research of selected relief, reconstruction and development agencies. The ultimate goals of the research are to make intelligible social and economic consequences of a major disaster through time, across cultural environments, and to test various hypotheses regarding the rates and directions of induced and secular social change. In addition, the research seeks to provide information for government and private agency planners and executive personnel that will be useful for future relief and reconstruction efforts.

This paper is based on findings obtained in seven ladino communities. Six of these communities are located in the eastern part of the country in the Department of El Progreso. These include El Progreso (departmental capitol); Sanarate (municipio or county seat); and four relatively isolated villages (aldeas): San Juan, Conacaste, Santo Domingo and Espiritu Santo. The seventh community is the Municipio of Zaragoza, a ladino enclave in the largely Indian-populated region in the midwestern highlands.

HOUSING CHARACTERISTICS BEFORE AND AFTER THE EARTHQUAKE

Prior to the earthquake, the "typical" poor rural ladino house was a modest one or two room structure that generally included a porch of "corredor." Cooking and other food preparation activities were usually conducted either in the corredor, or in a separate structure attached to the main building. The house site frequently had other divisions that served various purposes such as storehouses and additional dormitory facilities. Households are composed of various combinations of kinsmen and non-relative. For the purposes of this study, the household, our basic unit of analysis, is defined as being composed of all individuals who share a common hearth. The house is the principal dwelling on the house site where the household head (self-defined) sleeps and where household activities are centered.

Housing characteristics were determined by two methods, interviews and observation. To obtain information on the pre-earthquake dwelling, interviewers defined terminology and then asked if the house prior to the earthquake had the particular characteristics in question. The respondent was then asked to estimate the damage to each particular characteristic – "none", "little", "much", or "destroyed" [2]. The characteristics of the contemporary dwelling were then recorded, using both interview and observation techniques.

There are only three principal characteristics shared by all houses in this study: walls, roofs, and floors. Other features are expressions of individual variability according to economic resources and preference. Further, the structural significance (presence or absence) of some features such as corner posts, varies with the characteristics of the three principal components.

CHANGES IN PRIMARY HOUSING FEATURES: WALLS, ROOF AND FLOOR TYPE

The type of wall and roof employed in house construction has important implications for earthquake vulnerability. It also has a significant relationship to local tastes and values related to social status and to customary housebuilding economics and technology. As noted earlier, most pre-earthquake houses were built with adobe walls and a tile roof. Indeed 80 per cent of those interviewed lived in houses with adobe walls prior to the earthquake. Sixty-four per cent of all houses had tile roofs. The combination of adobe walls and a tile roof was found in 58 per cent of all houses at that time. Before the earthquake 16 per cent of the households studied lived in houses with either cane of bajareque walls. Other wall types such as wood or concrete and various other types accounted for only 3.5 per cent of all houses. While tile was the most common roofing material being used (64.1 per cent), lamina was found on 23 per cent of the houses and another 12 per cent had straw or palms.

Considerable change has occurred since the earthquake in the materials being used for walls and roofs. The most striking changes are in the use of adobe for walls and tile for roofing. While 80 per cent of the houses studied had adobe walls before the earthquake, only 17 per cent have such walls at present. The proportion of houses with tile roofs has decreased from 64 per cent before the earthquake to around 23 per cent at present. Furthermore, the combination of adobe walls and tile roof which proved so dangerous in the 1976 earthquake has changed from 58 per cent of all houses before the earthquake to 23 per cent at present [3].

An examination of data on damage to housing revealed that most existing houses with adobe walls and a tile roof have survived the earthquake and have either remained inhabitable or could be made so with minor repairs. Few new houses constructed from these materials have been built. Instead, there are marked increases in the use of all other materials such as wood and concrete blocks in making walls and half adobe or half concrete and half other light weight upper wall material [4]. The use of bajareque has remained constant and cane and a patchwork of salvaged materials has increased.

With respect to roofing, the primary shift has been away from tile to lamina. Tile has decreased from 64 per cent to 23 per cent, while lamina and duralita has risen from 23 per cent to 66 per cent. It is interesting to note also that the straw and palm for roofing have declined from 12 per cent to 6 per cent, while the application of "other" materials increased from 1 per cent to about 5 per cent above prequake levels.

This change in housing materials has reduced the earthquake vulnerability of the average house being occupied by the persons interviewed. The substitution of lamina and

duralita for heavy tile roofing and of wood and concrete for walls means that on a whole, houses are safer now than they were before the earthquake simply because the materials used in constructing them, on an average, present less of a threat to life.

This change has taken place partially as a result of agency housing programs that constructed complete houses which were then supplied the citizens of a community and partially as a result of the efforts of individuals who rebuilt their own homes. The houses with wooden walls and lamina roofs are built by one large agency which gave them to earthquake victims in return for their labor in the reconstruction process. These houses were intended to serve as temporary dwellings during a four or five year period and are expected to deteriorate and to be replaced by more permanent shelters. It is possible, therefore, that when the occupants of these houses begin to rebuild more permanent structures, they will return to the use of traditional materials and traditional building methods. The concrete block houses, most of which employed a duralita roof, were produced by another agency program in a different town. These houses have steel reinforcement and were given people in return for their work in the construction process. While the houses are permanent structures, they were built according to an agency plan under agency supervision and therefore do not represent local ideas about aseismic construction. A third type of house, is one which uses walls that employ either adobe or concrete block for the lower portion and a lightweight material such as wood, lamina or duralita for the upper wall. This type of construction was promoted by an agency working in one community in the sample as a more aseismic design than either full adobe or full concrete block walls.

The question arises as to whether the people living in these communities, if they were to rebuild their houses on their own without the guidance of agency personnel, would choose more quake resistant wall and roof material. An answer to this question may shed some light on what is likely to happen, once agency programs are terminated and people go back to building houses on their own. A tabulation was made which compares people who constructed their own houses with those who were assisted in some way by an agency.

The tabulation shows that individuals unassisted by agencies avoided the use of adobe nearly as often as those who were assisted by agencies. Only 19 per cent of those building or repairing their own homes used adobe for walls as compared to 14 per cent of those assisted by agencies. The differences are not statistically significant.

With respect to the use of tile for roofing, the picture is slightly different. When unassisted by agencies, 28 per cent of the people used tile for roofing, as compared to 18 per cent of those who were agency assisted. This difference is statistically significant. Nevertheless, both categories of people show a marked reduction in the use of tile for roofing as compared to before the earthquake, when 64 per cent of all houses had tile roofs. These figures indicate that the improvement in the aseismic qualities of housing noted earlier is due to both individual and agency efforts, but that agency programs produce slightly greater results in this direction. It should be noted that agency housing programs may have served as models for individual house construction and have had an educational effect on individual builders.

Much of the change in housing features mentioned above is a result of highly organized agency housing programs. The more permanent structures, those of concrete block and lamina, were often heavily subsidized by a relief agency and were built under the supervision of agency representatives to design specifications which often were predetermined by agency personnel. Further, such houses employ a combination of locally manufactured

materials, such as cement and imported material such as lamina and steel reinforcing rods, all of which are relatively expensive. As a consequence, the question arises as to the economic ability of poor rural Guatemalans to build such houses on their own.

Another shift in housing patterns is away from the more traditional indigenous materials that can be fabricated locally and inexpensively. The trend is towards the use of industrially processed materials. The relationship between house type and the before-after time periods is highly significant, both statistically and in terms of its meaning for future earthquake vulnerability.

Floor Types

Floor types have altered slightly since the earthquake, but these changes have little significance for earthquake vulnerability. The number of houses with dirt floors has increased from 53.8 per cent before the earthquake to 63.6 per cent at present. The number of houses with brick or tile floors dropped from 14.9 to 6.2 per cent. The use of concrete for floor material has remained about constant. Before the earthquake 30.2 per cent of the houses studied had concrete floors, while 27.1 per cent have such floors now. The principal change so far has been from the use of brick or tile to dirt floors. This reflects in part the existence of the wood and lamina houses built as temporary shelters, all of which have dirt floors. When these houses are replaced by more permanent structures, tile flooring will probably increase because it is culturally preferred.

Number of Rooms

The number of rooms in a house is an indicator of the social status and affluence of the family occupying the dwelling. Most houses in the surveyed communities had either one or two rooms before the earthquake (50.7 per cent had one room while 28.7 per cent had two rooms). Only 10.3 per cent had four or more rooms. Since the earthquake there has been a 16.3 per cent increase in the number of one-room houses and a decrease in houses with all other numbers of rooms. The greatest decrease is in the number of houses with four or more rooms. In short, it appears that people on an average are living under more crowded conditions than before the earthquake and that their current houses are smaller and equivalent to houses of slightly lower socio-economic status than before the disaster. Again, this is partially accounted for by the relatively large number of temporary wood and lamina structures built by the agency mentioned earlier. There were 92 such houses in our sample, all of which were built as one-room dwellings although some have been expanded since their construction by the agency.

Porches or Corridores

Another housing feature related both to living space and cultural preference is the porch or corridor. This feature expands the living space available in the home by offering additional room for family activities. As noted earlier, the corridor is often used for a kitchen as well as for storage or even additional sleeping space in mild weather. Before the earthquake 81 per cent of all houses had corridores in contrast to the 44.7 per cent that currently do. This is another indicator of loss of living space and of increased crowding. Furthermore, it represents a major shift away from a long established cultural practice. Most of the agency houses built within the sample communities lacked corridores, although small porches were present in a few cases. The reduction in the number of houses with this feature is therefore a result of agency design which excluded it.

Other Housing Features

Questions were asked concerning the presence or absence of certain housing features related to earthquake resistance. In particular, respondents were asked whether their pre- and post-earthquake houses had: (1) corner posts, (2) beams, (3) cross bracing in the walls, and (4) a solera (a wooden frame made of heavy timbers which is joined to the top of the walls and supports the roof). Responses were mixed regarding earthquake resistance in housing.

There was a substantial increase in the use of corner posts (from 23.8 to 82.8 per cent) indicating an improvement in aseismic qualities. Some of these posts were of wood and others of concrete and steel, depending on the type of walls being used in the house. In contrast, the use of beams diminished slightly (99.5 per cent before, 92.9 per cent after), cross bracing (7.6 per cent before, and 3.8 per cent after), and solera (82.2 per cent before and 79.9 per cent after). Both cross-bracing and a solera are associated more often with adobe construction and so these figures suggest a reduction in the use of this material for walls. On balance, it appears that a slight improvement in the aseismic qualities of houses has occurred because of the increased use of corner posts. This was a feature emphasized by several large agencies. Cross-bracing, also emphasized, actually decreased slightly though it was deemed necessary for adobe construction.

WHERE RESPONDENTS ARE LIVING NOW

In order to determine whether respondents are living in the same location as before the earthquake we asked them where they lived when the earthquake took place. This question is useful in determining how many households are living in the same house as before the earthquake, and therefore serves to indicate whether their houses survived. It was revealed that 19.5 per cent of the 370 persons interviewed are living in exactly the same house that they lived in before the earthquake. This shows that approximately this percentage of houses survived and were inhabitable after the disaster. Of those who lived in different houses, 60.8 per cent live in a different house located on the same site as their pre-earthquake dwelling and 14.9 per cent live in a different house on a different site in the same town or village where they resided before the earthquake. The remainder of the respondents (5 per cent) have migrated to their current location from a town either in the same or a different department. Because only persons present in the village two years after the earthquake were interviewed, it is impossible to say at the moment how many persons migrated out of the village as a result of the disaster. Later, a detailed analysis of family composition before and after the earthquake will permit migration estimates.

A check of the difference between the large and small communities shows that in the small places (aldeas of Santo Domingo, Conacaste, Espiritu Santo and San Juan) 42, or 40.4 per cent of the people interviewed live in the same house as before the earthquake. In contrast, in the large places (Sanarate, Zaragoza and El Progreso) 30, or 11.3 per cent live in the same house. This reflects a higher damage rate in the two types of communities. On an average, about 60 per cent of the houses were destroyed in the small aldeas, while 80 per cent on an average were destroyed in the larger towns. This difference in rate of destruction is associated with the type of houses employed in the two types of locations. The aldeas contained more houses made of straw, palm and bajareque than did the larger places. In Zaragoza, for example, virtually all of the houses were made of adobe. Not a single respondent in Zaragoza is living in the same house he occupied before the earthquake. In

contrast, in Conacaste and San Juan almost half of the individuals interviewed are living in the same house they occupied before the disaster.

CURRENT USE OF AGENCY HOUSES

Of the 370 respondents interviewed, 137, or 37 per cent, received a house from some agency either in return for work or on some other basis. These persons were concentrated in El Progreso, Sanarate, Zaragoza and Espiritu Santo. Eighty-three per cent of such houses are still being used as residences. Some have been converted into businesses, others are being used for storage or are uninhabited, or have been dismantled and recycled as building materials. Only one house in our sample has been sold and two are currently being rented. Perhaps the most important fact here is that 11, or 8 per cent, of those encountered in our survey were uninhabited at the time of the interviews.

One of the agencies which supplied houses in return for work intended these structures as temporary shelters good for a period of 3 or 4 years. This organization anticipated that these structures might be torn apart and used for building materials or added on to or converted to other uses. So far, only three individuals have used their agency houses as a source of building material. However, 35 per cent have made alterations and additions to the houses they received.

SECOND RECONSTRUCTED HOUSES

During the pretesting it was discovered that a number of individuals had either built or received more than a single house since the earthquake. As a consequence it was necessary to record characteristics of both the first and second house reconstructed and to determine the source of the second house. In all, 86 out of 370 persons interviewed reported either building or receiving a second structure. As far as can be determined, by cross-tabulating the source of the first house and the source of the second house, only 5 individuals received two agency houses.

WHO REPAIRED OR RECONSTRUCTED THE HOUSE

In the case of every agency program in the area studied, family members were required to participate in work programs associated with house building in order to receive a house from the agency. As a consequence, families perceived themselves as participating in the process of house building with Guatemalan and foreign agencies even when the agency house was built according to agency plans and specifications using agency materials. Nearly 56 per cent of all respondents reported building or repairing their own houses. It is apparent, however, that some respondents saw themselves as building the house by themselves, even when agencies provided the materials and supervised the work according to their plans. If all of the responses which mention agency assistance are added together, only 31 per cent of the families remember an agency's involvement in house building. When asked whether they received an agency house or not, 36.6 per cent said they got one in return for work or rented, borrowed or bought one. In short, 22 per cent of all persons who received an agency house reported that the family built it, rather than reporting that they had been assisted in the building by the agency.

ATTITUDES AND OPINIONS TOWARDS THE RECONSTRUCTION PROCESS

In the course of the interviews, a number of attitude and opinion questions were asked. One series dealt with respondents' opinions concerning how aid was distributed. Another asked respondents' suggestions

for how aid could be improved. The responses to these questions are discussed below.

Evaluations of the Aid Process

Taking all respondents together, 54.3 per cent felt that aid was distributed fairly within the communities in which they lived, while 38.6 per cent felt that aid was distributed unjustly. The remainder gave no answers to this question. There is a striking difference between the small and large communities and their evaluations of the fairness of aid distribution. In the four small communities, Santo Domingo, Conacaste, Espiritu Santo and San Juan, the great majority of respondents said that aid was distributed justly. In these four communities the program consisted primarily of the distribution of free lamina after residents had constructed an aseismic frame upon which to place the roof. In addition, food distribution was carried on in return for work. In one of the small communities, Espiritu Santo, wooden houses with lamina roofs were distributed to 60 per cent of the interviewers in return for work.

In Sanarate, Zaragoza and El Progreso, less than half of the respondents said aid was distributed justly within the community. In Sanarate the housing program constructed cement block or terrecreta houses, most often with duralita roofs, using the labor of community members. El Progreso's housing program consisted of the distribution of wooden houses with lamina roofs in return for work. Compared to El Progreso and Sanarate, Zaragoza received relatively little aid with respect to housing reconstruction. Eighty-seven per cent of the respondents from this town reported that they had not received an agency house. It will be noted in Zaragoza the highest percentage of persons regard the aid distribution as being unjust.

When asked whether aid to the community was adequate, considering the damage suffered, the majority of respondents in all communities responded "Yes." Again, however, there is a higher level of satisfaction with the aid process, as indicated by this question, in the smaller communities than in the larger ones. These questions seem to indicate that people feel that the aid offered within the community was "sufficient" or "adequate" considering levels of damage and loss. However, in the large communities they seem to feel that the distribution process could have been improved. In short, it was not what was offered in the way of aid but how it was distributed that is a source of some dissatisfaction among respondents.

It should be noted that in contrast to most of our survey questions an appreciable number of respondents gave no answers to these questions. In Sanarate 13.8 per cent failed to answer the question, "Was aid distributed fairly in the community?", and 11.9 per cent failed to answer the question, "Was aid to the community adequate considering damage?" In San Juan 17.4 per cent failed to answer the first question. It is unlikely that these "no answers" would divide evenly between the positive and negative categories if answers had been forced. They probably represent people with negative opinions who did not wish to go on record as expressing them.

A cross-tabulation was made between these two questions to determine whether answers to them were related. This cross-tabulation demonstrated that there is a significant positive statistical relationship between the answers to the two questions. Those people who said aid was unjust tend, in higher proportions, to say that aid to the community was not sufficient (64.1 per cent) while those who say it was just tend to say aid to the community was sufficient (65.2 per cent).

A third attitudinal question was asked regarding aid. This question asked, "In general, what do you think about the aid received by the community?" The answer

categories used in coding were "very bad," "bad," "average," "good," or "very good." Eighty-six per cent of the respondents, when asked this general question, said aid was "good" or "very good" and only 4.9 per cent said it was "bad" or "very bad."

Taking the results of this question and the other two discussed earlier, it seems that especially in the larger communities, subjects were satisfied with the kind and amount of aid but not with the way in which it was managed or distributed. This conclusion is supported by answers to the question, "How could aid be improved?"

Ways Subjects Thought Aid Could Be Improved

Subjects were asked the general question, "How could aid have been improved in this community?" During pretesting in which 300 interviews were done, a set of answer categories expressing their opinions was developed. A total of 113 or 34 per cent of those who answered this question said aid was adequate as it was. By and large, these individuals gave no further answers to this question. The most frequent answers given to the question by others are found in the categories "Should be distributed according to need," "Should be distributed equally to all," "Should be distributed house to house," and "Should be better controlled."

The category "Should be distributed house to house" needs some explanation. This answer category was used when subjects said people offering aid should come to disaster victims at their own homes and offer aid rather than having them stand in line or go through bureaucratic procedures to receive it. Subjects literally answered, "People distributing aid should go from house to house distributing it." When probes were used to discover the meaning of this answer, it was found that they were objecting to having to wait in lines and contend with formal distribution procedures. The two answers, "According to need," and "Equally to all" indicate that subjects feel a different plan of distribution than utilized should have been employed in distributing the aid. The answer, "Should be better controlled" probably indicates that the respondent felt aid was being given to undeserving persons or being wasted. It might also indicate that they disagreed on the equity principle upon which aid was being distributed.

The answers, "According to need," "Equally to all," "House to house" and "Better control," taken together, are related to the underlying basis upon which aid was distributed rather than to the type of aid or who distributed it. It will be noted that few subjects mentioned what was distributed as a way to improve aid. Only 3.4 per cent said more materials should have been distributed and 1.2 per cent said loans should be provided. All other answers are related either to the organization of aid or to the manner of its distribution. Of particular interest is the fact that 31 persons, or 9.5 per cent of those interviewed, said that aid should have been distributed directly by the outside agency without an intervening committee, local or otherwise. Only one subject mentioned that aid should be distributed by a local committee and six said no committee should be involved at all.

When the relationship between suggestions for how to improve aid and answers to the question, "Was aid distributed fairly?" are compared, it will be seen that a higher percentage of persons who said it was unjust gave answers related to the principles underlying aid distribution or its organization. The most common answers for those who thought it was unjust are the answers, "It should be distributed equally" and "It should be distributed house to house" which, in a sense, mean about the same thing. In short, it seems likely that the persons dissatisfied with the aid process feel that it should be distributed equally to all, perhaps regardless

of need. It should be noted, however, that those who said aid was just also gave these answers in higher proportions than any answer except "Aid was adequate."

SUMMARY AND CONCLUSIONS

The data discussed in this paper show that considerable change has taken place in housing characteristics in Guatemala since the 1976 earthquake. In the two years following that event, houses have changed from the typical adobe structure with a tile roof, characteristic in ladino communities in the East before 1976, to houses made of materials considered by most people to be safer in an earthquake. Roofs are lighter, using lamina or duralita instead of tile, and walls are made of materials such as wood, concrete block, terrecreta or a combination of these and other lighter, more flexible materials.

This substitution of other materials for adobe and tile has undoubtedly improved the safety of houses in an earthquake. It must be recognized, however, that the way materials are used to create an integrated structure is perhaos more important to earthquake resistance in housing than the materials used. At this stage of analysis, no firm conclusions can be drawn concerning improvements in structural integrity. It can be stated, however, that in the case of houses offered by reconstruction agencies, care has been exercised to provide an aseismic design and to carry through with aseismic construction techniques. Since the reconstruction process is still in progress, and since shear obsolescence in housing, coupled with population growth, will lead to continual house construction, it is impossible to say at present whether this trend towards the use of more earthquake resistant housing will continue indefinitely.

The changes which have occurred in housing are the result of a combination of individual efforts and agency programs. Individuals seem to be moving away from traditional house forms towards the use of less life threatening materials even when not directly assisted by agencies. This movement is away from indigenously produced local materials towards materials requiring industrial manufacture. Thus there appears to be an increase in the dependence of local communities on outside sources of supply and on a money economy in house building than before the earthquake.

Without more sophisticated statistical analysis than is possible at present, it is difficult to summarize the attitudes of the people interviewed in this study towards the reconstruction process. On the one hand they seem to be pleased with the amount and type of aid they received. On the other, they seem to be dissatisfied with some of the procedures and organizational patterns employed to render assistance to them. There also appear to be differences of opinion as to the underlying equity principle employed as a basis for distribution. Finally, the amount of satisfaction or dissatisfaction with aid seems clearly to be associated with the type of community (small or large) and perhaps with the type of agency program utilized in that community.

NOTES

1 For a description of the disaster and the immediate post-disaster period, including early damage estimates and death rates, see Robert A. Olson and Richard Stuart Olson, 1977.

2 Gross housing characteristics before the earthquake are given in *Vol. III, Censo de Vivienda, 26 de Marzo de 1973: Vivendos Particulares, Materiales de Construccion, Tipo de Local:* Direccion General de Estadistica, Ministerio de Economia, Guatemala, C.A. The figures for wall types used in houses were checked against our sample estimates based on the memories of respondents. There was close correspondence between our figures for pre-earthquake wall types in the villages studied and those given in this volume.

3 For a discussion of injuries and deaths related to house construction see Roger I. Glass, et al., 1977.

4 The category " concrete block" includes brick and a material called terrecreta, which is made of a mixture of earth and cement pressed into a block by the hand-operated cinvaram machine. Most houses in this category were constructed of cement block or terrecreta.

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GREEN GOLD AND ICE: THE IMPACT OF FROSTS ON THE COFFEE GROWING REGION OF NORTHERN PARANÁ, BRAZIL

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On a bitterly cold night in late July, 1975 the temperature plumeted below freezing for a number of hours in the coffee zone of the southern Brazilian state of Paraná. Several days later it was reported that 70 percent of the region's coffee crop was destroyed and that an undetermined number of coffee trees were killed during the frost – purportedly the worst within living memory. But the 1975 frost was only the most recent, albeit, the most devastating, of a long series of frosts and freezes that have plagued the inhabitants of Paraná, the largest coffee growing region in the world.

The latest frost received widespread media coverage which centered on its implications for world coffee prices. Little attention was given to the frost's immediate or future effects on the economic institutions of the communities where it took place. Although I have not visited northern Paraná since the 1975 frost, it is possible to predict its impact will follow the pattern of other recent frosts in the coffee zone of the state. Ouro Verde [1] a representative coffee growing community in northern Paraná, will be the focus of this discussion. I carried out field research there in 1967–1968 and in 1971 following a series of major and minor freezes that had greatly affected the local population, and had, in part, been responsible for a change in the community's economic base.

Before turning to the social and economic repercussions of frost in Ouro Verde and elsewhere in Paraná, it is essential to understand exactly what impact freezing temperatures have on coffee trees. In addition, the history of frosts will be outlined in order to demonstrate that frost as a disaster agent is neither a recent nor an uncommon scourge in Brazil's coffee zone.

FROSTS IN BRAZIL

In the coffee region of Brazil frosts are classified into two types according to their intensity. *Geadas brancas,* also called *geadas sapecar,* ("white" or "singeing" frosts), are relatively mild frosts which only "burn"[2] the topmost branches of the trees and have little affect on the size of the subsequent harvest. *Geadas negras* ("black" frosts) are severe frosts which greatly reduce or entirely eliminate the following harvest(s), and sometimes kill the coffee trees. Even when a severe frost occurs, however, it only does permanent damage if it immediately follows a rainy period when the tree's leaves and trunk are still wet. In such cases, water in the trunk's cells freezes and the cells are ruptured by the expansion of ice; eventually the trunk splits. When this occurs, the only remedy is to cut the tree down to within one or two feet of the ground in the hope that it will eventually

sprout new branches. "Black frosts" that follow dry periods do not damage the trees in this way, but they can be responsible for the loss of from one to three harvests, depending upon their severity.

Owing to its location in the most tropical part of Brazil's coffee zone, the Paraíba Valley in the state of Rio de Janeiro, which witnessed the nation's first coffee boom in the mid 19th century, escaped the freezing temperatures that play havoc with coffee cultivation. Due to a variety of other climatic and economic factors [3], however, coffee cultivation in the Paraíba Valley had met its demise by the end of the 19th century, a time when the second phase of the boom was well underway in the interior of the state of São Paulo. It was in this more southerly region that coffee trees were first subject to the vagaries of temperature – with sometimes disastrous results. Although the degree of frost damage was mediated by such variables as altitude, wind velocity, and prior rainfall, and varied from one area of São Paulo's coffee zone to another, a series of "black frosts" in 1870, 1902, 1918 and 1943 greatly reduced the size of the subsequent harvests, and, in some low lying areas, destroyed the trees. For example, after the frost of June 1918, the state's coffee production declined from 12.5 million sacks [4] of coffee in 1917–1918 to 7.2 million sacks during the 1918–1919 harvest, and 4.1 million sacks the following year (Monbeig, 1952:59). These frosts, along with depleted soils and fluctuating coffee prices, have turned many former "coffee counties" in the state to other economic activities.

The most recent site of Brazil's coffee boom, the northern portion of Paraná state, is also the one most subject to frosts. It is here that the 1975 frosts had such devastating effects; but, once again, this was not a unique event. In 1942, 1955, 1963, and 1969, "black frosts" swept through the region destroying millions of newly planted coffee trees and eliminating harvests. And in many parts of Paraná's coffee zones there are minor freezes every year. Although they do not destroy the trees or obliterate harvests, they still reduce the size of yields.

One may well inquire why coffee cultivation expanded into so climatically unsuitable a region. The answer is rather complex and involves governmental policy towards coffee cultivation, the crop's price structure, the availability of inexpensive virgin land, and the fact that a substantial portion of northern Paraná is covered with *terra roxa*, a dark red porous soil on which coffee trees thrive.

The initial impetus for the spread of coffee cultivation into northern Paraná came at the beginning of this century when government authorities distressed by the over-production which had led to lower coffee prices, banned the planting of new coffee trees in São Paulo. This ban did not extend to Paraná, however, and its rich *terra roxa* soil beckoned cultivators from the older coffee regions. Then too, the prices received for the crop, at least until the 1921 crisis, were very high. And over the last several decades, despite rather wide price fluctuations, government price supports continued to insure that coffee prices did not fall precipitiously, while the returns on alternative unsupported crops – cotton, rice, beans, etc. – have fluctuated greatly in accordance with the laws of supply and demand. Hence, no other crop could compete with coffee in terms of profitability even during periods of relatively low prices [5].

The availability of vast expanses of inexpensive fertile land attracted numerous cultivators to Paraná. Yields were high for at least the first few years after the trees came into production, and if frost damaged the trees or seriously diminished their harvest, one could move on to newer lands just opening up for cultivation. In fact, there is no question that availability of unoccupied land in northern

Paraná, in conjunction with the relative high prices paid for coffee, invited encroachment onto frost-prone tracts (Margolis, 1977) [6].

GREEN GOLD AND ICE IN OURO VERDE

During the winter months of 1966, frosts and the possibility of freezing temperatures were frequent topics of discussion in Ouro Verde, then a county of some 10,500 people, located about 32 miles northwest of Maringá in the state of Paraná. At the end of July of that year, there was a frost scare while I was living on a farm in the region.

> As the sky darkened toward evening a cold chill fell and a night-long vigil began. A group of farmers had gathered to drink *cachaça* (a strong alcoholic drink made from sugar cane), and discuss the possible losses they would incur if it froze. Every five or ten minutes one would go out to look at the thermometer and report. As the temperature inched downward, an air of anxiety began to fill the room; when it fell below zero (Celcius), all those present silently crossed themselves (Margolis, 1973: 46).

This turned out to be only a "*geada branca*". Nevertheless, those most affected lost up to half their crop.

On my return to Ouro Verde in 1967–1968, local residents were again preoccupied with frost hazard as the winter months drew near. Most people who had lived in the coffee zone for two or three decades could list the exact dates and degree of damage wrought by major frosts, and they began comparing current weather conditions to those which had preceded the most infamous "*geadas negras*". In May 1968 it was unseasonably cold, but it warmed up considerably in June. Some claimed that this was the same sequence of temperature changes that took place before the 1963 frost, while others scoffed, saying "there is a frost scare every year".

Frosts are blamed for all manner of problems in Ouro Verde, particularly the decline in coffee production. "It isn't the people, but the frosts that have ruined agriculture", said one local resident [7]. "The major sickness in Paraná is the frosts. If it weren't for them Paraná would be the richest state in Brazil", claimed another. One farmer likened the frost to time bombs; if they explode, an individual's livelihood can be affected for years to come:

> If it freezes there are three years of disaster, and one good harvest does not compensate for these three years. Before it froze my trees were like jewels, the most beautiful thing in the world. But afterwards, I didn't even have enough coffee to drink.

This is an over-simplification of the agricultural problems in the community since not only frosts, but soil depletion and profit margins reduced by lower coffee prices also have affected the economic well being of Ouro Verde. Still, frosts are a significant contributing factor.

Frosts have been a serious problem for coffee cultivators in Ouro Verde almost since the time of the county's founding in 1952. In late July, 1955 the temperature fell to −5°C, killing many of the coffee trees that had just begun producing their first harvest [8]. The aftermath of another major frost in 1963 was a harbinger of things to come. In that year a few hours of freezing temperatures wiped out the coffee harvest in the lowest-lying area of the county. In response, one large property owner, whose 100,000 coffee trees were thoroughly "burned", cut them down and planted pasture. Many small-scale landowners who lacked enough capital to carry them over to the next harvest sold their holdings for rather low prices. Buyers consisted of the fortunate few whose plantings had escaped the worst effects of the frost, and wealthy landowners seeking to establish or expand their ranching operations.

These events transformed the economy of Ouro Verde. Land consolidation and the concomitant change in the economic base from coffee cultivation to cattle ranching continue apace as frosts, soil depletion, and

uncertain coffee prices make the long-term devotion to "green gold" an ever more dubious proposition. The rise of the cattle industry in the county is correlated, in part, with declining yields due to frosts.

Cattle holdings, dating back to the founding of the community, have recently grown sizeably. This trend is related to frost cycles. During most of the 1950's, the number of head fluctuated between 1000 and 1500, while from 1959 to 1960 that figure more than doubled, and between 1963 and 1964 it tripled. By 1971, there were over 25,000 head of cattle in the county. More recent figures are unavailable, but, the developments to which I refer would suggest that cattle have assumed even greater local economic importance since the "black frosts" of 1975.

Frosts also have contributed to declining yields and the subsequent shift to cattle in another way. Simply put, the constant danger of frosts discouraged most farmers from investing in costly fertilizers for their coffee trees. In the event of a frost, cultivators not only stood to lose their harvests, but also the money plus interest it had cost them to purchase fertilizer [9]. And to make matters worse, fertilizer, once applied, will not benefit subsequent harvests, so that, when a frost occurs, the farmer's investment is a total loss (Margolis, 1972). As a result of these considerations, many cultivators did not employ fertilizer to keep yields high, yet, without it, the coffee harvests produced in Ouro Verde's mixed sandy soils, inevitably declined.

"WHERE CATTLE ENTER, MEN EXIT"

The conversion to a cattle economy and the increased size of landholdings have had major repercussions in many spheres: population size and density, class structure, social mobility, employment opportunities, agricultural labor arrangements, and the general economic well being and ambiance of the community all have been affected.

For more than a decade after its founding, Ouro Verde, like much of northern Paraná, was one of the few regions in Brazil in which small landholdings predominated. In 1966, even after land consolidation was well underway, close to 60 percent of the county's agricultural establishments were less than 60 acres, while only 19 percent could be classified as extensive – 180 acres or more. By 1971, the small farm of 10 or 20 acres virtually had disappeared in the low-lying, more frost prone sections of the county, and it was becoming increasingly rare in other areas as well.

Small-scale coffee growers lacked the land and capital necessary to convert their establishments into viable ranches. It was those with large holdings, consisting for the most part of 10 and 20 acre plots, who were mainly responsible for the tremendous growth of the cattle industry in Ouro Verde. Very rapidly, then, cattle ranching became synonymous with landed property. The social and demographic consequences of these developments for Ouro Verde were critical.

The exodus of small farmers and other agricultural workers from the county after the 1969 frost followed the pattern typical of post-frost emigration, spurred on by the attendant conversion of coffee lands to pasture. Laborers were dismissed *en masse* when the frost stricken landowners could not pay their wages. Large trucks with dozens of people aboard left Ouro Verde for Paraguay and other points west. They carried wage laborers seeking work, sharecroppers in search of productive coffee trees to cultivate, and small holders hoping to buy inexpensive land at the edge of the frontier. Still others headed for the cities of Paraná and São Paulo seeking jobs.

Ouro Verde's population subsequently declined by over 2300, or some 22 percent, between 1967 and 1970. The loss was not uniform throughout the county, however, and, once again, it was the lowest lying sections most affected by frost that suffered the greatest population decline. As we shall see,

a similar exodus followed the 1975 frost.

Additional land consolidation and the departure of small holders and sharecroppers has depleted the socially mobile "middle level" component of the community. In the process, Ouro Verde's social structure is growing more inflexible. For the first two decades of the county's existance, farmers with small holdings and prosperous sharecroppers served as "buffers" between the mass of landless laborers and the few wealthy landowners who resided in the community. Since the mid-1960's, however, this middle group has declined, both numerically and in percentage of the total population. By the beginning of the 1970's extensive landholdings had become the norm rather than the exception, with a concomitant increase in the number of individuals owning large tracts of land. At the same time Ouro Verde's landless segment – principally day and hourly wage laborers – although no greater in number than a decade earlier, had come to make up a large percentage of the county's population. As a result of these changes, Ouro Verde's class structure has taken on a pyramidal configuration with a few wealthy landowners at the apex and a mass of landless agricultural workers at the base.

One aspect of Ouro Verde's increasingly ossified class structure – the reduced opportunities for social mobility – is directly linked to coffee's decline and the subsequent planting of pasture. During the first years of the county's settlement, sharecropping high yield coffee trees was nearly a guaranteed path to landownership. Abundant harvests and high crop prices enabled many sharecroppers to make down payments on small farms in frontier areas just opening up for occupation. But the opportunities for upward mobility through sharecropping have decreased steadily since the early 1960's. Probably the most improtant factor has been the continual reduction in the number of sharecropping positions available, a result of the widespread displacement of coffee lands by pasture. Throughout the 1960's potentially lucrative sharecropping positions were in ever shorter supply and there was a great deal of competition for those that remained. The decline in sharecropping was particularly precipitous following the 1969 frost. By 1970, some 60 percent of the coffee sharecroppers living in the county only three years earlier had moved away.

Then too, frost damage and soil depletion have diminished prospects for social mobility. While sharecroppers were entitled to the same percentage of the crop – owing to smaller harvests – they actually received fewer sacks of coffee in return for their labor than they had a decade earlier. Finally, their financial return was reduced simply because the price received for coffee was considerably lower than it was during the crop's heyday in the 1950's. One local informant estimated that, given these conditions, a coffee sharecropper would need a minimum of ten years to save enough money to buy a small farm on the frontier, and this, of course, barring frosts. One can say with certitude, then, that the traditional route to landownership through sharecropping coffee had ceased to exist in the community.

Aside from the decline in sharecropping, other agricultural labor systems have been greatly modified by the transformation of Ouro Verde's economy. For instance, labor arrangements associated with coffee cultivation – sharecropping, day and piecework, and work gangs during harvests – have declined in importance. By the same token, those geared to cattle ranching – *mensal* labor and *bóia fria*, [10] have become increasingly common. *Mensal* labor and *bóia fria*, for example, are the only systems used on cattle ranches [11]. All cowhands and ranch administrators receive a fixed monthly wage. However, those working under the *bóia fria* system, which first appeared in 1970, are hired for short-term labor intensive tasks such as planting pasture

or building fences. Those employed as *bóia fria* usually work on a holding for only a few days and are then hired by another landowner who is short of hands. Parenthetically, under this system landowners can readily avoid paying workers the minimum wage and can circumvent labor laws in general; this was not so easily accomplished under the coffee regime since labor legislation pertaining to sharecroppers and other permanently resident laborers was more strictly enforced.

Rising unemployment rates have also accompanied the change-over from coffee cultivation to cattle ranching. As a local saying goes, "where cattle enter, men exit" (*onde o boi entra, o homem sai*), since ranching requires far fewer hands than does coffee cultivation. In the words of one informant:

> The coffee lands once tilled by men are now occupied by cattle. *Fazendas* (large landholdings) that had 200 families now have five. This was our ruin. The unemployed have no future. They don't know where to go next.

Precise unemployment figures are difficult to obtain since many of the unemployed do not stay in Ouro Verde very long. They move on to look for work in other areas of Paraná, and recently, in the Amazon region [12]. As we have seen, there was a massive discharge of sharecroppers following the 1969 frost, and they, as well as day laborers formerly employed on holdings devoted to coffee, left the county in droves. The reasons for the exodus are apparent: absence of local employment following the frost and the resultant 1970 crop failure. It was not until 1971, when the first coffee beans in two years were harvested, that the employment picture improved somewhat. Once again, I have little data on unemployment following the even more disastrous "black frost" of 1975. But there is every reason to believe that its outcome was the same; large scale dismissals, widespread unemployment, and flight from the county.

It goes without saying that unemployment and the resulting decline in Ouro Verde's population have had a great impact on local, non-agricultural enterprises in the county seat. Since coffee was the primary source of wealth in the community during the first two decades of its existence, the town's economy was profoundly affected by frosts, declining yields, and lower coffee prices. When coffee was king, local stores did a bustling business particularly from June through August when the coffee harvest was underway. By the late 1960's coffee's decline had taken its toll on the town's economy. By the end of the decade, two of the town's general stores had closed for lack of business, and another, which stocked such luxury items as canned goods and wine, also felt the squeeze since these items were in demand only when the coffee harvest was abundant, and brought an infusion of money into the economy.

Local businesses suffered a particularly severe blow after the 1969 frost. Most of the owners of the small stores in town agreed that sales fell off drastically following the frost and remained poor during the spring and summer of 1970 because of the destruction of that year's coffee crop. All businesses, however, were not equally affected. Food stores were not as hard hit since, as one proprietor put it: "People still have to eat". Sales in variety and fabric stores, on the other hand, were off by 50 percent during the months after the frost, clearly because their wares were deemed superfluous luxuries at a time of economic belt tightening.

But no proprietors in Ouro Verde have been as hurt by the shift from coffee to cattle as were the owners of the general stores in the rural area of the county. In one hamlet only four of the ten original general stores remain open: the others went out of business following the frosts of 1963 and 1969 and the subsequent planting of pasture. In the lowest lying portion of the county, a shopkeeper, who had been in business there since

the region first opened for settlement in 1952, marked 1963 as the beginning of the downward economic spiral; sales were off, he estimated, by 60 percent from what they had been in the 1950's when the entire region was devoted to coffee cultivation. He expressed little hope that things would improve.

Finally, it is worth considering local residents' perception of the rapid social and economic change which their community is undergoing. Most view the events of the last ten years with alarm. Indeed, a decided air of pessimism had overtaken the county by the time of my first field work there in 1967. The owner of a small hotel in town summarized the feelings of many:

> There was so much *movimento* here when we first came in 1954; so much coffee, so much activity... Now that is all in the past because of cattle. This place won't progress anymore.

A local agronomist rued the fact that the community's schools and health services were being wasted because of the loss of population: "Socially speaking, the depopulation of the rural zone because of the introduction of cattle is a horrible thing". Another resident pointed to the Vagalume section of the county, a low lying area in which frost damage had been most extensive and the transition to cattle ranching was nearly complete. The conditions there, he said, foreshadowed what was to come in the rest of the county: ".... houses abandoned, few people, no *movimento*. Within five years 90 percent of the county will be like this. This is our only possible future."

From everything I have been able to learn about the infamous "*geada negra*" of 1975, this man's prediction has been borne out. Although I have little data on the frost's consequences for Ouro Verde itself, reports of its affects on other communities in the coffee zone of northern Paraná indicate the devastation that it wrought.

THE 1975 FROST AND ITS AFTERMATH

What Brazilian coffee growers have come to call the "worst frost of the century" began on the night of July 16, 1975 when an unusually cold air mass moved northward from Antartica and swept the entire coffee zone of southern Brazil. Although the frost damaged trees in São Paulo, the damage was greatest in Paraná because of its more southerly location. As a result of this intense frost, millions of coffee trees were shattered by ice, and millions more were completely defoliated.

The Brazilian Coffee Institute estimated the pre-frost harvest of 23 million bags of coffee was cut by 70 to 80 percent and that a mere 5 to 6.5 million bags would be harvested following the frost. Within two days after news of the frost reached Wall Street, the wholesale price of a pound of coffee jumped from 27 to 84 cents (AP Report *Gainesville Sun,* February 16, 1977). The result of these events is well known: widespread publicity about the skyrocketing costs of coffee for the consumer and organized boycotts against the drink.

But what happened in the coffee region of Paraná itself where the primary devastation occured? In the June, 1976 issue of *Veja*, a popular Brazilian magazine, an article entitled "The End of Eldorado?" looked at the impact of the frost on some small communities in northern Paraná, and also briefly mentioned Ouro Verde. In Amaporã, a county about 62 kilometers WSW of Ouro Verde, population declined by nearly 17 percent in the year following the 1975 frost. "And if one were to count again, there would be still fewer people here", a functionary in Amaporã's town hall, was reported to have said. "There are coffee plantations here which employed one hundred families [before the frost]. But the trees were cut down and replaced with cattle. Now there is enough work only for a half dozen", he explained. An ex-major of the county

continued, "After the great frost of last year, there was a general flight to western Paraná and southern Minas Gerais."

In Tamboara, a coffee growing county about 42 kilometers southwest of Ouro Verde, the story was the same. The article describes the local ambiance:

> On the main plaza a majestic masonary church with showy stained glass windows is a reminder of the impetus that coffee sales gave to business and church funding raising activities Now, with 2,000 fewer inhabitants than in 1970, and without the vast plantations of old, the effects of this emigration are evident every morning in Tamboara's main plaza. There, instead of two or three dozen trucks arriving to take the *bóia fria* to the coffee groves, there are only two or three [my translation].

The decimation of coffee cultivation is seen by local residents as the cause of their problems. Schools also have been hard hit by the exodus. In 1970 the one room schoolhouse was too small for its seventy pupils, but the year following the frost, only seven children remained and the school was closed. Today, it is not uncommon to see cattle grazing on what was once the school's recreation yard.

In Paranacity, a county only three kilometers north of Ouro Verde, population also has fallen by nearly 2000 since 1970. Its mayor has attempted to stem the exodus of farmers with small acreages by selling them coffee seedlings well below the going market price. He hopes that his community will avoid the fate of nearby Paranapoema, where hundreds of small landholdings have been consolidated into sixteen huge cattle ranches, and land prices have tripled as the demand for pasture has grown.

But what of Ouro Verde? The article contains little information on the county, but does mention that its population has declined by some 2300 since 1970, a decrease of over 28 percent. A local resident who is in charge of voter registration had no doubt about the cause of the flight. He cited thirty families who left the county after the 1975 frost: "After their coffee trees were destroyed they lost interest in agriculture". He also pointed out the general malaise in the community as evidenced by the refusal of many farmers to register to vote in the municipal elections. As one explained: "Sooner or later, we are are going to have to leave here."

But word of the "end of Eldorado" has been slow in filtering back to Brazil's northeast, once the source of most of the seasonal labor employed in coffee cultivation. One migrant from the interior of Pernambuco made the four day trip to Paraná by bus and truck. Upon arriving in Paranapoema he discovered that there was no work to be had, but before he continued his journey west in search of employment, he commented on the present situation in northern Paraná.

> "There in the northeast everything is arid and provides nothing for anyone. But here on this verdant land, only cattle profit".

CONCLUSIONS

Frosts and their impact on human populations are rarely mentioned in the disaster literature [13]. Unlike earthquakes, tornados, and hurricanes, frosts and freezing temperatures do not present any clear threat to life and limb, and, as such, they are said to have a *low catastrophe potential* (White and Haas, 1975:71). Then too, even frost damage to property usually is not immediate. The full impact of the July 1975 frost, for example, was not felt for almost eleven months when the harvest of the badly "burned" coffee trees was due to begin. This is not to imply that frosts have no immediate effect; certainly banks would not loan money to farmers who wanted to use their ravaged coffee trees and their subsequent harvest as collateral. And, as we have seen, frosts can rapidly and dramatically increase wholesale commodity prices.

Despite frosts' low catastrophe potential,

their economic consequences for impacted communities, as well as for national economies should not be underestimated. The United States Office of Emergency Preparedness, for example, estimates that average losses attributed to frosts and freezing temperature run to some $ 1.1 billion annually in this country alone (White and Haas, 1975:305). But the economic outcome of frosts is not always adverse, at least not on the national level. Thus, despite the loss of some 70 percent of Brazil's coffee crop after the 1975 frost, greatly increased coffee prices on the world market, the sale of coffee reserves, and higher export taxes [14], more than offset the decline in production. In 1976, Brazil earned $ 2.3 billion from coffee sales, about two and a half times more than in 1975 (AP Report, *Gainesville Sun,* February 17, 1977).

While the Brazilian national economy may have benefited from this latest episode of freezing temperatures by increasing its foreign earnings and reducing its balance of payments deficit, it is abundantly clear that Ouro Verde and other communities like it were adversely, even tragically, affected. In county after county, where dense populations were once supported in at least modest style under a coffee growing regime, there are now abandoned schools and houses, shuttered stores, vast stretches of land with few human inhabitants, and the sort of malaise that comes with the awareness that a region's heyday has passed.

It is very important to emphasize, however, that it is not frosts alone which have been responsible for the decline of coffee cultivation in northern Paraná. Reduced yields due to soil depletion and the failure to use fertilizer, as well as falling coffee prices and higher cultivation expenses also have played a major role in lowering profits and spurring the shift to cattle ranching. Yet, it is worth asking whether the situation would have been different had there been no frost hazard in the region. Would farmers have been more willing to apply fertilizer to their coffee trees – thus insuring continued high yields – if frosts and freezing temperatures had not been a threat? If conditions of uncertainty had been reduced by the absence of frosts, would cultivators have been less apt to sell their land to ranchers and head for the frontier to seek their fortune? While this may be idle speculation which borders on climatic determinism, it is probably safe to conclude that the recent history of Paraná would have been quite different if frost, the bane of "green gold," had not existed.

NOTES

1 Ouro Verde ("Green Gold") is a pseudonym for a real community in northern Paraná, Brazil. "Green Gold" is a euphemism for coffee during periods of high prices.

2 The Portuguese verb "*queimar*" ("to burn") is used to describe frost damage to coffee trees. Frost turns the leaves black, giving them the appearance of having been burned.

3 See Stanley Stein's *Vassouras: A Brazilian Coffee County 1850–1900* for a discussion of the causes and consequences of coffee's decline in the Paraíba Valley.

4 Each sack contains 60 kilograms of coffee.

5 We find a similar phenomenon in the United States. In Utah's Wasatch Range, cherry orchards have become increasingly common despite the frost hazard to the fruit. According to Jackson (1974), this is because their return per acre in good years is higher than that of any other tree crop.

6 Coffee is by no means the only crop that has spread beyond its climatological limits. In the last century, spurred on by high prices, orange cultivation spread to northern Florida. A series of killing frosts in the 1890's devastated the citrus industry there, and citrus culture gave way to cattle ranching in less than a decade (see Divine, 1942).

7 All quotes by Ouro Verde residents are from Margolis (1973).

8 Coffee trees do not begin to bear fruit until the fourth year after planting, and it is not until the fifth year after planting that full yields are produced.

9 About 70 percent of the landowners and sharecroppers in Ouro Verde borrow money annually from banks or middlemen to finance their cultivation expenses.

10 *Mensal* laborers receive a fixed monthly salary. *Bóia fria* are labor gangs hired to perform a specific task. They are paid daily or on piecework basis. *Bóia fria* is slang for "cold lunch". These gangs are called by this term because the workers who form them bring their lunch with them

in the morning, and by the time they eat it in the fields at noon, it is cold.

11 By 1971 *bóia fria* also were employed on the few large holdings still planted in coffee. The work gangs were employed for pruning and harvesting the trees, and for other labor intensive tasks.

12 According to Moran (1975 and personal communication) a fairly large number of settlers in Altamira, a town on the Transamazon Highway, came from the coffee region of Paraná.

13 The only studies of frost and its impact on human populations of which I am aware are Margolis, 1973; Jackson, 1974; Ward, 1974 and Waddell, 1975 and 1977.

14 At the time of the 1975 frost Brazil had a stockpile of about 25 million bags of coffee to draw on during the three or four years it would take for newly planted coffee saplings to bear their first fruit. In addition, Brazil raised the export tax on a 132 pound bag of coffee from $ 21 before the frost to $ 100 by early 1977 (AP Report, *Gainesville Sun*, February 16, 1977).

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THE FRIULI EARTHQUAKE AS AN AGENT OF SOCIAL CHANGE IN A RURAL AREA

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On May 6, 1976, an earthquake of magnitude 6.4 on the Richter scale struck central Friuli, a region located in the hilly north-eastern part of Italy, near both the Austrian and Yugoslavian borders. On September 11, 1976, the earth shook again; two more shocks occurred followed four days later by one of 6.1 magnitude. Friuli has a long seismic history (Osservatorio Geofisico Sperimentale, 1976), but the violent force of these two earthquakes was, as far as is known, unprecedented. The epicenter of the first one was near Venzone, which is a small town at mid-point in the road system linking the Friuli plains and the Adriatic Coast with the central Danubian region. The epicenter of the second shock was a few kilometers north of Venzone.

On the basis of a preliminary analysis of field data, I will examine below some of the social and economic changes which seem to be the result of these disruptive events.

ECONOMY AND SOCIETY

The devastated area covers some 1800 km^2. The pre-quake population figure was 103,662 persons. Over one hundred villages were almost completely destroyed. Some 17,000 houses, a large number of schools, churches, town halls and factories were ruined. Many of these towns, such as Venzone and Gemona, had important art treasures and historical landmarks (Valuzzi, 1977). In Udine, the biggest urban center of the region with almost 100,000 inhabitants, more than 50% of all dwelling units were damaged.

Prior to the 1960s, Friuli had a principally agricultural economy. Typically, farms were small, with holdings averaging from two to five acres, and nearly self-sufficient. In the upper Friuli plain, maize, cereals, potatoes, a variety of other vegetables and wine were produced. The wine was widely admired for its excellence. The market structure was poorly developed; most farmers sold their products directly to small merchants from neighbouring regions. Limited non-agrian job opportunities, population growth, the tiny size of saleable plots of land and limited market facilities accounted for emigration, the tradition of which goes back to the seventeenth century. Population displacement accelerated at the turn of the century owing largely to land shortage. Large numbers of emigrants sought better job opportunities in other European countries and in Latin America, particularly Argentinia.

Emigration continued throughout this century, and the resulting labor drain became a decisive factor in the decline of agriculture in this region. In 1951, employment in the agrarian sector was only 39.8% of the job market, but ten years later it dropped to 25.7%, to 13.5% in 1971, and in 1976 it was a mere 7%. Most of those now engaged in agriculture are eldery persons who are no longer very produc-

tive. Non-agricultural workers found their employment either abroad or in the industrial areas of the Padama Plain, or more recently, in the small industrial centers of central Friuli. Along with the decline of agriculture, dairy collectives, small rural banks and cottage silkworm industries have also begun to disappear.

The region consists of small, scattered farms surrounding a number of urban centers. The latter include Udine, in the Central Friuli Plain, Pordenone, west of the Tagliamento River, and Tolmezzo. During the 1960s the rural character of Friuli was beginning to change. In 1964 the establishment of Friuli as a self-governing region permitted increased economic development of the area. Pordenone, lying on the border of the disaster area, became one of Italy's most important household manufacturing centers. Several smaller towns, typically not larger than 8,000 persons, established dozens of factories including iron, machinery, furniture and textile production. Prior to the quake, 18,000 persons residing in the disaster zone plus thousands of other "commuters" were employed in 300 of these small factories. Most Friuli workers also did a little farming.

RECONSTRUCTION

Massive migration was predicted following the May earthquake, but it did not materialize. Rather than fleeing, stricken rural families wanted tents they could erect in their courtyards despite government warnings about the danger of landslides and difficulties of transporting supplies into the area. In June, when the regional administrative authority started to formulate reconstruction plans, town planners began to draw up blueprints for the reorganization of settlement patterns for the entire region. They proposed to concentrate the population in areas situated away from danger zones. Residents resolutely protested these schemes through their town councils and by organizing public demonstrations. The Friuli–Venezia Giulia regional administrative authority at first did not want to be involved. But it eventually bowed for public pressure, giving each municipal administration the authority to make its own reconstruction plans.

Reconstruction began quickly. Thanks to outside aid, farmsteads were rebuilt, most damaged farm machinery was repaired or replaced and food supplies were maintained at or near pre-quake levels. In the meantime, many persons were living in tents supplied by government and donor nations. The administrative authority attempted to stimulate agricultural recovery. The Government thought that people would be disinclined from leaving the area by keeping agriculture healthy, even in its recent attenuated form. Industry also received substantial financial assistance. Thus, during the summer of 1976, most workers were able to return to the factories. By the end of August, the industrial area near Osoppo, situated close to the epicenter of the quake and thus sustaining considerable damage, was able to reopen all of its plants, restoring jobs to some 1,600 workers.

As recovery proceeded, Friulians began to display a preference for new settlement arrangements. The traditional rural model was that of dispersed terraced houses straddling both sides of the main roads. What became popular now was the model of small, single family home, a pattern which had already been spreading over rural areas in the last ten years. In the midst of these new developments the second terrible quake struck on September 15. Many buildings that were restored or were in the processes of being resurrected, collapsed.

Now, fully cognitant of the region's seismic dangers, the government launched preliminary geological and geo-seismic investigations. Authorities also instituted new building codes. Designs of all new buildings were to incorporate up-to-date seismic safety features. But there was no clear indication of how long this reconstruction would take. Thus, as winter

was approaching rapidly this mountaineous region, it was essential that temporary shelters should be erected immediately.

Regional and central government jointly arranged for the relocation of some 33,000 victims to the seaside resorts of the Adriatic Coast. Most of these relocatees were women, children and elderly, while many technicians, farmers, laborers and managers were settled in temporary shelters in or near the damaged areas. Coastal centers were linked up with destroyed villages through a daily bus service. Students coming from Udine aided in grape picking and this assistance was instrumental in saving the vital grape harvest. With help from the Italian army, temporary house construction began quickly and continued throughout the winter.

By April, 1977, 20,800 temporary houses were constructed. Thirty-seven different house types were used. Many were elementary iron and plastic containers while others, the minority unfortunately, were homey little wooden cottages. Government also built shops, stables, schools, churches and workshops, all made from prefabricated materials. The temporary housing was not very popular with its users, for several reasons. Firstly, the big wooden furniture normally found in houses throughout this region did not fit in its small rooms. Secondly, wood burning stoves had been replaced by gas or electric ranges, making it difficult to prepare many traditional dishes, such as *polenta*, a maize substitute for bread. Thirdly, there were no facilities for poultry. Also, many houses were located far from the main roads and in places exposed to cold winds and snow drifts.

A number of persons subsequently have choosen to build their own houses. In April 1977, 70,000 persons resided in these "temporary" structures, but a year later the number had fallen to 50,083. The provision of some permanent housing supplied by foreign donors and the fact that some victims settled elsewhere accounted also for this lower figure.

One interesting aspect of victims' reactions to disaster housing is shown by the birth rates. In the months following the first quake, the birth rate fell from an average of 8.4 births per thousand to 5.9 in April, 1977. It then rose to 8.8 on October 1977, but in December of the same year, nine months after the population had been moved to temporary houses, it fell again to 6.4.

POST-EARTHQUAKE SOCIAL CHANGES: SOME TRENDS

The two major quakes together have had a demoralizing effect on Friuli villagers. People responded to the first shock by endeavoring to rebuild their houses and quickly resume their productive activities. But the second tremble created a visible demoralization. While in May it was difficult removing even the elderly and sick from their home areas, in September, thousands of persons fled the area in a few hours. This attitude of wariness has persisted even two years later.

Prior to the quake, relatives who had moved to other regions or countries would come to visit during summer holidays and on Christmas so as to keep alive the extended family ties. But space restrictions characterizing the new houses have considerably discouraged this pattern of visiting. Likewise, kinsmen working in regional urban centers now prefer to remain in the town rather than returning to their villages for the weekends. The elderly, who used to reside in large rural houses with their children and grandchildren, have now to some extent been segregated from close kin.

Out of 19,525 families occupying temporary housing in the spring of 1978, 4,281 (22% in rounded figures) were occupied by one person only, 5,241 (27%) by two people, and 2,363 (12%) by five or more persons. Rather than living alone, many of the elderly have opted to reside in homes for the aged or have taken advantage of a

home care program financed with funds from the regional administration. However, as much as these developments may be weakening the foundations of rural family life, they seem not to have produced an evident impact on village solidarity, probably because the inter-household composition of many settlements has not changed radically.

The splintering of households has also undermined family horticultural enterprise. Some cottage industries have also suffered as a result of housing redevelopment. Many craftsmen in central Friuli did their work at home. New housing made it very difficult to continue this practice. Regional government decided to construct special work sheds, but these tend to be built some distance from the craftsmen's homes, thus making it hard for them to practice horticulture on a part-time basis.

Some local customs which date back as far as pre-Roman times have also fallen into disuse after the quake. For instance, following a very ancient tradition, fires were lit on hilltops on the twelfth night before Christmas to bring good omens for the next year's crop. Before the quake, virtually all villages between Gemona and Cividale practiced this rite, but now it has nearly disappeared. The feasts of the patron saints that were held annually in every village have also been abandoned. If and how these trends reflect changing sentiments regarding formal religion remain to be studied. However, I am inclined to think that the earthquakes have modified the outer-trappings of religious life without altering more deep-seated feeling about religion.

The hierarchical structure of regional trade centers has also undergone some transformations. Among the cities of Central Friuli, Udine and Pordenone had the largest concentration of commerce, infrastructure, schools and provincial administrative offices. Secondary centers included San Daniele, Osoppo, Maiano, Gemona, and Tarcento, and under these were even smaller administrative hubs. Commerce in some middle-sized cities badly damaged by the quake has come to a virtual standstill, and this paralysis has forced smaller centers to bypass the beleagured cities completely and to establish dependencies in Udine and Perdenone. Such realignments are also affecting inter-village commerce in the context of the damage sustained to middle-sized cities.

Two years after the May earthquake, 70% of temporary housing is occupied and final reconstruction is underway. Government, through a special edict, has given assurance of providing $ 2.87 billion for a five-year building program, to start in April 1977. The money is being channelled through regional government to local communities with the assistance of local bankers. Regional authorities, however, think that the reconstruction will take much longer than this, perhaps ten years or more. On the brighter side, growth in the building sector will generate jobs certain to lure many emigrants back to the region. But this influx will undoubtedly increase population in urban centers and possibly generate future urban housing problems.

Government, following a national policy for modernizing agriculture, is also attempting to concentrate farm holdings in larger, more productive commercial farm units. In Friuli, this policy may be inacted by withholding financial aid to part-time farmers and subsidizing reconstruction only for those farmers willing to commit themselves to full-time agriculture and stock breeding. So far, government has done little to implement its plans for agrarian reform. In fact, owing both to objections from the country's powerful trade unions and strong resistance among the farmers themselves, government's initial attemps in this direction have failed.

To date, government's inability to formulate and implement coherent and widely acceptable reconstruction programs and policies pose a serious threat to ultimate, successful recovery. Regional and central authorities

have left a great part of this initiative to local administrations. The risk here is that rather than regional economic integration, a patchwork of schemes for economic growth and urbanization will evolve, each differing according to specific political pressures and proclivities which arise in the particular municipality under consideration. Many areas in Friuli, for example, are torn between forces wanting to intensify urbanization and agrarian land consolidation and those attempting to conserve the traditional character of the countryside.

CONCLUSION

The earthquakes struck Friuli at a time when country life was undergoing significant changes. The deterioration of agricultural activity and altered housing conditions following the quakes have reinforced modernization trends in the rural sector. Still, traditional settlement patterns are highly valued. Most of the affected population has repeadly expressed a desire for the restoration of damaged villages, regardless of their location in seismically vulnerable areas. With respect to housing, Geipel's survey (1977) shows that 86.7% of the 6,400 persons interviewed, preferred housing of the same type as occupied prior to the quake. However, ironically, when having to make the choice, individuals are opting for small urban-type houses. I think that even if villages are rebuilt at their original sites, they will stay virtually empty because most of the population will have moved to larger centers in the plain. Owing to the earthquakes, Central Friuli is now rapidly on its way to assume an urban, industrial character.

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